



LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

By

LAURINE CHIKOKO

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DECLARATION

I, Laurine Chikoko, hereby declare that **LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS** is my own original work. All the sources used or quoted have been indicated and acknowledged by means of complete references. It has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification.

Laurine Chikoko

ABSTRACT

Macroeconomic and financial market developments in Zimbabwe since 2000 have led to an increase in many banks' overall exposure to liquidity risk. The thesis highlights the importance of understanding and building comprehensive liquidity frameworks as defenses against liquidity stress. This study explores liquidity and liquidity risk management practices as well as the linkages and factors that affected different types of liquidity in the Zimbabwean banking sector during the Zimbabwean dollar and multiple currency eras.

The research sought to present a comprehensive analysis of Zimbabwean commercial banks' liquidity risk management in challenging operating environments. Two periods were selected: January 2000 to December 2008 (the Zimbabwean dollar era) and March 2009 to June 2011 (the multiple currency era). Explanatory and survey research designs were used. The study applied econometric modeling using panel regression analysis to identify the major determinants of liquidity risk for 15 commercial banks in Zimbabwe. The financing gap ratio was used as the proxy for liquidity risk. The first investigation was on liquidity risk determinants in the Zimbabwean dollar era. The econometric investigations revealed that an increase in capital adequacy reduced liquidity risk and that there was a positive relationship between size and bank illiquidity. Liquidity risk was also explained by spreads. Inflation was positively related to liquidity risk and was a significant explanatory variable. Non-performing loans were not significant in explaining commercial banks' illiquidity, which is contrary to expectations. The second investigation was on commercial banks' liquidity risk determinants in the multiple currency era by using panel monthly data. The results showed that capital adequacy had a significant negative relationship with liquidity risk. The size of the bank was significant and positively related to bank illiquidity. Unlike in the Zimbabwean dollar era, spreads were negatively related to bank liquidity risk. Again, non-performing loans were a significant explanatory variable. The reserve requirements ratio and inflation also influenced bank illiquidity in the multiple currency regime. In both investigations,

robustness tests for the main findings were done with an alternative dependent variable to the financing gap ratio.

To complement the econometric analysis, a survey was conducted using questionnaires and interviews for the same 15 commercial banks. Empirical analysis in this research showed that during the 2000-2008 era; (i) no liquidity risk management guidelines were issued by the Reserve Bank of Zimbabwe until 2007. Banks relied on internal efforts in managing liquidity risk (ii) Liquidity was managed daily by treasury (iii) The operating environment was challenging with high inflation rates, which led to high demand for cash withdrawals by depositors (iv) Locally owned banks were more exposed to liquidity risk as compared to the foreign owned banks (v) Major sources of funds were new deposits, retention of maturities, shareholders, interbank borrowings, offshore lines of credit and also banks relied on the Reserve Bank of Zimbabwe as the lender of last resort (vi) Financial markets were active and banks offered a wide range of products (vii) To manage liquidity from depositors, banks relied on cash reserves, calculating and analysing the withdrawal patterns. When faced with cash shortages, banks relied on the daily limits set by the Reserve Bank of Zimbabwe (viii) Banks were lending but when the challenges deepened, they lent less in advances and increased investment in government securities. (ix) Inflation had major effects on liquidity risk management as it affected demand deposit tenors, fixed term products, corporate sector deposit mobilisation, cost of funds and investment portfolios (x) The regulatory environment was not favourable with RBZ policy measures designed to arrest inflation having negative repercussions on banks' liquidity management (xi) Banks had no liquidity crisis management frameworks.

During the multiple currency exchange rate system (i) Commercial banks had problems in sourcing funds. They were mainly funded by transitory deposits with little coming in from treasury activities, interbank activities and offshore lines of credit. There was no lender of last resort function by the Reserve Bank of Zimbabwe. (ii) Some banks were still struggling to raise the minimum capital requirements (iii) Commercial banks offered narrow product ranges to clients (iv) To manage liquidity demand from clients, banks

relied on the cash reserve ratio, and calculated the patterns of withdrawal, while some banks communicated with corporate clients on withdrawal schedules. (v) Zimbabwe commercial banks resumed the lending activity after dollarisation. Locally owned banks were aggressive, while foreign owned banks took a passive stance. There were problems with non-performing loans, especially from corporate clients, which exposed many banks to liquidity risk. (vi) Liquidity risk management in Zimbabwe was still guided by the Reserve Bank of Zimbabwe Risk Management Guideline BSD-04, 2007. All banks had liquidity risk management policies and procedure manuals but some banks were not adhering to them. Banks also had liquidity risk limits in place but some violated them. Furthermore, some banks were not conducting stress tests. Although all banks had contingency plans in place, none were testing them.

Specifically, the research study highlighted the potential sources of liquidity risk in the Zimbabwean dollar and multiple currency periods. Based on the results, the study recommends survival strategies for banks in managing liquidity risk in such environments. It proposes a comprehensive liquidity management framework that clearly identifies, measures and control liquidity risk consistent with bank-specific and the country's macroeconomic developments. The envisaged framework would assist banks in dealing with illiquidity in a manner that would be less disruptive and that could render any future crisis less painful.

Of importance is the recommendation that the central bank might not need to be too strict or too relaxed, but be moderate in ensuring an enabling regulatory environment. This would help banks to manage liquidity risk and at the same time protect depositors in any challenging operating environment. In both the studied time periods, there were transitory deposits. Generally there is need to inculcate a savings culture in Zimbabwe.

DEDICATION

I dedicate this thesis to my sons Kudzai Ryan Joseph and Tinashe Michael Chikoko.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
ALCO	Asset and Liability Committee
ALM	Asset and Liability Management
ARDL	Autoregressive Distributed Lag Model
BAZ	Bankers' Association of Zimbabwe
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
BOD	Board of Directors
BLUE	Best, Linier, Unbiased, Estimator
CAR	Capital Adequacy Ratio
CCP	Cash Capital Position
CD	Certificate of Deposit
CEO	Chief Executive Officer
CFP	Contingency Funding Plan
CPI	Consumer Price Index
CTL	Commitment to Lend
CSO	Central Statistical Office
DF	Dickey Fuller
ESB	Economic Stabilisation Bonds
FDR	Financing to Deposit Ratio
FE	Fixed Effects
FRS	Federal Reserve System
FSSB	Financial Sector Stabilisation Bonds
GCR	Global Competitiveness Report
GDP	Gross Domestic Product
HT	Harris Tzavalis
IMF	International Monetary Fund

IPS	Im Pesaran Shin
LDR	Loan to Deposit Ratio
LIBOR	London Inter Bank Offer Rate
LL	Levin Lin
LMB	Liquidity Management Bond
LOLR	Lender of Last Resort
LSDV	Least Squares Dummy Variable
LTRF	Long Term Funding Ratio
ML	Maximum Likelihood
ML	Minimum Lending Rate
MOF	Ministry of Finance
NCD	Negotiable Certificate of Deposit
NPF	Non Performing Financing
NPL	Non Performing Loan
OBIs	Other Banking Institutions
OMO	Open Market Operations
PLS	Profit and Loss Sharing
PPAP	Productive Asset Write-off Reserves
PP	Phillips Perron
PPI	Producer Price Index
RBZ	Reserve Bank of Zimbabwe
RE	Random Effects
RMM	Risk Management Manual
ROA	Return on Asset
RRR	Reserves Requirement Ratio
RTGS	Real Time Gross Settlement
SOMB	Special Open Market Bills
SRR	Statutory Reserve Ratio
TB	Treasury Bills

TLA	Total Marketable Assets
TVL	Total Volatile Liabilities
UFIRS	Uniform Financial Institutions Rating System
USD	United States Dollars
ZIMSTATS	Zimbabwe National Statistics

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

The role of banks as financial intermediaries is to try to solve the fundamental weaknesses in direct trading between individuals. Rather than simply on-lending funds that have been deposited with them, banks create a completely new financial security. Banks issue a type of liability that the surplus sector prefers to hold as an asset, and hold as an asset the type of liability that the deficit sector wishes to issue (Franck and Krausz, 2007; Koch and Scott, 2009; Rychtarik, 2009). The ultimate borrower is able to obtain the required investment funding on long term guarantee, and the primary lender need to achieve both liquidity and reduced risk on lending. Banks therefore issue short-term liabilities and hold long-term assets, so that the liabilities side of the balance sheet is more liquid than the asset side. Imbalances in the balance sheet, if not properly managed, lead to liquidity risk (Luckett, 1984; Bhattacharya and Thackor, 1993; Goacher, 2002; Bessis, 2009).

Liquidity risk is defined differently by financial institutions and in financial markets. An important dimension is that liquidity risk covers all risks associated with a bank failing to meet its obligations in time (Fielitz and Loeffler, 1979; Baltensperger, 1980; Crosse and Hempel, 1980; Diamond and Dybvig, 1983; Luckett, 1984; Cates, 1990; Swank, 1996; Sinkey, 2002; Agenor, Aizenman and Hoffmaister, 2004; Heffernan, 2005; BIS, 2006; Diamond, 2007; Matz, 2008; Acerbi and Scandolo, 2008; Freixas and Rochet, 2008; BIS, 2008a; Berger and Bouwman, 2009; Shen *et al.*, 2009; Moore, 2010). Liquidity risk is therefore the risk of a bank failing to obtain funds at a reasonable price within a reasonable time period to meet its commitments. It is important to highlight from the onset that liquidity risk includes two types of risk: funding liquidity risk and market liquidity risk (European Central Bank, 2002). Funding liquidity risk is the possibility that a bank will fail to efficiently meet both expected and unexpected current and future cash

flow and collateral needs without affecting either daily operations or the financial condition of the firm (Aspachs, Nier and Tieset, 2005; BIS, 2006; Valla and Saes-Escorbiac, 2006). Funding risk is therefore a function of the market perceptions of the credit standing and reputation of the bank. Market liquidity risk, on the other hand, is the probability that a bank cannot easily offset or eliminate a position at the market price because of inadequate market depth or market disruption, thus leading to fire sale prices (Machiraju, 2008; Freixas and Rochet, 2008).

Banking institutions need to manage liquidity carefully because liquidity needs are uncertain (Vodova, 2011; Moore, 2010; Anas and Mounira, 2008). A bank may be solvent, but if lenders lose confidence in its ability to provide funds on request, a liquidity crisis can ensue in the form of bank runs and bank panics. Bank crises can lead to the collapse of an otherwise healthy institution within a short space of time. Once started, a liquidity crisis can be very hard to stop as adverse dynamics may feedback on them (Gabbi, 2004; Ismal, 2010). Liquidity risk management becomes a key banking function and an integral part of the asset liability management process (Van Greuning and Bratavonic, 2003; BIS, 2006; BIS, 2008b). Most banking activities therefore depend on a bank's ability to provide liquidity to its customers.

The banking crisis experienced in the 2008/2009 global financial turmoil has underscored the importance of managing liquidity risk. The first line of defense against liquidity risk is a sound bank liquidity management policy on the part of both the central bank and the respective banking institutions. Strengthened liquidity management practices are desirable to prepare banks for a period of severe liquidity stress (BIS, 1992; BIS, 2000; BIS, 2006). Sound liquidity management is therefore crucial for to reduce funding and market liquidity stresses. Thus, sound liquidity management enables banks to meet cash flow obligations without affecting daily operations when banking systems come under severe pressure (Agenor *et al.*, 2004).

Accordingly, this thesis seeks to examine how commercial banks in Zimbabwe managed

liquidity risk during (i) the Zimbabwean dollar era and (ii) the multiple currency exchange rate regime. Zimbabwe experienced macroeconomic problems from 2000 to 2008. The country abandoned its local currency and adopted a multiple currency exchange rate system in January 2009, which was still in place at the time this thesis was written. Both the Zimbabwean dollar era and the multiple currency regime, posed extremely challenging operating environments for commercial banks. To this end, a comprehensive analysis of Zimbabwe's commercial banks' liquidity risk management is sought. The thesis analysed measures taken by the commercial banks and the Reserve Bank of Zimbabwe (RBZ) to ease liquidity pressures during the hyperinflationary periods and the options to deal with liquidity under the dollarised economic environment. Furthermore, the thesis sought to benchmark Zimbabwe commercial banks' liquidity risk management framework to the RBZ's liquidity risk management guidelines which were crafted in 2007 in line with the Basel Committee on Banking Supervision.

1.2 Background to the Study

Zimbabwe financially liberalised its economy in 1990. Since then, liquidity has been determined by the quantity of money supply in the economy as measured by broad money (M3). Broad money (M3) was made up of money in circulation plus demand, savings and time deposits with deposit money banks (commercial banks, merchant banks and discount houses) and the RBZ (RBZ, 2000). The amount of money in circulation was an important determinant of transactions done in the economy. As such, it had substantial influence on the aggregate demand of the economy. Due to the expanded nature of banking activities in January 1994, the RBZ redefined the aggregate to include the savings and time deposits of building societies, finance houses and the Post Office Savings Bank, collectively referred to as the "other banking institutions" (OBIs). From 1995, the RBZ accommodated the market surpluses and shortages through discount houses. However, from February 1997, the Reserve Bank introduced a new primary dealer system involving discount houses as counter-parties through the enactment of new banking legislation. The new system altered the settlement arrangements in that the discount houses were no longer operating accounts at the Reserve Bank. As a result,

commercial banks were thus regarded as clearing banks (RBZ, 2000; Makoni, 2006).

In order to improve the commercial banks' clearing function, in September 1997 the RBZ introduced repurchase agreements (repos) designed to assist banks during periods of shortages in the market. At such times, the RBZ supplied liquidity through repurchase agreements; the underlying instrument for this was the Government of Zimbabwe Treasury bill. The Reserve Bank of Zimbabwe also conducted anticipatory and reverse repos in order to smooth liquidity and lessen interest rate volatility. The use of the repo window however, became inactive due to a lack of sufficiently deep market shortages which would favour its use (RBZ, 2004b). In order to effectively mop up excess liquidity from the market, the Central Bank introduced Open Market Operations (OMO) Treasury bills in 1998 which were clearly separated from ordinary Treasury bills for funding government. The tenure of OMO Treasury bills ranged from 91 days to one year (RBZ, 2000).

From the time of financial liberalisation to 1999, the Zimbabwean banking sector generated solid income growth which was supported by the mushrooming of several banking institutions. The new and older banks supported asset values in the Zimbabwean economy (Makoni, 2006). The economic crisis started during the 2000-2008 era which underpinned the need to maintain financial sector stability. From 2003 to 2004, Zimbabwean banks experienced episodes of banking fragility emanating from liquidity issues, corporate governance deficiencies and macroeconomic challenges. Inflation rates rose to as high as 600% in December 2003 and 1 000% in January 2004 (Central Statistics Office (CSO) (2005). The high inflation rates had the effect of significantly increasing funding costs for commercial banks, squeezing interest margins and subsequently profitability. The result was the placement of nine financial institutions under curatorship by December 2004 (RBZ, 2005).

The problems of high rates of inflation saw the RBZ pursuing a tight monetary policy stance in December 2003. The aim was to maintain short money market positions through

a combination of direct and indirect instruments (RBZ, 2003). An active liquidity-mopping programme was put in place in 2004. A number of bills were introduced to withdraw excess money from the market. These included the Zimbabwe Treasury bill (ZTB), OMO bills, and Reserve Bank of Zimbabwe Financial bills (RBZFB), as well as Special Open Market bills (SOMB) introduced on 16 June 2004 (RBZ, 2004b). The new monetary policy dispensation saw a tightening of the RBZ accommodation facilities, resulting in a severe liquidity crunch for most banks (RBZ, 2004a). As from March 2005, the RBZ revised the key accommodation and bank rates upwards in line with inflation developments (RBZ, 2005). Bank Minimum Lending Rates (MLR) followed suit. Efforts by the RBZ to restructure government domestic debt by scrapping short-dated securities and lengthening tenor to 180-day, 365-day paper gathered momentum in 2006 together with the issuance of Consumer Price Indexed (CPI) bonds (RBZ, 2006). The Statutory Reserve Ratio (SRR) was also hiked to as high as 60% as the RBZ was aggressive in curtailing speculative lending and reining in high inflation rates. Following representations from the banking community through the Bankers' Association of Zimbabwe (BAZ), SRR was revised downwards to 45% for core demand deposits in July 2006. The RBZ also required banks to subscribe to Financial Sector Stabilisation Bonds (FSSB) and Economic Stabilisation Bonds (ESB) in proportion to their balance sheets (RBZ, 2006b).

Citing lack of cooperation from banks to lend to the productive sector of the economy, in October 2006 the RBZ issued thresholds for loans to the productive sectors of the economy through the banks (RBZ, 2006). In 2007, the RBZ committed itself to fight excess liquidity-induced inflation, which led to a predominantly short market being maintained. In the same year, the RBZ continued to float one-year Treasury bill tenders, which deepened market shortages (RBZ, 2007b). The Reserve Bank continued to use the overnight accommodation window as a pre-emptive tool whose main focus was to rein in inflation expectations and also manage inflationary demand for credit in the economy. Statutory reserves were adjusted in 2007 as and when liquidity conditions made this necessary. Money market rates followed developments in market liquidity and

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adjustments to policy rates. The interbank rate was very volatile, ranging from 0% (long money market position) to as high as 825% (short money market positions). Other short-term (7-30 days) deposit rates ranged from 6% to 400% whilst medium-term (60-90days) rates were in the 30-350% range. The one-year Treasury bill rate remained fixed at 340% throughout 2007 (RBZ, 2007a). In 2007, the RBZ introduced the Liquidity Risk Management Guidelines. The aim was to guide commercial banks in liquidity and liquidity risk management.

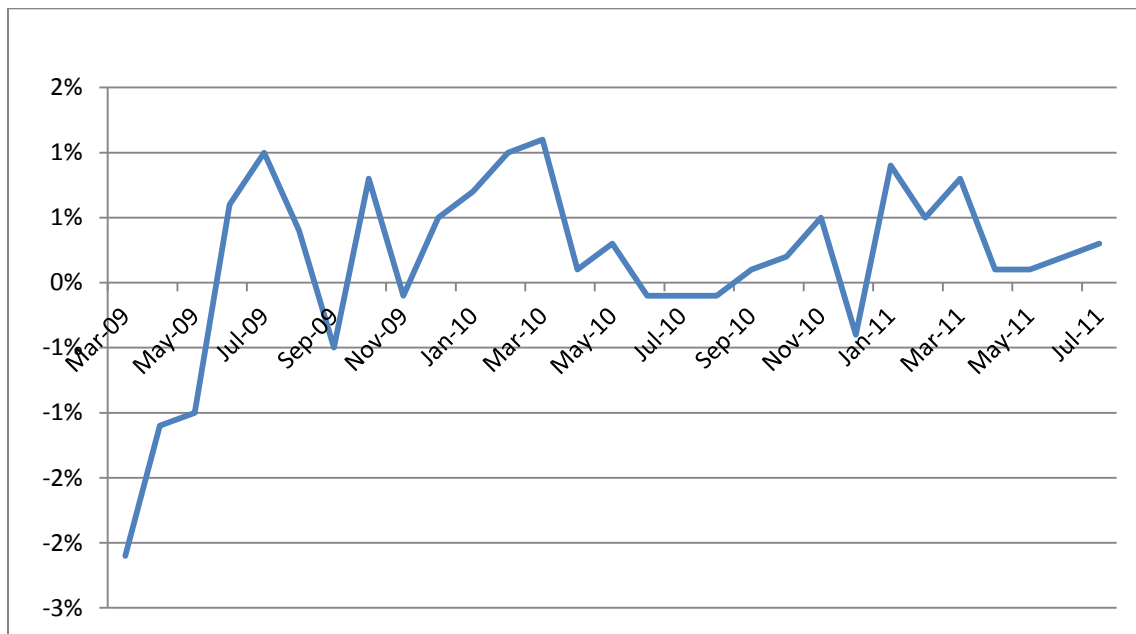
The last quarter of 2007 recorded huge market shortages, largely driven by statutory reserve payments by banks. In the same year, there was also increased demand for cash by depositors. These demands result in the withdrawal of significant amounts of liquidity as banks mobilised funds to pay for the cash allocations from the Reserve Bank (RBZ, 2007a). In 2008, the RBZ continued to hike overnight accommodation rates so as to discourage banks from using the lender of last resort facility. End of day surpluses continued to be accommodated through Liquidity Management Bonds (LMB). Money market interest rates were repressed and remained negative throughout 2008. The interbank market virtually collapsed during the last quarter of 2008 (RBZ, 2008).

From 2000 to 2008 Zimbabwe's economy was characterised by deteriorating macro-economic fundamentals. Chief among these were hyper-inflation, contracting national output as measured by real GDP, chronic foreign currency shortages, industrial capacity under-utilisation and high lending rates which stifled private sector investment (RBZ, 2009). In the same period, the money markets sub-section of the financial markets was characterised by negative real rates of return and a dwindling savings base. The environment made planning impossible. The "locking up" of bank funds for longer periods of time by the RBZ had the effect of lowering deposit rates, leading to a high degree of "disintermediation". Generally, banks experienced a considerable decline in interest margins and limited lending opportunities. Zimbabwe's financial system was faced with a highly challenging operating environment which continued to deteriorate. The RBZ's efforts to curtail excess market surplus driven by inflation brought challenges

to bank operations. Clearly, the main emphasis of banking operations was on the management of the money market and liquidity positions. Liquidity and liquidity risk management became the panacea to bank survival in a very harsh operating environment

Following the 2000-2008 decade of economic decline, the government of Zimbabwe deliberately allowed the use of a multiple currency system, which was adopted on 30th January 2009 (Ministry of Finance (MOF), 2009a). The system allowed trade to be conducted using major trading currencies, for example, the United States Dollar (USD), Pound Sterling, South African Rand, and the Botswana Pula. Settlement in payment systems however took place in the USD (MOF, 2009a; RBZ, 2009). The new regime helped restore price stability and restart financial intermediation (MOF, 2010; RBZ 2010). Figure 1.1 presents inflation trends after the multiple currency adoption.

Figure 1.1: Inflation Rate (%) Monthly



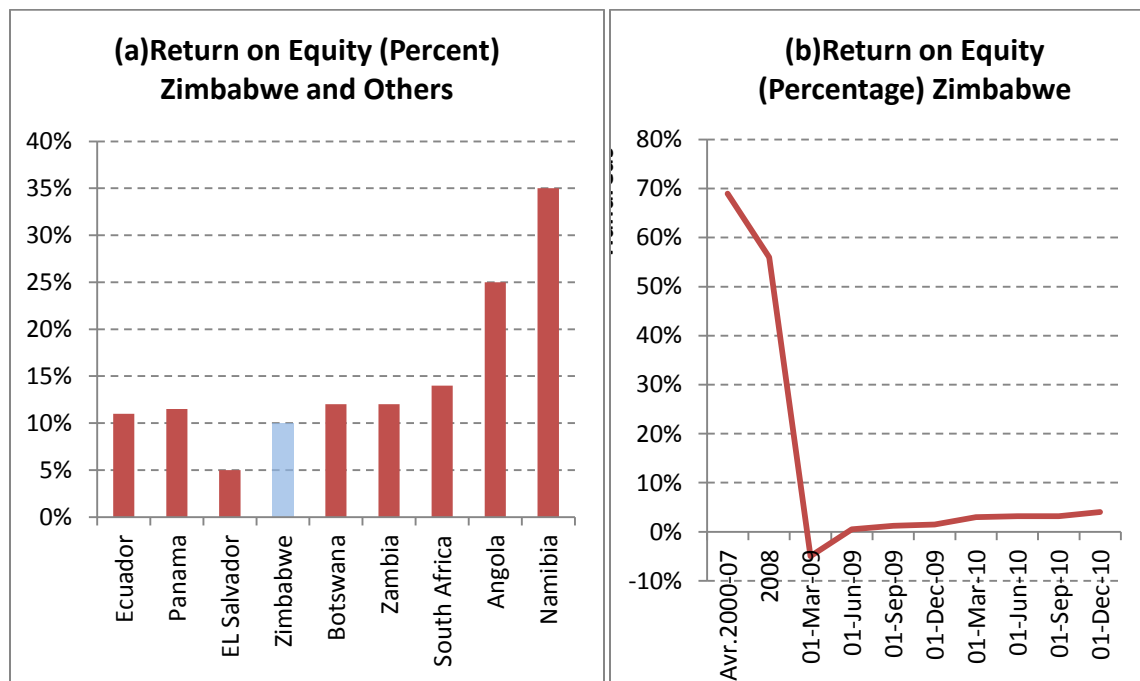
Source: Zimbabwe National Statistics (ZIMSTATS, 2011)

Figure 1.1 shows that after the multiple currency regime inflation in Zimbabwe was no longer an issue. Month-on-month inflation ranged from negatives to slightly above 1%.

In addition, with the adoption of the multiple currency system, banking deposits tripled and lending increased six-fold between March 2009 and December 2010 (RBZ, 2010). This rapid balance sheet expansion was in part driven by moral suasion on banks to lend to agriculture and to support economic activity.

Research conducted by the International Monetary Fund (IMF) (2010) indicates that banks improved profitability following more favourable economic environments during the new regime. The comparison of Zimbabwean and peer banks' soundness is presented in Figure 1.2.

Figure 1.2: Comparison of Zimbabwean Banks' Soundness Indicators with Peers



Source: IMF Global Financial Report (2010)

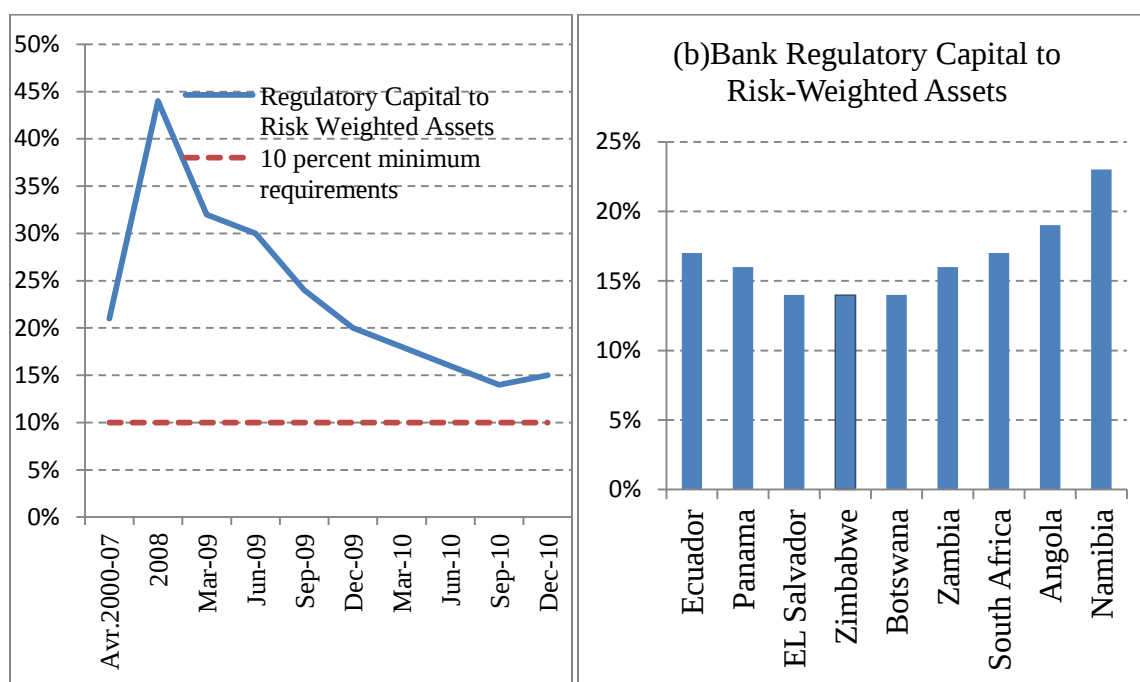
In figure 1.2 (a) Zimbabwean banks appear to be less profitable than their peers (IMF, 2010). In figure 1.2 (b) the return on equity for Zimbabwean banks averaged 68% in the 2000-2007 periods. In 2008, this declined to 56%. In 2009, the return on equity was as low as minus 5%. It picked up and averaged positive 4% in 2010. While officially reported, aggregate banking soundness indicators do not raise major red flags. They mask

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vulnerabilities specific to a fully dollarised banking system experiencing rapid credit growth, as well as significant variation in prudential indicators across individual banks.

In line with this, the IMF (2010) showed that some banking institutions in Zimbabwe were struggling to raise the minimum capital requirements after the multiple currency regime. Figure 1.3 shows the capital requirements for Zimbabwean commercial banks in comparison to peers.

Figure 1.3: Comparison of Zimbabwe Regulatory Capital with Peers



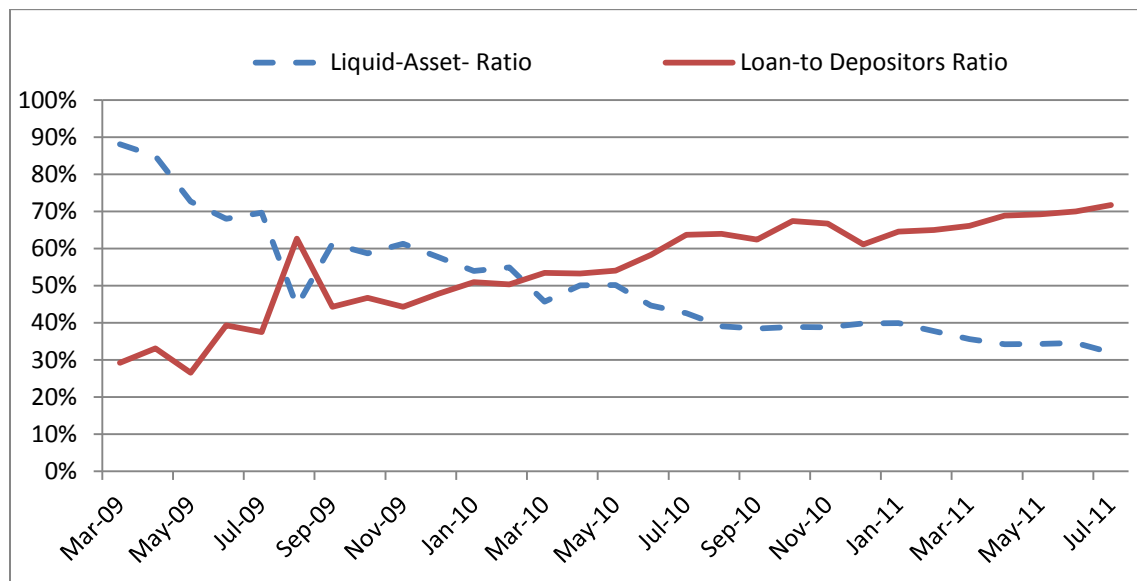
Source: IMF Global Financial Report (2010)

The Basel Accords published by the Basel Committee on Banking Supervision sets a framework for how banks must calculate capital adequacy by considering the regulatory capital to risk weighted assets. During the 2000-2007 period the Zimbabwe bank capital to risk weighted averaged around 21%. It increased to 44% in 2008. During the multiple currency regime, it was 32% in March 2009, 20% in December 2009, 18% in March 2010 and further declined to 14% in September 2010. Figure 1.3 (b), presents a comparison of regulatory capital to risk weighted assets with peers in 2010. The

presentation illustrates that Zimbabwe is one of the countries that had lower bank regulatory capital to risk weighted assets.

The multiple currency system posed challenges to commercial banks' liquidity risk management. Figure 1.4 shows trends in liquidity indicators for the banking institutions after the adoption of the multiple currency system.

Figure 1.4: Zimbabwean Banks' Liquidity Indicators Trends

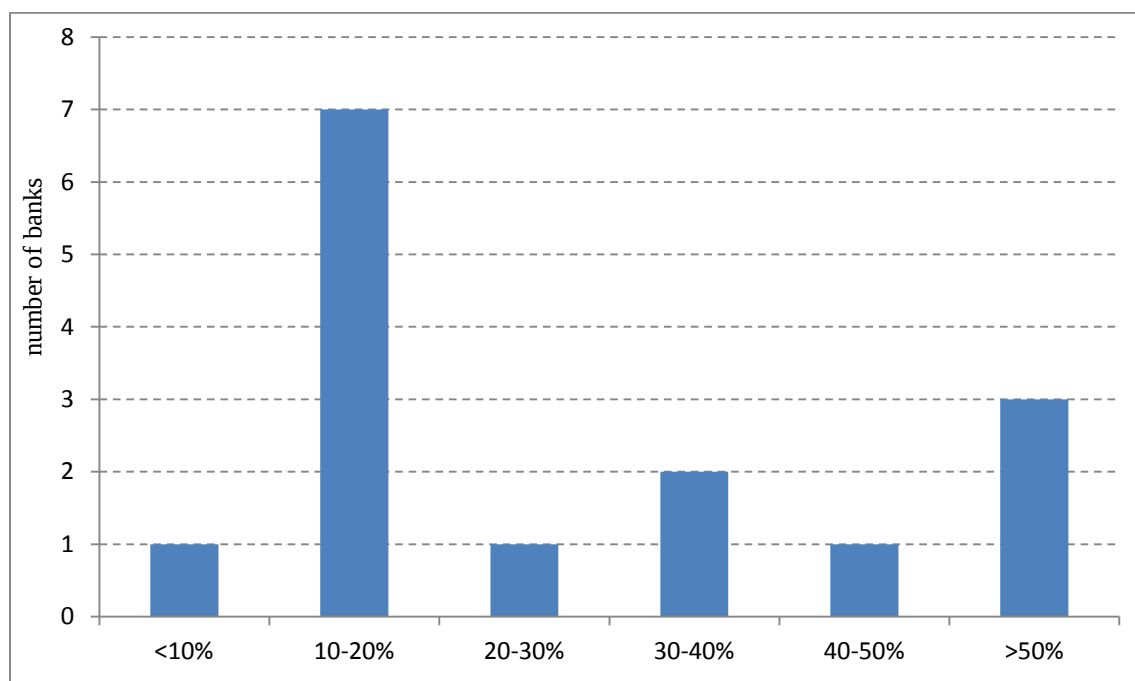


Source: Reserve Bank of Zimbabwe, 2011

The two liquidity ratios presented in table 1.4 are the liquid asset ratio and the loan to depositors' ratio. The higher the liquid asset ratio, the lower the loan to depositors' ratio (and *vice versa*). In March 2009, the liquidity ratio for banks was high at 88.1%. The loan to depositors' ratio was low at 29.2%, signaling low lending by banks after the new exchange rate regime. In the beginning of the multiple currency era there were greater volatility of deposits and increased riskiness in lending which led to banks holding higher levels of precautionary excess reserves. Some banks increased their lending portfolio progressively, leading to a decline in the liquidity ratio and an increase in the loan to depositors' ratio. In June 2011, the liquidity ratio was at 34.6% and the loan to deposit ratio was at 70%. The low liquidity ratios and the high loan to deposit ratio signal the

illiquidity of some banks. Furthermore, the problems of liquidity risk by some banks can be seen from the distributions of the prudential liquidity ratio as presented in figure 1.5.

Figure 1.5: Distribution of Prudential Liquidity Ratio



Source: Reserve bank of Zimbabwe, 2011

As at June 2011, one bank had a liquidity ratio of below 10% and seven banks had liquidity ratios of below 20%. These positions are major areas of concern because international practices among dollarised economies generally require a minimum of 25% or higher. The system's liquidity continued to be constrained and regulators in Zimbabwe allowed commercial banks to include illiquid assets. Many banks experienced problems of low liquidity ratios during the multiple currency regime.

In terms of the operating environment in Zimbabwe, there were still problems regarding depositors' levels of confidence. Despite the reported growth in deposits, the majority of depositors were salary earners, who withdrew all their funds immediately after being paid. The financial markets were thin, with a limited number of instruments to trade in

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(RBZ, 2010). There was not much activity in the interbank market. The RBZ lost its role as the lender of last resort. All the developments in the new regime pose challenges in liquidity risk management by commercial banks. Liquidity risk management in a multiple currency regime becomes complex and if left unaddressed, the Zimbabwean financial sector may be poised on the brink of a banking crisis. Inevitably, researchers are called on to contribute knowledge on options to deal with liquidity risk under the dollarised economic environment.

In conclusion, Zimbabwean commercial banks operated in challenging macroeconomic and financial environments from 2000 to 2008, when the country used its own currency, and after the introduction of the multiple currency system in 2009. Consequently, there is a need for academic research to identify and profile strategies employed by Zimbabwean commercial banks in managing liquidity risk during the Zimbabwean dollar and the multiple currency eras.

1.3 Statement of the Problem

The macroeconomic, financial market and regulatory developments in Zimbabwe from 2000 have led to an increase in banks' overall exposure to liquidity risk. In the Zimbabwean dollar era, in a bid to mop up excess liquidity in the market, the RBZ posed challenges to bank liquidity risk management. One wonders how banks managed liquidity risk, given the macroeconomic and regulatory constraints. The RBZ enhanced supervisory processes by issuing liquidity risk management guidelines in 2007 in line with international banking standards, which banks were required to adhere to. Notwithstanding this, vulnerabilities existed and still exist in the financial sector, with most banks still liquidity constrained. After the adoption of the multiple currency system, the conventional mechanisms of liquidity risk management, namely interbank market and secondary market financial instruments, were limited. The RBZ lost its function as the lender of last resort. It is therefore imperative to establish how banks in Zimbabwe manage both their assets and liabilities. This prompted investigations into various aspects of liquidity risk management by commercial banks in Zimbabwe, both when the

Zimbabwean dollar was in use and when multiple currencies were used. Given both scenarios, one is prompted to ask what programme or additional measures could be adopted by the commercial banks to comprehensively manage liquidity risk in a challenging macroeconomic environment and to avoid a banking crisis.

1.4 Objectives of the Study

The main objective of this study is to provide a comprehensive analysis of liquidity risk management by Zimbabwean commercial banks from 2000 to 2011. Arising out of the overall objective, the specific objectives of the study are as follows:

- To consider the determinants of liquidity risk in Zimbabwean commercial banks in the Zimbabwean dollar era and in the multiple currencies era;
- To establish how Zimbabwean commercial banks managed liquidity risk in the Zimbabwean dollar era;
- To ascertain how Zimbabwean commercial banks managed liquidity risk in the multiple currency environment;
- To benchmark Zimbabwean commercial banks' liquidity risk management policies to the RBZ liquidity risk management guidelines;
- To recommend additional measures that could be adopted by the RBZ and commercial banks to strengthen the monitoring of more comprehensive liquidity risk indicators;
- To suggest survival strategies Zimbabwean commercial banks could adopt in trying to circumvent the myriad of operational, regulatory, market and financial challenges that bedeviled the local financial sector.

1.5 Research Questions

Deriving from the above stated objectives, the specific research questions for the thesis are as follows:

- What were the main determinants of liquidity risk in Zimbabwean commercial banks in the Zimbabwean dollar era and in the multiple currencies era?

- How were Zimbabwean commercial banks managing liquidity risk in the Zimbabwean dollar era?
- How were Zimbabwean commercial banks managing liquidity risk in the multiple currencies era?
- Were there any differences in commercial banks' liquidity risk management policies as compared to the RBZ's liquidity risk guidelines?
- What additional measures could be incorporated by the RBZ and commercial banks in order to evaluate and assess liquidity risk?
- What other survival strategies could banks adopt in order to cope with liquidity risk management in challenging operating environments?

1.6 Significance of the Study

Liquidity risk management is part of the larger risk management framework of the financial services industry, and concerns all financial institutions. Failure to address the issue may lead to dire consequences, including the collapse of the banking sector. By extension, liquidity risk leads to the instability of the financial system. Notwithstanding this, among the studies on risk management, there is a paucity of studies that focus on liquidity risk. Considerable effort has been put into designing bank capital regulations over a long period of time. The Basel I Accord (BIS, 1988) set out the regulatory standards on market risk and credit risk. The Basel II Accord (BIS, 2004) took into account operational risk, but not liquidity risk. However, liquidity risk is one of the major reasons banks have failed. Whilst liquidity management is an ingredient that makes banks safer institutions, little attention has been paid to it. Despite the abundant literature on the good functioning of the banking sector, there are few studies on liquidity and liquidity risk management. This study on commercial banks' liquidity risk management in Zimbabwe therefore adds to the body of knowledge and closes this gap.

Studies to date have examined liquidity risk management (Aspachs *et al.*, 2005; Anas and

Mounira, 2008; Bingham, Kiesel and Schmidt, 2003; Karcheva, 2006; Valla and Saes-Escorbiac, 2006; Vodova, 2011). All these studies focused on commercial banks' liquidity management in developed nations and only after a banking crisis. The current study examines liquidity risk management by commercial banks in Zimbabwe, which is a developing nation. It also focuses on commercial banks' liquidity risk management when faced with macroeconomic, financial markets and challenging regulatory developments.

In order to account for financial market developments as well as glean lessons from the economic turmoil, the Basel Committee conducted a fundamental review of its 2000 Sound Practices for Managing Liquidity in Banking Organisations (BIS, 2000). This review was global in outlook and did not account for the idiosyncrasies that characterised the environment in which banks in Zimbabwe operated. Again, the Basel Committee did not identify dominant methodologies in order to assess and manage liquidity risk. No agreement exists in international finance and in the available literature on the proper measurement of liquidity and liquidity risk. Yet liquidity and liquidity risk are key ingredients of the safety of a bank.

The Basel Committee on Banking Supervision published its study on "Liquidity Risk Management and Supervisory Challenges" in February 2008. The study highlighted that many banks had failed to take account of a number of basic principles of liquidity risk management when liquidity was plentiful. According to the study, many of the most exposed banks did not have adequate frameworks in place that satisfactorily accounted for the liquidity risks posed by individual products and business lines. Therefore incentives at the business level were misaligned with the overall risk tolerance of the bank. Furthermore, many banks had not considered the amount of liquidity needed to satisfy contingent obligations, either contractual or non-contractual, as they viewed the funding of these obligations to be highly unlikely. Many banks viewed severe and prolonged liquidity disruptions as implausible and did not conduct stress tests that factored in the possibility of market-wide strain, and the severity or duration of the disruptions. Contingency funding plans (CFPs) were not always appropriately linked to

stress test results and sometimes failed to take cognisance of the potential closure of some funding sources. However, these findings were based on data from other countries and may not be applicable to the Zimbabwean experience. This study on liquidity risk management by Zimbabwean commercial banks closes this gap.

To the researcher's knowledge, no studies have been undertaken on liquidity risk management by Zimbabwean commercial banks. Again, according to the researcher's knowledge, no study has been conducted on commercial banks' liquidity risk management in the Zimbabwean dollar era and when the country adopted a multiple currency regime. Liquidity risk management by Zimbabwean commercial banks remains an under-researched subject. Against this background, the thesis contributes to the current issues in liquidity risk management. The thesis, in turn, provides a comprehensive analysis of liquidity risk by commercial banks in Zimbabwe. The importance of this study is to close a knowledge gap within the current existing literature. An important feature of this thesis is the empirical link that it establishes between liquidity risk management, bank specific factors, supervisory factors and the macro-economy.

The methodology employed by other studies was either purely qualitative or quantitative (econometric investigation). For example, (Fielding, 2005; Freixas, Parigi and Rochet, 2000; Bingham et al., 2003; Agenor *et al.*, 2004; Zheng, 2006; Karcheva, 2006; Lucchetta, 2007; Diamond, 2007; Anas and Mounira, 2008; Dinger, 2009; Matz and Neu, 2007; Vodova, 2011) used econometric methodologies to analyse commercial banks' liquidity risk. Other studies made use of only qualitative analysis (survey or descriptive research designs), for example (Altman and Saunders, 2001; Kannan, 2004; Motyka, Leuca and Fawson, 2005; Demirguc-Kunt and Detragiache, 2005; Bunda and Desquilbert, 2008; BIS, 2008a; Brunnermeir, 2009; Vento and Ganga, 2009). The thesis, instead, made use of triangulation methods and in particular an explanatory research design and a survey research design. The explanatory and survey designs allow for the use of both qualitative and quantitative analysis and use primary as well as secondary data (Creswell, 2003; Gujarati, 2003; Wooldridge, 2003; Saunders, Lewis and Thornhill,

2007; Brooks, 2008). This brought the benefits of combined research approaches to the study. The major advantage of using multi-methods is the fact that each method is used for a different purpose. The quantitative method identified and explained how certain variables behaved in the given circumstances. The qualitative method answered the question of why the commercial banks behaved also, in the given circumstances. Different research methods led to greater confidence and credibility being placed on the conclusions of the thesis.

1.7 Literature on Commercial Bank Liquidity Risk

Liquidity risk is the inability of a bank to accommodate decreases in liabilities or to fund increases in assets. Liquidity risk arises from the primary role of banks in the maturity transformation of short-term deposits into long-term loans (Baltensperger, 1980; Crosse and Hempel, 1980; Diamond and Dybvig, 1983; Prisman, Slovin and Sushka, 1986; Dewatripont and Tirole, 1994; Myers and Rajan, 1998; Swank, 1996; Strivasta, 2003; Strahan, 2006; Rochet, 2008; Moore, 2010).

Traditionally, liquidity risk was measured by using different liquidity ratios. Bank liquidity and illiquidity measures can be calculated from the balance sheet positions of banks. Initially, the loan-to-deposit ratio was used to measure bank illiquidity (Saunders and Cornett, 2007). Several ratios were considered to measure liquidity and took the form of readily marketable assets as a percentage of total assets; volatile liabilities as a percentage of total liabilities; readily marketable assets as a percentage of volatile liabilities; readily marketable assets as a percentage of all deposit type liabilities; and interbank loans as a percentage of interbank deposits. However, Poor and Blake (2005)'s study reached the important conclusion that it was not enough to measure liquidity by using liquidity ratios. The case in point was South East Bank of Miami which failed due to liquidity risk but had used in excess of 30 liquidity ratios to measure liquidity. Furthermore, Shen *et al.* (2009) show that beyond sheer liquidity ratios, there is need for banks and researchers to develop new methods of liquidity measurement. The various measurements of bank liquidity and liquidity risk beyond liquidity ratios are summarised in table 1.1.

Table 1.1: Alternative Measures of Liquidity Risk

Study	Method of Measuring Liquidity Risk
Bank for International Settlements (2000)	Maturity laddering method
Saunders and Cornett (2006)	Sources and uses of liquidity; peer group ratio comparisons; liquidity index; financing and financing requirement; liquidity planning
Matz and Neu (2007)	Balance sheet liquidity analysis; cash capital position and maturity mismatch approach
Shen <i>et al.</i> (2009)	Financing gap ratio
Vivian <i>et al.</i> (2009)	Liquidity planning
Schertler (2010)	Stock and cash-flow mapping approach

Source: Reviewed Literature

Based on previous studies, different variables have been found to determine liquidity risk. Table 1.2 below presents a typology of previous research on liquidity risk determinants.

Table 1.2: Various Liquidity Risk Determinants

Study	Country	Variables
Agenor <i>et al.</i> (2004)	Thailand	(i) lagged values of the ratio of excess reserves to deposits (ii) current and lagged values of the ratio of required liquid assets (iii) ratio of required liquid assets to total bank deposits

		(iv) current and lagged values of the coefficient of variation of the cash-to-deposit ratio (v) deviation of output from trend (vi) current and lagged values of the discount rate
Fielding (2005)	Egypt	(i) the level of economic output (+) (ii) discount rate (+) (iii) reserve requirements (?) (iv) cash to deposit ratio (-) (v) rate of depreciation of the black market exchange rate (+) (vi) impact of economic reform (-) (vii) violent political incidents (+)
Aspachs and Tiesset (2005)	England	(i) probability of obtaining support from the lender of last resort, which should lower the incentive for holding liquid assets (-) (ii) interest margin as a measure of opportunity costs of holding liquid assets (-) (iii) bank profitability, which, according to finance theory, is negatively correlated with

		liquidity (-) (iv) loan growth, where higher loan growth signals an increase in illiquid assets (-); (v) size of bank (?); gross domestic product as an indicator of business cycle (-) (vi) short term interest rate, which should capture the monetary policy effect (-).
Karcheva (2007)	Ukraine	(i) assets (ii) highly liquid assets (iii) government securities (iv) troubled loans (v) non-working assets (iv) balance capital (v) current liabilities (vi) household deposits
Lucchetta (2007)	Europe	(i) behaviour of the bank on the interbank market and a positive relationship attained. (ii) monetary policy interest rate was included as a measure of a bank's ability to provide loans to its customers.

		(iii) share of loans on total assets and share of loan loss provisions on net interest revenues, were both taken as a measure of risk-taking behaviour. (iv) bank size was measured by logarithm of total bank assets.
Bunda and Desquilbert (2008)	Emerging countries	(i) total assets as a measure of the size of the bank (-) (ii) the ratio of equity to assets as a measure of capital adequacy (+) (iii) the presence of prudential regulation, which means the obligation for banks to be liquid enough (+) (iv) the lending interest rate as a measure of lending profitability (-) (v) the share of public expenditure on gross domestic product as a measure of supply of relatively liquid assets (-) (vi) the rate of inflation, which increases the vulnerability of banks to nominal values of loans provided to customers (-) (vii) the realisation of a financial crisis which could be caused by poor bank

		liquidity (-) (viii) the exchange rate regime
Rauch <i>et al.</i> (2009)	Germany	(i) monetary policy interest rates, where they tighten monetary policy, reduce bank liquidity (-) (ii) level of unemployment, which is connected with demand for loans (-) (iii) savings quota (+) (iv) level of liquidity in previous period (+) (v) size of bank measured by total number of bank customers (-) (vi) bank profitability (-)
Shen <i>et al.</i> (2009)	12 Advanced Economies	(i) size (ii) square of size (iii) less risky liquid assets (iv) risky liquid assets (v) external funding dependence (vi) supervisory power index (vii) private monitoring index (viii) overall bank activities and ownership restrictiveness

		(ix) annual percent change of GDP (x) lagged variable of annual percentage change in GDP (xi) inflation
Moore (2009)	Latin America	(i) coefficient of variation of the cash-to deposit ratio (ii) output to trend output ratio (iii) the coefficient of variation of the output to trend output ratio (iv) money market interest rate
Schertler (2010)	Germany	(i) change in payment obligations (ii) change in payment obligations lagged (iii) assets (iv) lagged interest margins (v) lagged regulatory capital
Vodova (2011)	Czech Republic	(i) share of own capital on total assets of the bank (+) (ii) share of non-performing loans on total volume of loans provided by the bank (-) (iii) return on equity: the share of net profit

		on own capital of the bank (-) (iv) logarithm of total assets of the bank (+/-) (v) dummy variable for realisation of financial crisis (-) (vi) growth rate of gross domestic product (-) (vii) inflation rate (+) (viii) interest rate on loans (-); interest rates on interbank transactions (-) (ix) difference between interest rates on loans and interest rates on deposits (-) (x) monetary policy interest rates (-) (xi) unemployment rate (-)
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Source: Reviewed Literature

The studies summarised above show that commercial banks' liquidity is determined by bank-specific factors, macroeconomic factors and supervisory factors. An important task is to choose appropriate explanatory variables. Consideration needs to be given to whether the use of a particular variable makes sense for the case country's conditions. Other considerations include the availability of data.

1.8 Methodological Approach

A number of methodologies can be used to evaluate commercial banks' liquidity risk management. Each approach has its weaknesses and strengths. Notwithstanding the debate on the preferred approach, this thesis uses explanatory and survey research designs. This was prompted by the research objectives and the availability of data. In the

survey, interviews and questionnaires were used.

The explanatory research design made use of econometric models. Once the variables have been chosen, it is important to estimate the model. There are various estimation procedures, as shown in table 1.3.

Table 1.3: Various Liquidity Risk Estimation Procedures

Study	Country	Estimation Method
Tobin and Brown (2003)	Australia	Bottom Up Approach
Fielding (2005)	Egypt	Panel Regression
Aspachs and Tieset (2005)	England	Panel Regression
Karcheva (2007)	Ukraine	Nonparametric Statistics Methods
Lucchetta(2007)	Europe	Panel Data Regression
Bunda and Desquilbert (2008)	Emerging countries	Time Series Analysis
Shen <i>et al.</i> (2009)	12 Advanced Economies	Panel Data Instrumental Variable Regression
Schertler (2010)	Germany	Dynamic Panel Data Regression
Rifki (2010)	Indonesia	Auto Regressive Distributed Lag (Dynamic) Model
Vodova (2011)	Czech Republic	Panel Data Regression

Source: Reviewed Literature

From the above table, one can conclude that, of the various ways in which the liquidity risk model can be estimated, the most preferred is panel regression analysis. There are benefits to using panel regression analysis (Baltagi, 2008). Among other benefits, these include controlling for individual heterogeneity; providing more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency; and ability to study the dynamics of adjustment. In line with this, the thesis used panel data regression to understand what determines Zimbabwean commercial banks' liquidity risk in the Zimbabwean dollar era (2000-2008) and in the multiple currency era (2009- 2011).

1.9 Thesis Overview

The thesis is organised as follows; chapter one provides the introduction to the subject matter and the study. It discusses the background to the study and economic developments in Zimbabwe from 2000 to 2011. It outlines the contingency measures taken by the RBZ to support the local financial system in the wake of different operating environments. Finally it presents the problem statement, objectives of the study, research questions and the justification for the study. Chapter two reviews the literature on the fundamental principles of liquidity risk management. Chapter three reviews the literature on the measurement and determinants of commercial bank liquidity and liquidity risk. Chapter four reviews the literature on inflation and commercial bank liquidity risk management. Chapter five presents the research methodology. Chapter six econometrically investigates commercial banks' liquidity risk determinants in the Zimbabwean dollar era and the multiple currency exchange rate regime. Chapter seven presents survey results on liquidity risk management in Zimbabwe during the Zimbabwean dollar era, when there was a hyperinflationary environment. Chapter eight presents the findings on commercial bank liquidity management in a multiple currency environment. Chapter nine presents the summary of findings, conclusions and recommendations of the study. A liquidity risk management framework is proposed

which could be used by the RBZ and commercial banks as a tool to manage liquidity risk smoothly across business cycles. This framework is proposed to facilitate the operations of banks' liquidity risk management, and to accommodate the demand for highly liquid assets in periods of heightened stress.

1.10 Summary

The chapter introduced the subject of liquidity and liquidity risk management by commercial banks in Zimbabwe. Liquidity management is an integral part of the entire funds management of any bank. A bank may be solvent, but if exposed to liquidity risk, it may fail in a short period of time. Since 2000, liquidity in Zimbabwe has been determined by the quantity of money supply in the economy as measured by the broad money, M3. In 2000, the country started experiencing macroeconomic problems, chief among which were high rates of inflation. From 2003 to 2004, a banking crisis saw nine financial institutions, including commercial banks, placed under the management of a curator.

For the greater part of 2000 to 2008, the financial markets in Zimbabwe were characterised by negative real rates of return and a dwindling savings base. To curb the money supply growth, the Reserve Bank pursued a tight monetary policy stance. The RBZ adopted a combination of direct and indirect instruments aimed at maintaining short market positions. These included the Zimbabwe Treasury bill, Open Market Operations, RBZ financial bills and Special Open Market Bills. The active liquidity mopping up programme resulted in a severe liquidity crunch, rendering liquidity risk management a challenge for most banks.

The RBZ continuously revised the key accommodation bank rates upwards in line with inflation. This continuous revision led to increased minimum lending rates, which discouraged lending activity by commercial banks. Zimbabwe's financial sector was faced with a highly challenging operating environment, leading to an emphasis on the management of the money market and liquidity positions.

Following a decade of economic decline, the Zimbabwean government adopted a multiple currency system in January 2009. The new regime helped to restore price stability and to restart financial intermediation. Despite this, the new regime posed a challenging operating environment characterised by a liquidity constrained environment. Interbank activities were limited, and there were limited money market activities and conventional liquidity instruments to trade in, as well as a lack of confidence on the part of depositors and no lender of last resort function by the RBZ. The banking sector faced increasing risk in a number of areas which heightened liquidity risk. Commercial banks struggled to raise their minimum capital requirements. Liquidity management became complex in the new regime.

In conclusion, Zimbabwean commercial banks operated in challenging operating environments with macroeconomic and financial market developments from 2000 to 2011, leading to an increase in many banks' overall exposure to liquidity risk. If left unattended, this could lead to a banking crisis in the near future. The main objective of the thesis is to present a comprehensive analysis of Zimbabwean banks' liquidity risk management in a challenging operating environment. The ultimate objective is to propose a liquidity management framework that could be used by the RBZ and the commercial banks as a tool to manage liquidity smoothly across business cycles. The survey will allow the thesis to highlight potential causes of liquidity risk, the survival strategies commercial banks undertook and other strategies to survive. The study is significant because there is a paucity of research on liquidity risk management as compared to credit, operational and market risk management. The studies that have examined liquidity management have mainly been undertaken in relation to bank crisis. To the researcher's knowledge, no research has been done on Zimbabwean commercial banks' liquidity risk management.

The next chapter reviews the theoretical and empirical literature on liquidity risk management by commercial banks. The review provides a conceptual framework of liquidity risk management by commercial banks.

CHAPTER TWO

LIQUIDITY AND LIQUIDITY RISK MANAGEMENT ISSUES

2.1 Introduction

Chapter two reviews the relevant literature surrounding the fundamentals of liquidity and liquidity risk management by commercial banks. Liquidity is essential in all banks to compensate for expected and unexpected balance sheet fluctuations and provide funds for growth. Banks are particularly vulnerable to liquidity problems, whether at an institution specific level or from a systematic or market viewpoint (Van Greuning and Bratavonic, 2003). In line with this, theoretical and empirical postulations are critically examined. The chapter is subdivided as follows: Section 2.2 presents the definitions of liquidity and liquidity risk. Section 2.3 presents the relationships between liquidity risk and other banking risks. Section 2.4 examines the importance of liquidity risk management. Section 2.5 deals with liquidity management theories which include the commercial loan theory; shiftability theory; anticipated income theory and the liability management theory. Section 2.6 analyses the rating of the liquidity factor. Section 2.7 reviews various ways of managing liquidity mismatches. Section 2.7.1 considers the important sources of funds and section 2.7.2 considers other sources of funds. Section 2.8 reviews liquidity risk management and International Banking Standards. The aim is to place the research within best banking practices. Section 2.9 examines liquidity risk management strategies. Finally, section 2.10 provides a summary of the main issues discussed in this chapter.

2.2 Liquidity and Liquidity Risk Defined

Bank liquidity is the ability of a bank to fund increasing assets and meet obligations when due, without incurring unacceptable losses (Harrington, 1987; Cates, 1990; Cooper and Thomas, 1998; Freixas and Rochet, 1999; Holmstrom and Tirole, 2000; Sinkey, 2002; Tobin and Brown, 2003; Van Greuning and Bratavonic, 2003; Agenor *et al.*, 2004; Aspachs *et al.*, 2005; Dev and Vandara, 2006; Karcheva, 2006; Acerbi and Scandolo, 2008; Machiraju, 2008; Bessis, 2009; Drehmann and Nikolaou, 2009; Moore, 2010;

Ismal, 2010). Failure by the banks to manage liquidity brings about liquidity risk. According to Machiraju (2008), liquidity risk covers all risks associated with a bank failing to meet its obligations in time or only being able to do so by emergency borrowing at high cost. The Bank for International Settlements (BIS) (2008a) defines liquidity risk as the risk of a bank being unable to obtain funds at a reasonable price within a reasonable time period to meet its commitments. Liquidity risk is the risk to a bank's earnings and capital arising from its inability to meet obligations when due, without incurring unacceptable losses (Bessis, 2009). From the given definitions, one can conclude that all financial institutions that engage in maturity intermediation, borrowing short and lending long, are necessarily placed in a potentially illiquid position.

The term “liquidity risk” includes two types of risk: funding liquidity risk and market liquidity risk. Funding liquidity risk is the risk that a bank will fail to efficiently meet both expected and unexpected current and future cash flow and collateral needs without affecting either daily operations or the financial condition of the firm (Aspachs *et al.*, 2005; Vento and Ganga, 2009). Accordingly, funding risk is a function of market perceptions on the credit standing and reputation of the bank. Market liquidity risk is the risk that a bank cannot easily offset or eliminate a position at the market price because of inadequate market depth or market disruption (Nikolau, 2009; Vento and Ganga, 2009; Drehmann and Nikolaou, 2009). There is a strong relationship between funding liquidity risk and market liquidity risk. Lower market liquidity leads to higher margins, which increases funding liquidity risk (Brunnermeir, 2009). In addition, Vodova (2011) shows that it is more evident if the shocks to funding liquidity can lead to asset sales, leading to a decrease in asset prices. Liquidity risk dynamics therefore vary according to a bank's funding market, balance sheet, and inter-corporate structure. The most common signs of possible liquidity problems include rising funding costs; requests for collateral; a rating downgrade; concentrations in either assets or liabilities; rapid assets growth funded by volatile large deposits; decreases in credit lines; large off-balance sheet exposures; or reductions in the availability of long-term funds (Goacher, 2002; Anas and Mounira, 2008; Berger and Bouwman, 2009; Bessis, 2009; Chikoko and Le Roux, 2011). For the

purposes of this thesis, funding liquidity risk is regarded as liquidity risk. Bank management must ensure that sufficient funds are available at a reasonable cost to meet potential demand from both fund providers and borrowers.

2.3 Relationship between Liquidity Risk and Other Banking Risks

Bankers and supervisors need to understand and assess how a bank's exposure to other risks may affect its liquidity. There are nine categories of risk: credit, interest rate, liquidity, price, foreign currency translation, transaction, compliance, strategic, and reputation (Bessis, 2009; Ismal, 2010). These categories of risk are not mutually exclusive. Any product or service may expose the bank to multiple risks. A real or perceived problem in any area can prevent a bank from raising funds at reasonable prices, thereby increasing liquidity risk. The primary risks that may affect liquidity are reputation, strategic, credit, interest rate, operational, price, and transaction. If not properly managed and controlled these risks will eventually undermine a bank's liquidity position. A brief description of how these risks may affect liquidity is provided below.

Credit risk is the risk that borrowers will fail to make promised interest and principal payments. Credit risk is the current and prospective risk to earnings or capital arising from an obligor's failure to meet the terms of any contract with the bank or otherwise to perform as agreed. Credit risk is seen in the portfolio of non-performing loans. A non-performing loan is a loan that is not earning income and full payment of principal and interest is no longer anticipated, or the maturity date has passed and payment in full has not been made (Stylz, 1996; Van Greuning and Bratavonic, 2003; Bessis, 2009). At a practical level there is no global standard to define non-performing loans. Variations exist in terms of the classification system, the scope, and contents. Such a problem potentially adds to disorder and uncertainty in non-performing loans issues. Presently, the five-tier system is the most popular risk classification method. The standard loan classifications are defined by BIS (2008) as follows:

(i) Passed: These are solvent loans when debt service capacity is considered to be beyond

any doubt. Loans in this category are fully secured by cash or cash substitutes (e.g. bank certificate of deposits and treasury bills) regardless of arrears or other adverse credit factors.

(ii) Special Mention/Watch list: These are loans to borrowers which may pose some collection difficulties, for instance; because of continuing business losses. This also applies to borrowers with an adverse trend in their operations or an unbalanced position in the balance sheet, but which have not reached a point where repayment is jeopardised. Examples include credit given through an inadequate loan agreement or without proper documentation.

(iii) Substandard: These are loans to borrowers with insufficient cash flow to meet repayment. When the primary source of repayment is insufficient the bank must look to secondary sources for repayment such as collateral, sale of fixed assets and refinancing. Substandard loans also cover loans whose interest or principal payments are more than three months in arrears. The banks make 10% provision for the unsecured portion of the loans classified as substandard (BIS, 2008b).

(iv) Doubtful: Full liquidation of outstanding debts appears doubtful and the accounts suggest that there will be a loss, the exact amount of which cannot be determined as yet. These include non-performing loans that are at least 180 days past due. Banks make 50% provision for doubtful loans (BIS, 2008b).

(v) Virtual Loss and Loss (Unrecoverable): Outstanding debts are regarded as not collectable; these are usually loans to firms which applied for legal resolution and protection under bankruptcy laws. Banks make 100% provision for loss loans.

Non-performing loans comprise the loans in the latter three categories, and are further differentiated according to the degree of collection difficulties (Stylz, 1996; Saunders and Cornett, 2006). Whichever way, when clients fail to settle commitments in time, it negatively affects the liquidity of the bank and exposes it to liquidity risk.

Operational risk is the risk of loss resulting from inadequate or failed internal processes, people or systems or from external events. This includes legal risk, but excludes strategic risk and reputational risk (Bessis, 2009; Nedbank, 2009). The sub-risks of operational risk are:

- Business disruption and system failures;
- Clients, products and business practices;
- Damage to physical assets;
- Employment practices and workplace safety;
- Execution, delivery and process management; external fraud; internal fraud;
- Legal risk (legal risk is a subcategory of the sub-risk clients, products and business practices); and
- Model risk (for economic capital purposes, model risk is a subcategory of the sub-risk clients, products and business practices).

Operational risk leads to financial loss and feeds into liquidity risk.

The risks of liquidity have reputational effects (Holmstrom and Tirole, 2000). Reputational risk is the potential loss resulting from a decrease in a bank's standing in public opinion. Nedbank (2009) defines reputational risk as the risk of impairment of the group's image in the community or the long-term trust placed in the group by its shareholders as a result of a variety of factors. These factors include group performance, strategy execution, and ability to create shareholder value or an activity or stance taken by the group. Reputational risk is therefore the current and prospective impact on earnings and capital arising from negative public opinion. A bank's reputation in terms of meeting its obligations and operating in a safe and sound manner is essential to attract funds at a reasonable cost and retain funds during troubled times. Failure to attract funds in time and at reasonable cost leads to liquidity problems.

Strategic risk is the risk of an adverse impact on capital and earnings due to business policy decisions (made or not made), changes in the economic environment, deficient or

insufficient implementation of decisions, or failure to adapt to changes in the environment (Saunders and Cornett, 2006; Saunders and Cornett, 2007). Nedbank (2009) maintains that strategic risk is either the failure to do the right thing, doing the right thing poorly, or doing the wrong thing. Strategic risk includes:

- The risk associated with the deployment of large chunks of capital into strategic investments that subsequently fail to meet stakeholders' expectations;
- The risk that the strategic processes to perform the environmental scan, align various strategies, formulate a vision, strategies, goals and objectives and allocate resources for achieving, implementing, monitoring and measuring the strategic objectives are not properly in place or are defective; and
- Failure to adequately review and understand the environment in which the group operates, leading to underperformance of its strategic and business objectives (specific environmental components are *inter alia* industry, political, economic, government, competitive and regulatory factors).

Common sources of strategic risk are competition; a shift in customer priorities and overreliance on few customers; economic factors; regulations; work processes and procedures; and inadequate information for decision making (RBM, 2007). Strategic risk therefore affects banks' liquidity management. No strategic goal or objective should be planned without considering its impact on a bank's funding abilities.

Interest rate risk is the risk that the group's earnings or economic value will decline as a result of changes in interest rates (Heffernan, 2005). The sources of interest rate risk in the banking book are:

- Repricing risk (mismatch risk) [timing differences in the maturity (for fixed-rate) and repricing (for floating-rate) of bank assets, liabilities and off-balance-sheet positions];
- Basis risk (imperfect correlation in the adjustment of the rates earned and paid on different instruments with otherwise similar repricing characteristics);
- Yield curve risk (changes in the shape and slope of the yield curve); and

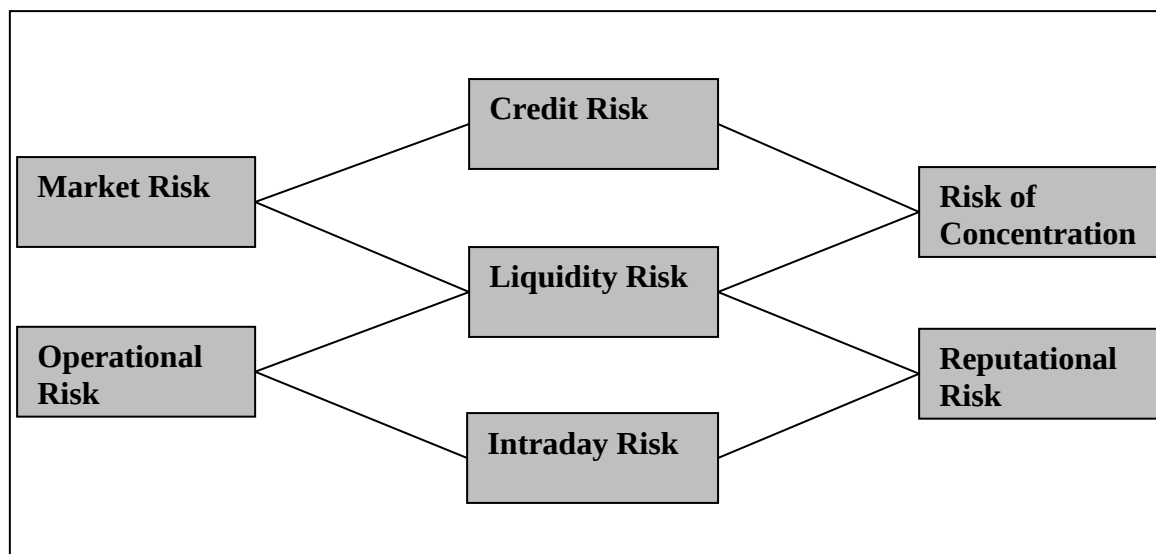
- Embedded options risk (the risk pertaining to interest-related options embedded in bank products).

Changes in interest rates affect income earned from assets and the cost of funding those assets. The RBM (2007) highlighted that changes in interest rates affect the underlying value of banking institutions' assets and liabilities.

Market risk (or price risk) is defined as the risk of losses in on- and off-balance-sheet positions arising from movements in market prices. According to Bingham *et al.* (2003), market risk is the risk to earnings or capital arising from changes in the value of traded portfolios of financial instruments. Under the Basel II market risk encompasses the risks pertaining to interest rate related instruments and equities in the trading book and foreign exchange risk and commodities risk throughout the bank. The risk is most prevalent in large banks that actively trade financial instruments. Market risk may result in volatile earnings which feed into bank illiquidity.

The link between liquidity risk and other types of risk is shown in figure 2.1.

Figure 2.1: The Link between Liquidity Risk and other Types of Risk



Source: Vento and Ganga (2009)

Vento and Ganga (2009) highlight the fact that liquidity risk is not an isolated risk but a

consequential risk, with its own intrinsic characteristics, that can be triggered or exacerbated by other financial and operating risks within the banking business. Liquidity risk should not be seen in isolation because financial risks are not mutually exclusive.

2.4 The Importance of Liquidity Risk Management

Liquidity risk management in day-to-day operations is typically achieved through the management of a bank's assets while, in the medium term, it is achieved through management of the structure of the bank's liabilities (Mueller, 1998; Myers and Rajan, 1998; Motyka, Leuca and Fawson, 2005; Poorman and Blake, 2005; BIS, 2006; BIS, 2008b). Asset and liability management can be viewed as the proactive management of both sides of the bank's financial statement position with special emphasis on the management of interest rates and the liquidity risk (Heffernan, 2005). Liquidity management thus encompasses both asset and liability management dimensions. When viewed in this context, liquidity management may be appropriately viewed as an important part of the entire funds management programme and the overall financial condition of the bank. It is clear, then, that strategies to cope with pressures arising from the banking environment are executed in the form of Asset Liability Management (ALM) practices. An efficient ALM technique aims to manage the volume, mix, maturity, rate, sensitivity, quality and liquidity of the assets and liabilities as a whole so as to achieve a predetermined acceptable risk reward ratio (Rose, Kolari and Fraser, 1993; Bhattacharya and Thackor, 1993; Gabbi, 2004). The implication is that the sophistication of a bank's liquidity management process depends on its business activities and overall level of risk.

Most banking activity depends on the bank's ability to provide liquidity to its customers. The majority of financial transactions and commitments have implications for a bank's liquidity. In line with this, various authors (Bhattacharya and Thackor, 1993; Freixas and Rochet, 1999; Van Greuning and Bratavonic, 2003; RBM, 2007) have indicated that effective liquidity risk management by banks serves some of the following important functions:

- (i) It demonstrates to the market place that the bank is safe and therefore capable of
-
- LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS**

repaying its borrowings. It provides the confidence factor, in line with the popular saying that “banking is all about confidence”, a point which has proved very challenging for the majority of commercial banks.

(ii) Liquidity risk management enables the bank to meet its prior loan commitments, whether formal or informal.

(iii) It enables the bank to avoid the unprofitable sale of its assets, when a sudden need for funds arises and the bank has no liquid funds on hand but has assets; these assets may be sold at unprofitable prices and terms negatively affecting profitability.

(iv) It lowers the size of the default risk premium that the bank must pay for funds.

(v) Liquidity risk management enables banks to avoid abusing the privilege of borrowing at the central bank’s discount window. The central bank offers lender of last resort facilities to banks with short positions; effective liquidity management therefore entails limited use of these facilities.

By assuring a bank’s ability to meet its commitments, liquidity risk management can reduce the probability of an adverse situation developing. The importance of liquidity transcends individual institutions as liquidity shortfalls in one institution can have repercussions on the entire system. As a result of the intricate network of banking business, when some institutions fail, others within the same corporate group would also be exposed to risk.

The core activity of banks is to offer liquidity to their customers. Depositors, borrowers and lenders have different liquidity preferences which change over time because of unexpected events. Because of this, the importance of the process of liquidity risk management cannot be underestimated both for an individual bank and for the entire system. There is continuous need for a bank to be in line with the preference changes and perform the key role of liquidity provision efficiently, even in a challenging operating environment.

2.5 Liquidity Management Theories

Theories of bank liquidity management emanated almost simultaneously with the organisation and development of commercial banks. Initially, the issue of bank liquidity management had two theoretical approaches. The first was based on the fact that the structure of the bank's assets on terms must exactly match the structure of its liabilities. This virtually eliminated the possibility of commercial banks adopting active policies to manage liquidity risk. The second approach was based on the real disparity between the structures of assets and liabilities balance because not even the most powerful commercial bank is immune from the effects of financial and credit phenomena.

There are three theories based on the management of assets. These are the commercial loan theory, the shiftability theory and the anticipated income theory. There is one theory based on the liabilities and is it referred to as the liability management theory. These theories are discussed in turn.

2.5.1 Commercial Loan Theory

The commercial loan theory maintained that commercial bank liquidity would be assured as long as assets were held in short-term loans that would be liquidated in the normal course of business. Banks were expected to finance the movement of goods through the successive stages of production to consumption. The commercial loan theory holds that banks should lend only on “short-term, self-liquidating, commercial paper”. The theory was designed to finance trade. It was in line with what is called working capital loans or inventory today. Loans should be based on “real” goods as opposed to loans for speculative or purely financial purposes, hence the alternative phrase; *the real bills doctrine* (Lockett, 1984; Reed and Gill, 1989; Machiraju, 2008).

Various researchers criticised the commercial loan theory. Lockett (1984) maintained that the theory prohibits the making of longer-term loans, which are considered illiquid. The basic argument is that the liabilities of a bank are payable on demand and the bank cannot therefore meet its obligations if assets are tied up for longer periods of time. Rather, a

bank needs a continual and substantial flow of cash moving through it in order to maintain its own liquidity, and this cash flow can only be attained if the bank limits its lending activities to shorter-term maturities. Reed and Gill (1989) observed that the commercial loan theory failed to take into account the needs of the economy. In the US, banks rigidly adhered to the theory and were prohibited from financing expansion of plant and equipment, house purchases, livestock acquisition and land purchases. The ultimate result was the birth of competing financial institutions such as mutual savings banks, savings and loan associations and credit unions, among others.

Luckett (1984) concurred that the commercial loan theory is flawed by serious misconceptions, both analytical and historical. On a theoretical level, the most basic weakness of the real bills doctrine is that it has misconceived the nature of what is and is not “real”. The fact that a bank is making a loan against physical goods does not guarantee the full repayment of the loan. This is because the value of the goods may fall appreciably and this may impair the ability of the borrower to repay the loan. In short, therefore, the bank does not lend against the goods bought by the funds so advanced, but against the value of those goods, which may decrease. Hence, there is a speculative element to any loan, whether or not it has real goods as its immediate source.

It therefore follows, that even if banks had adhered rigidly to the tenets of the commercial loan theory, they would still have been vulnerable to bankruptcy during the depressions of the nineteenth century. A bank’s liquidity is not fully guaranteed unless its loans are entirely safe and liquid (Smith, 1991). Commercial loans are not liquid unless the bank can demand repayment at any time. They are not safe unless it is certain that the financed goods will, in fact, be sold.

However, the theory assumes that all commercial loans would be liquidated in the normal course of business. While businesses have no difficulty meeting their obligations during periods when economic activity is high, in periods of economic recession, the movement of goods from cash to inventory, to sales, to accounts receivable, to cash is interrupted,

and business finds it difficult, if not impossible, to liquidate bank credit (Reed & Gill, 1989). The real bills doctrine asserts that liquidity crises are less likely when banks hold short-term liquid assets. However, as Smith (1991) noted, the real bills doctrine is not sufficient to avoid liquidity crises, especially during periods of economic crisis.

Another important critique was that the commercial loan theory did not take into account the relative stability of core bank deposits (Machiraju, 2008). Core deposits enable a bank to extend loans for reasonably long periods without being illiquid. However, the relative stability of deposits can be questioned in times of economic crisis when confidence in the banking system is usually at an all-time low and depositors maintain accounts largely for transaction purposes. This trend supports the extension of only short-term loans, as advocated by the real bills doctrine.

Despite the critics, the commercial loan theory has been a persistent theory of banking. Remnants of it still remain in the structure of bank regulatory agencies, bank examination procedures, and the thinking of many bankers.

2.5.2 Shiftability Theory

The shiftability theory was an extension to the commercial loan theory. The theory is based on the proposition that the assets of the bank could either be sold to other lenders or investors or shifted to the central bank. In particular, a bank could satisfy its liquidity requirements if it held loans and securities that could be sold in the secondary market prior to maturity. The ability to sell government securities and eligible paper effectively substituted for illiquid, longer-term loans with infrequent principal payments. A commercial bank would be able to meet its liquidity needs if it had assets to sell (Crosse and Hempel, 1980; Santomero, 1984; Tobin and Brown, 2003).

The shiftability theory had a profound influence on banking practices by shifting the attention of bankers and banking authorities from loans to investments as a source of liquidity. A bank holding short-term money market instruments such as Treasury bills (TBs) or call loans is actually in a better position to shift its assets than a bank holding

customer notes, since the open market debt can be sold before maturity if necessary. As Luckett (1984) indicated, the liquidity position of a bank consequently came to be associated with the amount of money market instruments it was holding (its secondary reserves).

The shiftability theory had a major weakness, which however, according to Luckett (1984), does not lie in the theory itself, as it is well understood by the various writers on the subject. The flaw in the shiftability theory was that although one bank could raise liquidity by shifting its assets, the same strategy would not work if all banks attempted to shift at the same time. This is what logicians call “the fallacy of composition”, that is the supposition that what is true if one member of a set behaves in a particular way will continue to be true when all members of the set behave that way. Clearly, all banks cannot gain additional cash reserves by shifting their earning assets to one another. This problem becomes acute in times of crisis. Machiraju (2008) highlighted that liquidity problems could arise if the market prices of securities fall and loans are only liquidated at a loss.

The shiftability theory suffers from the weakness that in periods of economic crisis, banks cannot all raise additional liquidity simply by shifting assets. This is because there is selling pressure as all banks attempt to raise funds and buyers are difficult to find. Where a seller manages to sell an asset, the sale will be at a huge discount, representing an appreciable loss in value. The price is not at all predictable. Assets that are liquid during normal times may therefore be relatively illiquid in periods of economic crisis.

In 1929-1933, all the US banks wanted to be sellers and none wanted to buy. What was needed was some agency outside the banking system to chip in with funds and buy all the assets available for sale. This was the purpose for which the Federal Reserve System (FRS) had been set up, but it acted rather sluggishly, resulting in a banking crisis that could have been abated if the “right” thing had been done (Luckett, 1984). The problem of the liquidity of the whole banking system is simply not solvable by commercial banks

alone. A central bank that is prepared to act quickly and decisively is an absolute necessity.

2.5.3 The Anticipated Income Theory

The anticipated income theory holds that liquidity can be ensured, if scheduled loan repayments are based on the future income of the borrower. The theory relates loan repayment to income that relies on collateral. It also holds that a bank's liability can be influenced by the maturity pattern of the loan and investment portfolios. The theory recognised that certain types of loans have more liquidity than others. On the basis of the theory, bank management adopted the ladder effect in the investment portfolio. Banks ensured a certain amount of securities annually and at times when funds might be demanded for lending or withdrawal (Levine, 1997; Strahan, 2006).

The major critique of the anticipated income theory was that there were no clues as to the future income of the borrowers. During periods of economic crisis, there is widespread uncertainty regarding almost all major macroeconomic fundamentals that affect the future earnings of businesses, such as inflation, output, exchange rates, and interest rates. Planning is very difficult and businesses usually adopt short-term strategies that are mainly survival-oriented. Earnings forecasts cannot be relied on. Under such conditions, the anticipated income theory becomes difficult to apply, as it exposes banks to increasing credit risk. The only markets that tend to do well during periods of economic crisis are the speculative asset markets (real estate, foreign exchange and stock markets). These markets have the potential to realise substantial short-term gains, but entail the risk that the speculative bubble may burst before holders offload their holdings of speculative assets. The involvement of banks in such markets, either directly by purchasing assets or indirectly by financing the acquisition of such assets, may result in substantial liquidity problems.

2.5.4 Liability Management Theory

The liability management theory presents that banks can satisfy their liquidity needs by

borrowing in the money and capital markets. According to this theory, banks can meet their liquidity requirements by bidding in the market for additional funds to meet loan demand and deposit withdrawals. When in need of immediate available funds, banks can simply borrow *via* Federal funds, repos, commercial paper and Eurodollars. The liability management theory became increasingly popular as banks gained the ability to pay market interest rates on large liabilities. The fundamental contribution of the theory was consideration of both sides of a bank's balance sheet as sources of liquidity. Today, banks use both assets and liabilities to meet liquidity needs. Available liquidity sources are identified and compared to expected needs by a bank's Asset and Liability Committee. Management considers all potential deposit outflows and inflows when deciding how to allocate assets and finance operations. Key considerations include maintaining high asset quality and a strong capital base that reduces liquidity needs and improves a bank's access to funds at low cost (Koch & Scott, 2008).

In a broad sense, liability management consists of the activities involved in obtaining funds from depositors and other creditors and determining the appropriate mix of funds for a particular bank. In a narrower sense, liability management has come to be known as the activities involved in supplementing liquidity by actively seeking borrowed funds when needed (Reed & Gill, 1989).

The term "liability management" is something of a misnomer (Luckett, 1984). It does not mean that the bank only manages its liabilities and is passive with respect to its assets. Rather, the theory also recognises that the asset structure of a bank plays a prominent role in providing a bank with liquidity. But the theory goes on to argue that the bank can also use its liabilities for liquidity purposes. The ability to sell certificates of deposit, to sell securities under repurchase agreements (repos), and to borrow Eurodollars enables a bank to rely less on low-earning secondary reserve assets for liquidity, which may enhance the earning power of a bank. However, as Reed and Gill (1989) point out, these activities are not without risk. Instead, liability management requires consideration of the extra risk as well as the difference between the cost of obtaining funds and the return that can be

earned when the funds are invested in loans or securities. Thus, the relationship between asset management and liability management is a critical determinant of a bank's profitability.

As Luckett (1984) indicated, a number of observers have expressed serious reservations about liability management banking, because the theory and practice seem to be flawed in the same way that the shiftability theory was flawed. Specifically, while any individual bank can acquire funds through selling liabilities, the entire banking system cannot. Thus the concern is that a financial panic might very quickly eliminate the liability markets, as viable sources of liquidity, and banks that place too much reliance on them would find themselves in deep financial difficulties.

The liquidity management theories are essential in this research study in helping analyse liquidity management by commercial banks in challenging operating environments. One would want to investigate which of the liquidity management theories Zimbabwean commercial banks adopted to manage liquidity risk.

2.6 Rating of the Liquidity Factor

As part of liquidity risk management, liquidity may be rated (Uniform Financial Institutions Rating System (UFIRS) (2007). In evaluating the adequacy of financial institutions' liquidity position, various categories of rating liquidity are given (UFIRS, 2007). A rating of one indicates strong liquidity levels and well-developed funds management practices. The institution has reliable access to sufficient sources of funds on favourable terms to meet present and anticipated liquidity needs.

A rating of two indicates satisfactory liquidity levels and funds management practices. The institution has access to sufficient sources of funds on acceptable terms to meet present and anticipated liquidity needs. Modest weaknesses may be evident in funds management practices. A rating of three indicates liquidity levels or funds management practices in need of improvement. Institutions rated three may lack access to funds on reasonable terms or may present evidence of significant weaknesses in funds

management practices. A rating of four indicates deficient liquidity levels or inadequate funds management practices. Institutions rated four may not have or be able to obtain a sufficient volume of funds on reasonable terms to meet liquidity needs. A rating of five indicates liquidity levels or funds management practices so critically deficient that the continued viability of the institution is threatened. Institutions rated five require immediate external financial assistance to meet maturing obligations or other liquidity needs.

According to the *Risk Management Manual* (RMM) (2007), liquidity is rated one through to five with respect to the various aspects shown in table 2.1.

Table 2.1: Determinants of Liquidity Ratings

Volatility of deposits
Reliance on interest-sensitive funds and frequency and levels of borrowings
Unused borrowing capacity
The capability of management to properly identify, measure, monitor, and control the institution's liquidity position, including the effectiveness of funds management strategies, liquidity policies, management information systems, and contingency funding plans
Level of diversification of funding sources
Ability to securitise assets
Availability of assets readily convertible into cash
Ability to pledge assets
Impact of holding company and affiliates
Access to money markets
The institution's earnings performance
The institution's capital base
The nature, volume and anticipated usage of the institution's credit commitments

Source: RMM (2007)

Ratings of the liquidity factor are critical in liquidity risk management. This is because ratings reflect the ability of the institution to manage changes in the funding sources and reaction to changes in market conditions when they are adverse. Ratings of the liquidity factor would help in the analysis of how banks manage liquidity risk given specific conditions.

2.7 Management of Liquidity Mismatches

As highlighted earlier, banks borrow on short-term and lend for long-term which leads to liquidity mismatches. It is important, then, to analyse how banks manage these mismatches. This can be examined in view of funding sources in relation to assets and liabilities. Machiraju (2008) observed that sources of liquidity are the maturity structure of the balance sheet on the asset side, to sell, discount or pledge assets at short notice at minimum cost. On the liabilities side, the source of liquidity is the ability of the bank to raise new money at short notice. Accordingly, the bank's ability to maintain adequate liquidity is a factor of market perceptions and its reputation regarding credit risk and financial strength.

2.7.1 Important Sources of Funding

The important sources of funding are discussed in turn.

(i) Deposits

Deposits may be grouped as core deposits, public funds and large depositors (Goacher, 2002). Deposits play a critical role in a bank's ongoing and successful operation. Accordingly, it is important for banks to implement programmes to retain and expand the depositors' base and monitor the nature and volatility of the deposit structure (Howells and Bain, 2002). It is important to note that management must not only project deposit growth, but also determine the make-up of the accounts in terms of stable deposits, fluctuating or seasonal deposits and volatile deposits (Latzko, 2006). The reason for this is that a lack of such knowledge could lead to unwise employment of funds which leads to liquidity risk problems.

(ii) Drawing Credit Lines from Peer Banks

The other avenue for funds is to borrow at interbank-market level. Generally central banks encourage banks to participate actively in this market. However, in some cases committed lines of credit from peer banks may be really limited; hence the need to explore other avenues.

(iii) Negotiable Certificate of Deposits

Negotiable certificate of deposits are an effective tool for banks to raise large volumes at short notice. This is because in terms of this avenue, there is no concept of premature withdrawal, making it a better way to raise short term deposits and at the same time managing asset and liability concerns.

(iv) Drawing of Funds from the Central Bank

In the normal course of business, banks generally do not rely on the central bank for their funding sources. However in the recent past, Indian banks have been accessing the liquidity facility of the central bank to respond to short-term asset and liability mismatches (RBM, 2000). Generally, central banks have reiterated that banks should use their liquidity facility only for very short-term mismatches and not for onward lending. Banks are expected to depend on other sources to fund themselves and not the central bank. When a country has a multiple currency regime, banks cannot depend on the central bank for liquidity. They would have to provide liquidity from their ability to deal in financial markets and from lines of credit established from other banks.

(v) International Funding Sources

There are a number of sources of international funding (Machiraju, 2008). The cited benefit of this avenue is that they are free of reserve requirements and deposit insurance assessments. Despite this, international sources of funds have the potential to be volatile.

2.7.2 Other Sources of Funding

There are many ways banks can manage asset and liability mismatches. Various authors (Agenor *et al.*, 2004; Demirguc-Kunt and Detragiache, 2005; Berger and Bouwman, 2009) recommend the acquisition of funds in a market at a competitive cost. This strategy enables profitable banks to meet the expanding customer demand for loans, with the misuse or improper implementation of liability management having severe consequences. Despite this, there are risks associated with the practice of market funding-based liquidity management and these are summarised as follows:

- (i) Purchased funds may not always be available when needed. If the market loses confidence in a bank, the bank's liquidity may be threatened.
- (ii) Over-reliance on liability management may cause a tendency to minimise the holding of short-term securities and to relax asset liquidity standards, and may result in a large concentration of short-term liabilities that support assets with longer maturities. During times of tight money, this tendency could squeeze earnings and give rise to illiquid conditions.
- (iii) Due to rate competition in the money market, a bank may incur relatively high costs when obtaining funds, and may be tempted to lower its credit standards to invest in high-yielding loans and securities.
- (iv) If a bank purchases liabilities to support assets that are already on its books, the high cost of purchased funds may result in a negative yield spread.
- (v) When national monetary tightness occurs, interest rate discrimination may develop, making the cost of purchased funds prohibitive to all but limited number of large banks. Small banks with restricted funds should therefore avoid taking excessive loans from money market sources.
- (vi) Preoccupation with obtaining funds at the lowest possible cost and with insufficient regard to maturity distribution can greatly intensify a bank's exposure

to interest rate fluctuations.

2.8 Liquidity Risk Management and International Banking Standards

The formality and sophistication of liquidity management depend on the size and sophistication of the bank, as well as the nature and complexity of its activities. Regardless of the bank, good management, information systems, strong analysis of funding requirements under alternative scenarios, diversification of funding sources, and contingency planning are crucial elements of strong liquidity management (BIS, 2008b).

Regarding general economic conditions, the BIS recommends that banks organise the process controlling liquidity risk (BIS, 2008b). Such a process entails at least five elements:

- The liquidity management policies of the Board of Directors (BOD);
- Policies and procedures;
- An effective information system for monitoring and reporting liquidity risk;
- The role of internal control systems in liquidity management; and
- Contingency plans.

The following sections will explain each element of this process in detail.

2.8.1 Board and Senior Management Oversight

Liquidity risk management processes start with the stipulation of liquidity risk management policies. These are laid down by the Board of Directors and senior managers as the ultimate guidelines for all entities in the organisation. The BIS (2008b) prescribes the following roles for the Board of Directors and senior management in this regard:

- (i) Understand the bank's liquidity risk profile and the internal and external business environment and stipulate the liquidity risk tolerance;
- (ii) Determine and approve the strategies, policies, and practices of liquidity

- risk management;
- (iii) Disseminate, communicate, and guide the senior managers to manage liquidity effectively; and
- (iv) Incorporate liquidity costs, benefits, and risks in internal pricing, performance measurement, and new product approval.

Liquidity management policies vary across banking institutions, but at the very minimum, the four components below should be incorporated into the policies (Ismal, 2010).

- (i) The policies must contain the specific goals and objectives of managing liquidity, including the short-and long-term strategies of managing liquidity.
- (ii) The policies should determine the roles and responsibilities of the bodies involved in the liquidity management process, including asset and liability management policies, and the relationship with other financial institutions and regulators.
- (iii) The policies must determine the tools to identify, report, monitor, and review the bank's liquidity conditions.
- (iv) The policies should set the limits of liquidity risk and prepare a contingency plan to handle and mitigate liquidity pressures.

When preparing and formulating liquidity management policies, BODs may consider and incorporate ideas from the bodies in charge of managing liquidity risk, such as the Chief Executive Officer (CEO) and heads of risk management departments (divisions). In particular, inputs from banking regulators and stakeholders are also very important and must be taken into account in the policies. Intensive, integrative cooperation and coordination will ensure that the board fully understands the realities of the internal and external business environments in order to be able to formulate applicable liquidity management policies. The Asset and Liability Committee (ALCO), consisting of the bank's senior management including the CEO, should be responsible for ensuring adherence to the limits set by the BOD as well as for deciding on the business strategy of the bank in line with its budget and decided risk management objectives. ALCO is a
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decision making unit responsible for balance sheet planning from a risk-return perspective, including strategic management of interest rates and liquidity risks.

2.8.2 Policies and Procedures

Banks are expected to have comprehensive liquidity risk management policy and procedures manuals which cover in detail various aspects of liquidity and funds management (BIS, 2008b). The liquidity policies should be reviewed and updated continuously. Commercial banks should measure and determine their own liquidity risk

tolerance in light of the banks' business strategy, business characteristics and risk appetite, and then formulate management strategy, and liquidity risk policies and procedures. Risk tolerance may be expressed in terms of quantity, such as the unmitigated liquidity risk level that the banks could bear under normal conditions and stress situations.

The strategy, policy and procedures of liquidity risk management are expected to cover various aspects of the on-and off-balance-sheet business of the bank, business agencies, branches and affiliates that may exert significant effect on its liquidity risk both at home and abroad, including liquidity risk management under normal conditions and when under stress. The organisational structure, main business line, breadth and diversity of products and markets, and the regulatory requirements of home and host country, should also be taken into consideration when commercial banks formulate their liquidity risk management strategy.

2.8.3 Management Information Systems

Effective information systems support the liquidity management process. They enable banks to monitor, report, and control liquidity risk exposure and determine the funding needs inside and outside the organisation.

An effective information system concerns two players, namely, the decision makers in liquidity management and the decision followers (BIS, 2008b). At a practical level, on

receiving instructions on managing liquidity from the decision makers, the senior managers assign and monitor their subordinates, and ask them to report on the implementation of liquidity management. The decision makers receive a special internal report about any liquidity risk problems, and information about internal and external liquidity management from senior managers. In some cases, the bank's management publishes reports about the implementation of liquidity management for public disclosure so as to enable market participants to make an informed judgment about the soundness of the bank's liquidity risk management framework and liquidity position (BIS, 2008a). An effective information system, and comprehensive coordination and communication between decision makers, decision followers, and all related parties in the organisation create a robust mechanism to manage and control liquidity risk.

2.8.4 Internal Control Systems

In order to maintain the soundness of the liquidity management process, banks should have an internal control system to ensure compliance of the process conducted by the decision followers with that stipulated by the decision makers (BIS, 2008b). The internal control system can be assigned to the ALCO as a representative of the BOD to bridge the gap between decision makers and decision followers. In the case of liquidity risk problems, the ALCO investigates the level of liquidity risk and mitigates it based on guidance from the decision makers. But in the case of a serious liquidity risk problem, the ALCO consults with the decision makers in order to decide on the necessary and immediate action. However, the regular functions of the internal control system are to comprehensively audit the liquidity management process, to evaluate the liquidity position, and, when necessary, to propose revision or enhancement of the liquidity management process to the BOD (decision makers). Furthermore, the organisation can cooperate and communicate with external supervisors such as government bodies to assess the adequacy of a bank's liquidity risk management framework and the level of its liquidity (BIS, 2008a).

2.8.5 Liquidity Contingency Plans

In international banking practice, each bank's liquidity policy should include contingency plans. Contingency plans propose alternative funding if there is a liquidity crisis. These plans help to ensure that a bank can efficiently manage routine and extraordinary fluctuations in liquidity. Such a plan may help management to monitor liquidity risk, ensure that the appropriate level of liquid assets is maintained, measure and project funding requirements during various scenarios, and manage access to funding sources (BIS, 2008b). Having liquidity contingency plans in place helps management because during crisis periods there is no time to plan strategies. According to international best practice, contingency plans should:

- (i) Define responsibilities and decision-making authority so that all personnel understand their role during a problem-funding situation;
- (ii) Include an assessment of the possible liquidity events that an institution might encounter, for example high probability with low impact events and low probability with high impact;
- (iii) Assess the probability of erosion of funding sources under optimistic, pessimistic and *status quo* scenarios;
- (iv) Assess the potential liquidity risk posed by other activities such as asset and liabilities sales;
- (v) Match potential liabilities and uses of funds;
- (vi) Identify the sequence in which sources of funds would be used during crisis periods;
- (vii) Accelerate the timeframes for reporting, such as daily cash flow schedules, in a problem liquidity situation;

The importance of reviewing the international banking standards on liquidity risk

management thus introduces important, testable hypothesis that enable one to benchmark what banks are doing and identify possible areas of improvement.

2.9 Liquidity Risk Management Strategies

The various ways to mitigate against bank liquidity risk can be summarised (Aspachs *et al.*, 2005; Boyd, Ross and Smith, 2000; Borio, Furfine and Lowe, 2001; Mainell, 2008; Rychtarik, 2009) as follows:

- (i) Holding liquid assets (net defensive position – cost in terms of lower profitability);
- (ii) Dissipating withdrawal risk by diversifying funding sources (liability management);
- (iii) Seeking low volatility ratio where volatile liabilities to liquid assets as a ratio of total assets to liquid assets for prudent banks have a ratio of less than zero;
- (iv) Backup capital adequacy to ensure that creditworthiness is maintained in the face of shocks; and
- (v) The important role of supervision and reserve requirements.

Machiraju (2008) showed that a bank can lengthen interbank borrowing, issue floating rate notes, substitute three or six month CDs for short-term interbank borrowing, improve the terms offered on medium-term time deposits and bank bonds and concentrate new asset purchases on assets of very short maturity. For new long-term liabilities, an equity or bond issue may be raised. Finally, the banks may attempt to manage liquidity by attracting core deposits from clients and offering better terms or creating new financial instruments.

2.10 Summary

Chapter two reviewed the theoretical and empirical literature on commercial bank liquidity risk management. Liquidity risk is the risk that the firm will not be able to efficiently meet both expected and unexpected current and future cash flows and collateral needs without affecting either daily operations or the financial condition of the

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firm. Banks are vulnerable to liquidity problems at an institutional level and from a market perspective, leading to funding liquidity risk. Bank management must ensure that sufficient funds are available at a reasonable cost to meet potential demands from both fund providers and borrowers.

Although liquidity risk dynamics vary according to a bank's funding market and balance sheet, the most common signs of possible liquidity problems include rising funding costs, request for collateral, rating downgrade, a decrease in credit lines or reductions in the availability of long-term funds. Liquidity risk management in the day-to-day operations of a bank is typically achieved through the management of the bank's assets and in the medium-term through management of the structure of the bank's liabilities. Liquidity management thus encompasses both asset and liability management dimensions. Viewed in this context, liquidity management can be viewed as an important part of the entire funds management programme and the overall condition of the bank.

It is also evident that liquidity risk is linked to market risk, operational risk, credit risk, reputational risk and risk of concentration. Bankers and supervisors need to understand how a bank's exposure to other risks may affect bank liquidity. The reviewed literature prompts the researcher to undertake an analysis of how other risks feed back into liquidity risk. Researchers have pointed out that credit risk is a major contributor to liquidity risk. The testable hypothesis would be to test whether credit risk has been a cause of concern in liquidity risk in Zimbabwe.

There are four different theories of bank liquidity management: the commercial loan theory, shiftability theory, anticipated income theory and the liquidity management theory. The commercial loan theory holds that banks should lend only on short-term, self-liquidating commercial paper. This theory was criticised mainly because of the weakness that a bank makes loans against physical goods. This act does not guarantee the full repayment of the loan. This is because the value of the goods may decrease, which may impair the ability of the borrower to repay the loan.

The weakness of the commercial loan theory led to the evolution of the shiftability theory. In terms of this theory, the bank could satisfy its liquidity requirements if it held loans and securities that could be sold in the secondary market prior to maturity. The major weakness of the shiftability theory is that although one bank could raise liquidity by shifting its assets, the same strategy would not work if all banks attempted to shift their assets at the same time. The result was the evolution of the anticipated income theory. This theory encouraged banks to adopt a ladder effect in their investment portfolio. It meant that securities portfolio took on the cash flow characteristics of a loan portfolio with regular amortisation of principal and interest. The weakness of the theory is that if banks became involved in such markets, either by directly purchasing assets or by indirectly financing the acquisition of such assets, this might result in substantial liquidity problems.

The commercial loan theory, shiftability theory and the anticipated income theory only focused on the asset side of the balance sheet in liquidity management. Several significant developments in banking practices in the 1960s led to a new theory, the liability management theory of banking. This theory emphasised liquidity management by focusing on the liabilities and assets in managing liquidity.

In terms of liquidity management, liquidity is rated from one to five. A rating of one indicates strong liquidity levels and well developed funds management practices. A rating of five indicates funds management practices that are critically deficient, which indicates a threat to the continued viability of the institution. There are various ways in which a bank can manage liquidity mismatches. A financial institution can utilise new deposits, maturing assets, borrowed funds and or the discount window (borrowing from the central bank) to meet its liquidity needs. Given that there may be a penalty attached to accessing these facilities and that they may not always be available, adequate liquidity management takes on even greater importance.

The BIS recommends liquidity management processes that include the liquidity risk

management policies of the BOD, policies and procedures, effective information systems for monitoring and reporting liquidity risk, internal control systems and contingency plans. In addition, the BIS highlights various liquidity management strategies which include the liquid asset approach, the cash flow approach and the mixed approach. Management of adequate liquidity is the backbone of banking. When liquidity risk is left unattended, it can be fatal and can render the bank insolvent.

This review allows for the development of testable hypothesis. The first question would be how Zimbabwean banks managed liquidity risk in challenging operating environments. How efficient were the strategies employed by commercial banks to manage liquidity in relation to international standards? What additional measures could be incorporated by banks as a way of evaluating and assessing liquidity?

Chapter two has highlighted the conceptual framework of banks' liquidity and the underlying fundamentals of liquidity risk management. However, it did not review how liquidity risk is measured and estimated. The next chapter reviews the literature on bank liquidity measurement and estimation procedures and investigates the determinants of liquidity and liquidity risk presented by various studies. The objective of chapter three is to position this study within the current strand of existing literature by highlighting the key areas in which research on liquidity risk estimation has been undertaken. This will help to identify the strengths and the contribution of the current study to the existing literature.

CHAPTER THREE

MEASURING AND ESTIMATING LIQUIDITY RISK

3.1 Introduction

The analysis of liquidity requires bank management to identify; measure and monitor the bank's liquidity position on an ongoing basis. This chapter discusses various ways in which liquidity risk can be measured and highlights the determinants of liquidity risk. An organic review of studies that used different methodologies to estimate banks' liquidity and liquidity risk is presented. A synthesis of what determines bank illiquidity is undertaken to assist in realising one of the main objectives of the study, which was to investigate the main determinants of commercial banks' liquidity risk in Zimbabwe. Chapter three is structured as follows: section 3.2 presents the measures of liquidity and liquidity risk. Subsection 3.2.1 reviews the stock approach, 3.2.2 looks at the cash-flow based approaches and 3.2.3 examines hybrid approaches. Section 3.3 reviews the determinants of liquidity risk with subsection 3.3.1 looking at the causes of liquidity risk. Section 3.4 presents the estimation procedures. A summary is provided in section 3.5.

3.2 Measuring Liquidity and Liquidity Risk

Liquidity is very important for the functioning of the banking sector and the financial markets. The known and potential cash needs have to be quantified. Banks need to examine how funding requirements evolve under various scenarios, including adverse conditions. It is important, then, to understand how liquidity and liquidity risk are measured. The main approaches to measuring liquidity risk are stock-based approaches, cash flow analysis and an unadjusted (hybrid) maturity mismatch.

3.2.1 Stock-based Approaches

Stock-based approaches look at liquidity as a stock. By comparing the balance-sheet items, these approaches aim to determine a bank's ability to reimburse its short-term debts obligations as a measurement of the liquid assets amount that can be promptly liquidated by the bank or used to obtain secured loans. The most commonly used

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approaches based on stock are the long-term funding ratio and the cash capital position. These are discussed in turn.

3.2.1.1 The Long Term Funding Ratio

The long term funding ratio (LTFR) is based on the cash flow profile arising from the on- and off-balance sheet items of an institution. It indicates the share of assets with a maturity of n years or more, funded through liabilities of the same maturity. Vento and Ganga (2009) presented that:

$$LTFR = \sum_i Outflows_i(> n_years) / \sum_j Inflows_j(> n_years) \quad (3.1)$$

In a short-term horizon, the long term funding ratio is frequently lower than 100% because of maturity mismatches between assets and liabilities. The change over time and comparison with peer groups may draw attention to a potential maturity discrepancy between assets and liabilities. In line with this ratio, banks often set limits on roll-over risk, concentration risk and term transformation as these are important drivers for the liquidity risk the banks are exposed to.

3.2.1.2 The Cash Capital Position

A variant of the stock approach is represented by the cash capital position (CCP) analysis. In general, in order to guarantee an appropriate balance sheet structure with respect to liquidity risk, illiquid assets should be funded by stable liabilities, or, alternatively, total marketable assets (TLA) should be funded by total volatile liabilities (TVL). Total marketable securities are mainly composed of cash, promptly reimbursable loans and marketable securities that are available to be used as collateral. Total volatile liabilities include overnight and very short-term wholesale funds, and shares of customer deposits that could be claimed in the short term such as savings deposits. An illustration of the cash capital position is provided in the following balance sheet structure:

Table 3.1: The Cash Capital Position

		Assets	Liabilities		
Liquid assets	{	Collateral value of unencumbered assets (=liquid assets excluding haircuts)	Short term funding (CP, short term bank facilities, e.tc)	{	Volatile liabilities
		Cash	Non-core deposits		
		Reverse Repos	Repos		
		Total Liquid Assets (TLA)	Total Volatile Liabilities		
Core & illiquid assets	{	Illiquid assets (e.g. fixed assets, intangibles, etc.)	Medium/long term funding Core deposits	{	Core funding + Equity
		Haircuts	Equity		
		Total on balance-sheet			
		Commitment to lend (CTL)	Steadily available lines of credit		

Source: Vento and Ganga (2009)

The difference between TLA and the sum of TVL and commitments to lend (CTL) is the cash capital position. Therefore to get the CCP it is given as $CCP = TLA - TVL - CLT$. That is, highly liquid securities (i.e. cash, eligible assets, repo able bonds etc.) should be able to replace for unsecured rating sensitive funding. CCP measures the ability of the bank to fund its assets on a fully collateralised basis and ensures that the bank is able to conduct business during the survival period. If the result is negative, it means that illiquid assets are greater than long-term funding. The cash capital position approach is a far more preferable framework than the use of loans to depositors' ratio because the loans to depositors' ratio ignore the quantity of loans that can quickly generate cash by either being pledged or sold (Vento and Ganga, 2009). Nevertheless, the cash capital position

has some drawbacks:

- it excludes the unfunded commitments, which the bank could be obliged to fund anytime;
- it does not take into account long-term liabilities that are maturing within a short-term horizon; it does not incorporate cash earnings generated by the bank;

The stock approach uses balance sheet ratios to identify liquidity trends. These ratios reflect the fact that banks should be sure that appropriate, low cost funding is available in a short time. This might involve holding a portfolio of assets that can be easily sold (cash reserves, minimum required reserves or government securities), holding significant volumes of stable liabilities (especially deposits from retail depositors), or maintaining credit lines with other financial institutions (Berger and Bouwman, 2009).

3.2.2 Cash-Flow Based Approaches

Generally banks control their liquidity principally by managing the structure of the respective maturities of assets and liabilities so as to generate adequate net cash flows. In cash-flow based approaches, the essence of liquidity risk is cash flow (Machiraju, 2008). Liquidity needs are usually determined by the construction of a maturity ladder that comprises expected cash inflows and outflows over a series of specified time bands. The difference between the inflows and outflows in each period, that is excess or deficit funds, provides a starting point from which to measure a bank's future liquidity excess or shortfall at any time (Vento and Ganga, 2009; Schertler, 2010). An institution should regularly estimate its expected cash flows instead of focusing only on contractual periods during which cash may flow in or out. Matz (2008) maintained that the inflows and outflows on account of retail deposits and retail lending and likely outflows have to be assessed on a probabilistic basis, say of past experiences. In cases of large volumes of wholesale funds of fixed duration, liquidity can be ensured by maturity matching. Maturity profiles are important in asset and liability management. The bank tabulates information on maturities, which provides insight into liquidity risk. Despite their essential use, maturity profiles are dependable only at the time of compilation and need to

be continually updated. The quality of measurement of liquidity depends on the quality and timeliness of information on maturities of existing assets and liabilities (Saunders and Cornett, 2006; Matz, 2008). The quality also depends on past and projected loan and deposit trends, and accounting and processing systems.

Once the liquidity needs have been determined, a bank must then decide how to fulfill them. According to Saunders and Cornett (2004), liquidity management is related to net funding requirement, which emphasises that a financial institution's liquidity position must be measured on a daily basis, with the "net liquidity statement" being a useful tool. Basically, sources and uses of liquidity are listed and thus provide a measure of a bank's net liquidity position.

Koch and McDonald (2000) indicated that an evaluation of whether or not an institution is sufficiently liquid depends on the behaviour of each cash flow under different conditions. The position, in turn, would involve the chief dealer comparing the total cash inflows (which involve maturing assets, interest received, asset sales and draw downs) with total cash outflows (which involve maturing liabilities, interest payable, disbursement on lending commitments, early deposit withdrawals and operating expenses). A liquidity excess or shortfall would be attained. This would be assessed under normal conditions, bank specific crisis and when there is a market wide crisis. In turn, liquidity risk management must therefore involve various scenarios, namely the going concern, a crisis situation for the organisation and general market crises. If there is liquidity excess, then there would be a need to invest prudentially. When there is liquidity shortfall, there would be a need for proper sourcing of funds.

The stock approach in determining a bank's liquidity adequacy thus requires an analysis of the current liquidity position, present and anticipated asset quality, present and future earnings capacity, historical funding requirements, anticipated future funding needs, and options for reducing funding needs or obtaining additional funds.

The flow approach, in contrast, treats liquid reserves as a reservoir where the bank

assesses its liquidity risk by comparing the variability in inflows and outflows to determine the amount of reserves that are needed during a particular period.

Researchers generally agree that although both frameworks are intuitively appealing, the flow approach is more data intensive and as a result, the stock approaches are more popular in practice (Fielitz and Loeffler, 1979; Crosse and Hempel, 1980; Bhattacharya and Thackor, 1993; Drehmann and Nikolaou, 2009; Vento and Ganga, 2009). In general, stock-based approaches are not forward looking and are therefore not capable of covering all the material aspects of the liquidity risk that an institution faces.

3.2.3 Hybrid Approaches

Hybrid approaches combine elements of the cash flow matching and of the liquid assets approaches. Here, every credit institution is exposed to unexpected cash in- and outflows, which may occur in the future because of unusual deviations in the timing or magnitude of liquidity risk. This would require a considerably larger quantity of cash than the amount needed for bank projects. For this reason, the bank tries to match cash expected and unexpected outflows in each time bucket against a combination of contractual cash inflows, plus inflows that can be generated through the sale of assets, repurchase agreements or other secured borrowing. Unencumbered assets, which are used as collateral in financing transactions securing access to adequate funding sources (e.g. interbank lines of credit, discount facilities with central banks, etc.) and most liquid assets are typically counted in the shortest time buckets, while less liquid assets are counted in later time buckets. An example of the hybrid approach is highlighted in table 3.2.

Table 3.2: An Example of the Hybrid Approach and Liquidation Horizon

Band (Upper Limit)	Based on Maturity	Based on Liquidation Horizon
ON	0	550
1 W	0	100
2 W	10	100
1 M	100	50
3 M	130	0
6 M	110	0
1 Y	200	50
>1 Y	350	50
Total	900	900

Source: Adopted from Vento and Ganga (2009)

Even though a strong capital position is a prerequisite for high-investment grade rating and consequently, for improved funding costs and accessibility and contributes to the reduction of the likelihood of liquidity pressure, capital is not considered an appropriate risk cushion in stressful conditions or liquidity shortages. In this scenario, bank capital is usually replaced by a mix of risk management techniques in order to reduce the net cumulative outflows and through a surplus of unencumbered assets, to counterbalance net cumulative outflows (Vento and Ganga, 2009). The implied suggestion is that liquidity risk is adequately covered if cash inflows go beyond the net cumulative outflows within the same time horizon.

The two most popular ratios used in academic literature were the loan-to-deposit ratio and the liquid asset ratio, where the higher the loan-to-deposit ratio (or the lower the liquid asset ratio) the less able a bank is to meet any additional loan demands (Shen *et al.*, 2009; Moore, 2010). Both these indicators have their shortcomings. The loan-to-deposit ratio does not take into account the other assets that may be available for conversion into cash to meet demands for withdrawals or loans. The liquid assets ratio ignores the flow of funds from repayments, increases in liabilities and the demand for bank funds (Moore, 2010). For this reason, the researcher summarises the various ratios that can be used in measuring bank liquidity and liquidity risk in table 3.3.

Table 3.3: Various Forms of Liquidity Ratios

Liquidity Ratios
Readily marketable assets as percentage of total assets
Volatile liabilities as percentage of total liabilities
Volatility coverage (readily marketable assets as percentage of volatile liabilities)
Bank run (readily marketable assets as percentage of all deposit-type liabilities)
Customer loans to customer deposits
Interbank loans as percentage of interbank deposits
Net loans and investments as percentage of total deposits
Demand deposits as percentage of customer deposits
Deposits with maturities longer than three months as percentage of customer deposits
Less than 90 days deposits as percentage of customer deposits
Certificates of deposits as percentage of customer deposits
Ten largest deposits as percentage of customer deposits

Adopted from Levine (1997), Koch and McDonald (2000), Howells and Bain (2002), Gabbi (2004) and Matz and Neu (2007)

The key liquidity ratios can be computed and then compared from say period one, period two and the current period and compare to a set benchmark. Lucchetta (2007) conducted

research in European countries on the liquidity measure using different liquidity ratios. Machiraju (2008) looked at liquidity as measured by temporary investment ratios and volatile liability dependency ratios. The temporary investment ratio is given as investment securities with maturities of less than one year plus due from banks divided by total assets. Temporary investments (these include investments with maturities of less than one year and interbank lending) are highly liquid; the higher the ratio to total assets, the greater the liquidity. The volatile liabilities dependency ratio is given by total volatile investments (brokered deposits and CDs) minus the temporary investment dependency ratio divided by the total assets.

For an evaluation of the liquidity positions of Czech commercial banks, Vodova (2011) used four different liquidity ratios.

L1 = liquid assets/ total assets

The liquidity ratio L1 would give information about the general liquidity shock absorption capacity of a bank. As a general rule, the higher the share of liquid assets in total assets, the higher the capacity to absorb liquidity shock, given that market liquidity is the same for all banks in the sample. Nevertheless, a high value of this ratio may also be interpreted as inefficiency because liquid assets yield may lower income liquidity for the bank.

L2 = liquid assets/ deposits+short term borrowing

The ratio, L2 also uses the concept of the liquid asset ratio, although it is more focused on the bank's sensitivity to selected types of funding. L2 is meant to capture the bank's vulnerability related to the funding sources. The bank is able to meet its obligations in terms of funding (the volume of liquid assets is high enough to cover volatile funding) if the value of this ratio is 100% or more. Lower values indicate a bank's increased sensitivity to deposit withdrawals.

L3 = loans/ total assets

The ratio, L3 measures the share of loans in total assets. It indicates what percentage of the assets of the bank is tied up in illiquid loans. The higher the ratio, the less liquid the bank is. Earlier, Bessis (2009) showed that if the loan to deposit ratio is high, the bank either has a large loan portfolio or is using non-deposit or purchased funds to finance assets. When the loan to deposit ratio is relatively high, banks would be less inclined to lend and invest. Banks would become selective, with standards applied to increased leading to reduce credit, which increases interest rates.

L4 = loans/ deposits+ short term financing

The last ratio relates illiquid assets to liquid liabilities. Its interpretation is the same as in the case of L3. The higher the ratio, the less liquid the bank is.

Liquidity ratios can be used to measure bank liquidity and illiquidity. Furthermore, these can then be compared with other commercial banks. The central banks can make use of these ratios for supervisory purposes. Nevertheless, Poor and Blake (2005) revealed that it was not enough to measure liquidity or illiquidity by using liquidity ratios. The point in the case was that of South East Bank which failed due to liquidity risk but had used in excess of 30 liquidity ratios to measure bank liquidity. In addition, Shen *et al.* (2009) showed that beyond sheer liquidity ratios, there is a need for banks and researchers to develop a new view of liquidity and liquidity risk measurement. The various measurements beyond the liquidity ratios are summarised in table 3.4.

Table 3.4: Alternative Measures of Liquidity Risk

Study	Method of Measuring Liquidity Risk
Bank for International Settlements (2000)	Maturity laddering method
Saunders and Cornett (2006)	Sources and uses of liquidity; peer group ratio comparisons; liquidity index; financing gap and financing requirement; liquidity planning
Matz and Neu (2007)	Balance sheet liquidity analysis; cash capital position maturity mismatch approach
Shen <i>et al.</i> (2009)	Financing gap ratio
Vivian <i>et al.</i> (2009)	Liquidity planning
Schertler (2010)	Stock and cash-flow mapping approach

From the literature reviewed, it is clear that no agreement exists on the proper measurement of liquidity and liquidity risk; however, the main approaches to measure liquidity risk include the stock approach, a cash flow analysis and the hybrid approach. After identifying the liquidity risk proxy it is important to understand the various determinants of liquidity risk.

3.3 Determinants of Bank Liquidity and Liquidity Risk

The underlying variables driving the exposures of banks to liquidity risk can be dynamic. For banks to manage liquidity risk, it is important that they are able to identify and monitor its various causes. Liquidity risk can originate from internal banking factors. These are referred to as bank specific. Similarly liquidity risk may emanate from external sources. The causes of liquidity risk are presented in table 3.5.

Table 3.5: Internal and External Factors Leading to Liquidity Risk Problems

Internal Banking Factors	External Banking Factors
High off-balance sheet exposures.	Very sensitive financial markets and depositors.
The banks rely heavily on short-term funding.	External and internal economic performance.
A gap in the maturity dates of assets and liabilities.	Low/slow economic performance.
The banks' rapid asset expansions exceed the available funds on the liability side.	Decreasing depositors' trust in the banking sector.
Concentration of deposits in the short-term tenor.	Non-economic factors (political unrest, etc.).
Less allocation in the liquid government instruments.	Sudden and massive liquidity withdrawals from depositors.
Fewer placements of funds in long-term deposits.	Unplanned termination of government deposits.

Source: Ismal (2010)

Rochet (2008) highlighted three main sources of liquidity risk:

- (i) On the liability side, there is large uncertainty on the volume of withdrawals of deposits or the renewal of rolled-over interbank loans, especially when the bank suspected to be insolvent or when there is a temporary aggregate liquidity shortage,
- (ii) On the asset side, there is uncertainty on the volume of new requests for loans that a bank will receive in the future,
- (iii) off-balance sheet operations, like credit lines and other commitments, and positions taken by banks on derivatives markets.

The above analysis illustrates that liquidity risk is caused by exogenous and endogenous

factors.

Agenor *et al.* (2004) estimated a demand function for commercial bank liquidity (lq). Liquidity is expressed as a function of customer characteristics and the macroeconomic environment as follows:

$$lq = A_1 lq + A_2 CV_{c/d} + A_3 Y/Y_T + A_4 CV_{Y/Y_T} + A_5 r + \varepsilon \quad (3.2)$$

The coefficient on $CV_{c/d}$, the coefficient of variation of the cash-to-deposit ratio is included to capture fluctuations in customer cash requirements. To account for the macroeconomic environmental influences on liquidity Y/Y_T , the output to trend output ratio, CV_{Y/Y_T} , the coefficient of variation of the output to trend output ratio, and r , the money market rate of interest, are also included as explanatory variables.

Mueller (1998), Tobin (2003), and Crowley (2007) note that the specific characteristics of commercial banks that are usually theorised to have an impact on liquidity include:

- (i) The size of the bank,
- (ii) Ownership patterns,
- (iii) The quality of the loan portfolio,
- (iv) Capital adequacy,
- (v) Overhead costs,
- (vi) Operating expenses, and
- (vii) Shares of liquid and fixed assets.

Bank size is used to gauge the possibility of economies of scale in banking. Banks that enjoy economies of scale incur lower costs in gathering and processing information, resulting in greater financial flexibility. Similarly, banks with a large branch network can penetrate deposit markets and mobilise savings at a lower cost. To account for bank size, two measures are adopted; the bank's financial standing and network size. The first variable in bank size is the log of total assets. The second variable relates to the number of branches (Poorman and Blake, 2005; Shen *et al.*, 2009).

Aspachs and Tiesset (2005), in their study of English banks, assumed that the liquidity ratio as a measure of liquidity should be dependent on the following factors, with estimated influence on bank liquidity in parenthesis: probability of obtaining the support from lender of last resort, which should lower the incentive for holding liquid assets (-); interest margin as a measure of opportunity costs of holding liquid assets (-); bank profitability, which, according to theory, is negatively correlated with liquidity (-); loan growth, where higher loan growth signals an increase in illiquid assets (-); size of bank (?); gross domestic product as an indicator of business cycle (-); and short term interest rate, which should capture the monetary policy effect (-).

The research done by Fielding (2005) on Egyptian commercial banks considered the determinants of liquidity to be the level of economic output (+); discount rate (+); reserve requirements (?); cash to deposit ratio (-); rate of depreciation of the black market exchange rate (+); impact of economic reform (-); and violent political incidents (+). This approach was entirely unique because it took political risk into consideration as an important factor in explaining the liquidity of a bank.

Lucchetta (2007) conducted research in European countries and showed that liquidity should be influenced by the behaviour of the bank on the interbank market and a positive relationship attained. The more liquid the bank is, the more it lends in the interbank market. The interbank rate was included as an explanatory variable as a measure of the incentives for banks to hold liquidity. The monetary policy interest rate was included as a measure of a bank's ability to provide loans to customers. Share of loans on total assets and share of loan loss provisions on net interest revenues were both taken as a measure of risk-taking behaviour. Bank size was measured by logarithm of total bank assets.

Bunda and Desquilbert (2008) analysed the determinants of liquidity risk of banks in emerging economies. The liquidity ratio as a measure of banks' liquidity was assumed to be dependent on total assets as a measure of the size of the bank (-); the ratio of equity to assets as a measure of capital adequacy (+); the presence of prudential regulations, which

means an obligation on the part of banks to be liquid enough (+); the lending interest rate as a measure of lending profitability (-); the share of public expenditure on GDP as a measure of supply of relatively liquid assets (-); the rate of inflation, which increases the vulnerability of banks to nominal values of loans provided to customers (-); the realisation of a financial crisis which could be caused by poor bank liquidity (-) and the exchange rate regime, where banks in countries with extreme regimes were more liquid than in countries with intermediate regimes.

Shen *et al.* (2009) examined 12 advanced economies. They included the following as explanatory variables, (i) size (ii) square of size (iii) less risky liquid assets (iv) risky liquid assets (v) external funding dependence (vi) supervisory power index (vii) private monitoring index (viii) overall bank activities and ownership restrictiveness (ix) annual percentage change in GDP (x) lagged variable of annual percentage change in GDP and (xi) inflation.

Rauch *et al.* (2009) analysed Germany's state-owned savings banks, focusing on macroeconomic factors and also captured bank specific characteristics. The following factors were cited as determining a bank's liquidity, (i) monetary policy interest rates, where tightening monetary policy reduces bank liquidity (-); (ii) level of unemployment, which is connected with demand for loans (-); (iii) savings quota (+); (iv) level of liquidity in previous period (+); (v) size of bank measured by total number of bank customers (-) and (vi) bank profitability (-).

Schertler (2010) examined liquidity risk management by German banks. The explanatory variables used were (i) change in payment obligations (ii) change in payment obligations lagged (iii) assets (iv) lagged interest margins and (v) lagged regulatory capital.

Vodova (2011) looked at commercial bank liquidity in the Czech Republic. In this study both bank specific variables and macroeconomic variables were used as explanatory variables and are: (i) share of own capital on total assets of the bank (+); (ii) share of non-

performing loans on total volume of loans provided by the bank (-); (iii) return on equity: the share of net profit on own capital of the bank (-); (iv) logarithm of total assets of the bank (+/-); (v) dummy variable for realisation of financial crisis(-); (vi) growth rate of GDP (-); (vii) inflation rate (+); (viii) interest rate on loans (-); (ix) interest rates on interbank transactions (-); (x) difference between interest rates on loans and interest rates on deposits (-); (xi) monetary policy interest rates (-) and (xii) unemployment rate (-)

The studies reviewed above show that commercial banks' liquidity is determined by both bank specific factors (e.g. profitability, size of the bank, capital adequacy, risk of the bank), macroeconomic factors (such as GDP, different types of interest rates, changes in regulation and political incidents.) and supervisory factors (e.g. government regulation, reserve requirements ratio, official supervisory power index and private monitoring index).

3.4 Estimation Procedures

There are broadly three types of data that can be employed in the quantitative analysis of financial problems: time series data, cross-sectional data and panel data (Brooks, 2008). Time series data are data that have been collected over a period of time on one or more variables. Cross-sectional data are data on one or more variables collected at a single point in time. Panel data have the dimensions of both time series and cross-sections. According to Baltagi (2008), panel data regression differs from a regular time series or cross-section regression in that it has a double subscript on its variables i , denoting cross section dimension and t denoting time i.e.

$$y_{it} = \alpha + X'_{it}\beta + u_{it} \quad i = 1, \dots, N; \quad t = 1, \dots, T \quad (3.3)$$

Y_{it} indicates the dependent variables, while X_{it} determines the vector of k explanatory variables.

Various procedures have been used by different researchers to estimate liquidity risk. Fielding (2005) used panel regression analysis to analyse bank liquidity in Egypt. For England, Aspachs and Tieset (2005) used panel regression analysis, while Karcheva

(2007) used non-parametric statistics methods when analysing liquidity management in the Ukraine. Lucchetta (2007) used panel regression analysis to estimate the liquidity risk of European banks. Bunda and Desquilbert (2008), used panel data regression analysis to analyse the determinants of liquidity risk of banks in emerging economies. Shen *et al.* (2009), used panel data instrumental variable regression in their analysis of 12 advanced economies. Schertler (2010) applied dynamic panel data regression to German banks, while Ismal (2010) used auto regressive distributed lag (dynamic) model in estimating Islamic banks' liquidity in Indonesia.

Vodova (2011) looked at commercial bank liquidity in the Czech Republic using panel data analysis (fixed effect). The following model was estimated:

$$L_{it} = \alpha + \beta X_{it} + \delta_i + \varepsilon_{it} \quad (3.4)$$

In investigating liquidity risk by commercial banks it is evident that most researchers used panel regression analysis. The main consideration would that banks are heterogeneous. If one considers only time series analysis or cross sectional analysis and does not control for heterogeneity, there would be a risk of obtaining biased results. The use of panel data thus controls for firms' heterogeneity. Brooks (2008) showed that panel data provides more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency. Panel data is able to study the dynamics of adjustment. Cross sectional distributions that look relatively stable hide a multitude of changes. In this study, if one was to look at measuring bank liquidity, cross sectional data can estimate what proportion of the bank is having liquidity problems at a point in time. Repeated cross-sections can show how this proportion changes over time (Hsiao, 2003; Baltagi, 2008). Only panel data can estimate what proportion of those who have liquidity problems will continue to do so in another period.

Panel data are better able to identify and measure effects that are simply not detectable in pure cross-section or pure time series. Panel data allow the construction of and test more complicated behavioral models than purely cross-sectional or time series data

(Wooldridge, 2002; Hsiao, 2003; Brooks, 2008; Baltagi, 2008). A number of approaches are used in panel data analysis. These include the pooled ordinary least squares (POLS), fixed effects (FE) and random effects (RE) techniques. The POLS approach is simply an ordinary least squares approach. This approach does not consider the differences among individuals across time periods and thus it does not consider the panel nature of the dataset. In addition the estimates obtained by adopting this measure are heavily biased because of the heterogeneity between the error term and the independent variables. It is because of the inadequacy of the POLS to capture the panel nature of the dataset that the fixed effects and the random effects models become useful.

3.4.1 Fixed Effects

The fixed effects (FE) model rests on the assumption that the fixed effects are arbitrarily correlated with the explanatory variables (ν_t and χ_{it}) in the regression model. The error term, which is the source of the differences between the fixed effects and the random effects model, is specified as follows:

$$\mu_{it} = \nu_t + \varepsilon_{it} \quad (3.5)$$

where μ_{it} denotes the unobservable individual specific effects, ν_t are individual specific errors (defined as unobserved effect, unobserved heterogeneity, latent variable) and ε_{it} are idiosyncratic errors. The fixed effects model can be estimated using the least squares dummy variable model (LSDV). This model makes use of the dummy variables. Fixed effects models can also be estimated using the within-effect model. The similarity between the two strategies is that they both provide identical slopes for non-dummy explanatory variables.

3.4.2 Random Effects Models

The random effects (RE) model defines individual errors as random variables, which are identically and independently distributed (i.i.d random effects). The model is defined as follows:

$$Y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad i = 1, \dots, N; t = 1, \dots, T_i \quad (3.6)$$

Where $\varepsilon_{it} = \mu_i + v_{it}$ reflect the error component disturbances. The individual specific effects are random and distributed normally ($\mu_i \sim \text{IIN}(0, \delta^2 \mu)$). They are independent of the residual terms v_{it} which are also distributed normally ($v_{it} \sim \text{IIN}(0, \delta^2 v)$)

Despite the debate on the fixed effects model *versus* the random effects model, a Hausman test is used to decide which one to use (Hausman, 1978; Hausman and Taylor, 1981). Following Baltagi (2008), the Hausman test statistic is given by:

$$m_i = \hat{q}_1' [\text{var}(\hat{q}_1)]^{-1} \hat{q}_1 \quad (3.7)$$

and under H_0 is asymptotically distributed as χ_K^2 where K denotes the dimension of slope vector β .

In order to validate the fixed effects specification, the question is to prove, according to the empirical application, that individual coefficients α_i , $i = 1, \dots, N$, are not equal. This leads to the following joint null hypothesis:

$$H_o : \alpha_i = \alpha \dots \alpha_N = \alpha \quad (3.8)$$

3.5 Summary

This review of the theoretical and empirical literature has revealed that bank liquidity and liquidity risk can be measured in various ways. The stock or flow approach can be used to measure the liquidity needs of a bank. The stock approach uses balance sheet ratios to identify liquidity trends. There are several of these ratios but the most popular is the loan to deposit ratio. With the flow approach, the bank assesses liquidity risk by comparing the variability in inflows and outflows. The stock approach is the more popular one. Liquidity management must be measured on daily basis, with a useful tool being the net liquidity statement. Evaluating if an institution is liquid is determined by the cash flows under various scenarios. The objective of cash flow analysis is to allow the bank to

conduct gap analysis. Another method to measure liquidity needs is for the bank to compute the funding gap. As the funding gap increases, the banks would be forced to borrow, which increases liquidity risk. There are modern, alternative ways of measuring liquidity risk. These were investigated and include the financing gap, financing requirements methods and the liquidity index methods.

Various studies have been conducted in order to identify the determinants of bank liquidity and illiquidity. These determinants include return on assets, capital adequacy, interest rates, non-performing loans, interbank borrowings and political factors. The demand function for commercial bank liquidity is expressed as a function of bank specific, macroeconomic and supervisory determinants. The testable hypothesis is, then, what explains liquidity risk in Zimbabwean commercial banks in terms of these categorisations? However, most studies on liquidity risk seem to focus on developed countries. These are largely centered on Europe, the USA, Australia and Asia with very few such studies on Africa. The review of previous studies therefore identified a gap in the literature. As far as the researcher is aware, no studies have been conducted on commercial bank liquidity risk determinants in Zimbabwe. This study intends to fill this gap.

The next chapter examines inflation and commercial banks' liquidity management. These are important topics because the thrust of this thesis is to understand how commercial banks in Zimbabwe survived and managed liquidity in the Zimbabwean dollar era, when there were problems of hyperinflation. The multiple currency system was meant to eliminate the problem of hyperinflation and in turn led to deflation and a liquidity constrained environment. The objective of this thesis is also to understand how banks managed liquidity in a multiple currency environment.

CHAPTER FOUR

INFLATION AND LIQUIDITY RISK MANAGEMENT

4.1 Introduction

This chapter reviews the literature on commercial banks' liquidity risk management when there is high inflation (or hyperinflation) and when there is deflation. One of the objectives of this thesis was to look at liquidity risk management by commercial banks in Zimbabwe during challenging operating environments. Zimbabwe experienced episodes of hyperinflation in the Zimbabwean dollar era and deflation as a result of the adoption of the multiple currency systems. It is therefore important to review the literature on liquidity management where there is inflation (or even hyperinflation) and when there is deflation that results from policies that aim to eliminate inflation. Of importance is to establish the relationship between inflation and interest rates. A review is also undertaken of the fundamentals of liquidity management, which are asset management and liability management under inflationary (or deflationary) environments. It is important to highlight that there has been considerable experience of inflation (and even hyperinflation), while there has been only limited experience of deflation. Consequently, few lessons can be drawn on liquidity risk management in a deflationary environment from the literature. Chapter four is structured as follows: Section 4.2 provides insights on inflation and commercial banks' liquidity risk management. Section 4.3 looks at inflation and interest rates. Section 4.4 examines inflation and liability management. Section 4.5 looks at inflation and asset management, with sub-section 4.5.1 reviewing advances to customers, and sub-section 4.5.2 investments. A summary is provided in section 4.6.

4.2 Inflation and Commercial Banks' Liquidity Risk Management

Inflation refers to the general increase in the price levels of goods and services in an economy (Perry, 1992). Inflation is normally caused by a general increase in the supply of money. It is usually measured by the use of the Consumer Price Index (CPI) and the Producer Price Index (PPI). Central banks actively try to maintain a specific rate of

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inflation, which is usually 2-3% but can vary depending on circumstances. Various researchers (Boyd *et al.*, 2000; Valla and Saes-Escorbiac, 2006) have shown that the impact of inflation on liquidity management or banking activities depends on inflationary expectations, as well as the actual changes in the rate of inflation and whether it is low, high or very high.

The world has witnessed a dramatic decline in inflation rates, but concerns about inflation may still be justified in most African and developing countries where it has been on an upward trend, with some countries experiencing hyperinflation (Argentina, Barbados, Bolivia, Brazil, Chile, Ecuador, El Salvador, Jamaica, Mexico, Paraguay, Peru, Uruguay and Zimbabwe). Demirgüç-Kunt and Detragiache (2005)'s study revealed that countries experiencing hyperinflation were prone to banking crises. In similar vein, Kaminsky and Reinhart (1998) concluded that banking crises tend to be prevalent during periods of weak growth and loss of monetary control, reflected by high real interest rates and inflation. Empirical evidence (Huybens and Smith, 1999; Boyd *et al.*, 2000) shows that even moderate rates of inflation of plus or minus 10% are harmful to economic activity in the effect they have on banking activities. Boyd *et al.* (2000) established a negative link between high inflation and banking activities. Khan *et al.* (2001)'s study illustrated that there are benefits connected to inflation. However once inflation exceeds some "critical level", there would be a discrete decline in the amount of banking activity.

As opposed to inflation, deflation is a sustained decline in the general price level of current goods and services. Bordo and Redish (2003) relate deflation to a persistent, negative rate of inflation. It is important to note that the definition of deflation does not refer to asset price deflation. Riddiough and Wu (2007) define deflation as a decline in general prices as a result of reduction in the supply of money or credit. Deflations are normally the result of policies that would have been effective in preventing or eliminating inflation (Bordo and Redish, 2003). Countries that have experienced deflation are Japan, China, the United States and India.

There are good and bad deflations. According to Bordo and Redish (2003), good deflations occur when positive supply shocks cause potential output to grow faster than nominal aggregate demand. Good deflations are characterised by rising employment and output growth, robust profits and booming stock markets. Bad deflations occur when negative shocks to aggregate demand cause nominal demand growth to fall below the growth rate of potential output. These are characterised by falling employment and output growth, weak profits and declining stock markets.

The costs and benefits of deflation (and of eliminating inflation) are not qualitatively different from the costs and benefits of inflation (and of eliminating deflation). With reference to Fieldman (2005), anticipated inflation leads to welfare losses due to the shoe-leather costs of cash management if the costs of holding cash increase with the expected rate of inflation.

4.3 Inflation and Interest Rates

Strahan (2006) states that interest rates is the cost of money. In an economy the important rates are deposit rates, investment rates and lending rates. For a bank to be able to source funds, the cost of funds would determine the amount of deposits. Similarly when the banks lend money, this would be determined by the rates of interest. It is clear that interest rates are very important in the day-to-day management of liquidity by banks. Howells and Bain (2002) show that interest rates are very important because:

- They are payments from borrowers to lenders;
- Asset values move inversely with changes in interest rates;
- They are part of the cost of a firm's investment.

It is important to distinguish between nominal and real rates of interest in order to show the relationship between inflation and interest rates. Nominal rates are the rates of interest actually paid in money form. The real interest rate, which measures the purchasing power of interest receipts, is calculated by adjusting the nominal rate charged to take inflation into account. The real rate of interest is defined as the return that lenders require even if there is no risk and prices are constant. Interest rates can also be viewed as a price

established by the interaction of supply of and demand for future claims on resources (Aspachs and Tieset, 2005). Goacher (2002) highlighted that the real rate of interest is a nominal rate that is adjusted to take account of the impact of inflation on the real value of the loan or investment. The expected real returns on an investment, before it is made are:

$$i_r = i_n - Pe$$

where i_r = real interest rate,

i_n = nominal interest rate

Pe = projected inflation over the year

Lenders and investors thus require that they be compensated for any rise in prices that they expect to occur over the duration of the loan or investment. An important distinction is between positive and negative interest rates. If the rate of inflation over the period of a loan is greater than the nominal interest rate paid, the real rate on the loan would be negative. Nominal rates should normally be positive. Rose *et al.* (1993) showed that inflation rates normally have a powerful impact on the level of interest rates. There is a chain in which high inflation affects the financial sector (Boyd *et al.* 2000; Kosse, 2002). It is highlighted that high inflation rates reduce savers' real rates of return and lower the real rates of interest that borrowers pay. Accordingly, the end result is that more people prefer to borrow than to save.

The other cause of negative relationships between the rate of inflation and the rate of return is nominal interest rate rigidity caused by regulatory measures. Central banks in developing countries usually discourage commercial banks from increasing nominal interest rates when there is higher inflation (Barro, 1991; Perry, 1992). This proposition is in line with Kosse (2002)'s study in the Ukraine, which investigated the relationship between nominal interest rates and inflation. The findings show that a high degree of nominal interest rate rigidity is attributable mainly to regulatory measures.

In deflationary conditions, nominal interest rates may come close to the lower bound of zero (Buitter, 2004). A good example can be drawn from Japan's experience in 2003, when the CPI was -0.3%. Deflation may reduce the opportunity cost of holding non-interest bearing cash securities.

4.4 Inflation and Bank Liability Management

Mishkin (2006) showed that a bank's liabilities are comprised of deposits, loans from the Federal Reserve Bank, loans from other banks (interbank) and Negotiable Certificates of Deposit (NCDs). The sources of bank funds are commonly checkable (demand) deposits, time and savings deposits and interbank borrowings, with the basic idea behind liability management being to acquire funds and use them profitably, especially to meet loan demand. Liability management thus focuses on the composition and costs of bank liabilities (sources of funds). Latzko (2006) concurred that a bank's liabilities are its sources of funds. Van Greuning and Bratanovic (2003) added that the source of deposits (who supplies the funding) adds to the volatility of funds as some creditors are more sensitive to market and credit events than others. Hyperinflation can be seen as a market event that also has a significant impact on the source of funds, which has affected bank creditors to varying degrees. Heffernan (2005) underscores the importance of properly managing deposits which are liabilities for banks if a bank is to maximise profit. This becomes ever more important in a highly unstable environment such as a hyperinflationary one.

Strahan (2006) argues that there are three faces of liability management which are an unchanging aspect of commercial banks' business irrespective of the environment in which they operate in, including inflationary ones, which are:

- Banks always attempt to minimise deposit interest costs by varying applicable deposit rates with the sensitivity of specific pools of customer funds (minimising the bank's interest expense). In an inflationary environment however, the pools of customer funds tend to diminish in line with trends in general savings in the wider economy. In

a deflationary environment, nominal interest rates would be very low and close to zero. In this case, depositors are not motivated to save with formal banking institutions.

- Banks have written and unwritten commitments to meeting spurts in loan demand.. The general decline in commercial lending activity characteristic of an inflationary environment results in banks having to meet depositor demands. Customer relationship management becomes key as banks increasingly turn to corporate clients for deposit funding. In deflationary environments, corporate companies would be facing challenges of low demand for their products, making production a challenge. It is in this scenario that banks reduce their lending to the corporate sector and rely on personal loans and non-core banking business as part of their risk management.
- Banks desire to offset regulatory burdens imposed on them by reserve requirements and deposit insurance.

The tools of liability management are then highlighted as federal funds (interbank), certificates of deposit (NCDs), Eurodollars, repurchase agreements, brokered certificates of deposits, notes and debentures.

Boyd *et al.* (2000) showed that bank lending activities, bank liability issues, stock market size and liquidity display strong negative correlations with inflation which entails that the liability issues in terms of pool and products are negatively affected by inflation. They further argued that inflation lowers the real rates of return, resulting in a smaller pool of savings because lower real rates of return reduce the attractiveness of savings from the depositors' perspective. Hyperinflation also has the effect of reducing the sources of cheap funds which Hawkins and Milhajak (1999) espouse as having the detrimental effect of reducing profit margins, thereby straining the bank's "margin of safety" that is generally slim in a hyperinflationary environment.

Makoni (2006) further underscores the effect of statutory reserves which are usually hiked in high inflation periods by showing that an increase in the statutory reserves of

banks in a hyperinflationary environment reduces the real return to banks which is passed on as lower returns on deposits. This means that when there is hyperinflation, which would normally result in negative real interest rates on deposits, customers would maintain accounts for transactional purposes rather than retaining wealth. This in turn would lead to the banking industry being funded almost entirely at the short end of the market, with most deposits maturing on demand.

Van Greuning and Bratanovic (2003) emphasise that diversification of funding sources and maturities enables a bank to avoid the vulnerability associated with the concentration of funding from a single source. Generally, if a bank's deposits are composed primarily of small, stable accounts the bank will need lower liquidity. Funding structure is a key aspect of liquidity management in that a bank with a stable, large and diverse deposit base is likely to have fewer liquidity problems than a bank lacking such a deposit base. An evaluation of the stability and quality of deposits is the starting point for liquidity risk assessment, with a focus on product range, deposit concentration and deposit administration. Hyperinflation has the effect of constraining depositors' disposable income and thus leads to a significant drop in the amount of savings from the household sector of the financial system. Hyperinflation also negatively affects the availability and utilisation of deposit products for the corporate sector of the economy due to shrinking volumes and profitability levels, and in severe cases company closures and downsizing of operations. The overall result is a reduction in the size of the deposit base and an overall shortening of deposit tenor, making deposit diversification a challenging task.

Fisher (1932; 1933a) argued that the interaction of deflation and large accumulations of private nominal debt could account for every major recession in the US. Borrowers with short-maturity nominal liabilities and illiquid and/or real or foreign currency-denominated assets are especially vulnerable to deflationary shocks. Commercial banks fit this description and the incidence of banking crises and bank defaults during the Great Depression of the 1930s and other severe recessions are consistent with the role of (unanticipated) debt deflation in the propagation of the business cycle. Homeowners with

mortgages, or households with significant outstanding unsecured consumer debt, have similar vulnerabilities in their portfolios, as do highly indebted enterprises.

4.5 Inflation and Bank Asset Management

The uses of funds from the bank's liabilities are the bank's assets (Latzko, 2006). Loans and government bonds are earning assets as the bank receives income from these assets. Reserves are the cash the bank keeps on hand in physical or liquid form. Required reserves (RR) are specified as a percentage of deposits (the required reserve ratio). Any excess of this minimum are called excess reserves (ER), therefore:

$$\text{Total reserves (TR)} = \text{Required Reserves (RR)} + \text{Excess Reserves (ER)}.$$

Mishkin (2006) concurs and lists the bank's assets as reserves and cash items in the bank's vault or on deposit with the central bank, securities (government, local government and other securities), loans (commercial and industrial, real estate, consumer, interbank). Deposit taking and lending, the key functions of commercial banks, are only profitable if and when:

$$\text{Interest on loans} - \text{interest paid on deposits} = \text{positive}$$

This depicts a situation where interest earned on loans and investments exceeds interest paid on deposits, Srivastava (2003) highlights that banks employ their funds in the following assets in order of liquidity: cash in hand (cash balances), money at call or short notice, bills discounted, investments and advances to customers. Deflation reduces the opportunity cost of holding non-interest bearing cash. Redistributions from debtors to creditors associated with unexpectedly high deflation in a world with imperfectly index-linked debt contracts is more likely to lead to default, bankruptcy and other forms of financial distress than redistributions from creditors to debtors associated with unexpectedly high inflation (Buiter, 2004). Default, bankruptcy and corporate restructuring are not just mechanisms for redistributing ownership and control of assets.

4.5.1 Advances to Customers

Rose *et al.* (1993) refer to lending as a vital activity not only because loans represent the largest commitments of funds for depository institutions but because they also produce the greatest share of total revenue generated from all earning assets, making lending the basic “raison d’etre” for commercial banks. Srivastava (2003) concurs with the fact that banks’ use of funds in giving loans and advances to customers is the most profitable of banks’ assets, with most earnings being mainly derived from these assets.

Boyd *et al.* (2000) show that an increase in the rate of inflation drives down the real rate of return not just on money, but on assets in general. The implied reduction in real returns exacerbates credit market frictions. Since these market frictions lead to the rationing of credit, credit rationing becomes more severe as inflation rises. As a result, the financial sector makes fewer loans, resource allocation is less efficient, and intermediary activity diminishes, with adverse implications for capital investment. The reduction in capital formation negatively influences both long-run economic performance and equity market activity, where claims to capital ownership are traded. Critically looked at, one can conclude that higher inflation implies less long-run financial activity. In economies with high inflation, financial intermediaries would lend less and allocate capital less effectively.

As bank balance sheets display ever decreasing loan components, their core business of financial intermediation declines. Furthermore, a “crowding out” effect of high government borrowing at the expense of investment entails that capital allocation becomes less efficient. Hyperinflation erodes consumers’ disposable incomes, affecting volumes for industry which, together with high inflation-driven operational costs, depress corporate profitability. An overvalued and unviable exchange rate also reduces business confidence in the private sector, thus constraining demand for credit to expand operations, compounded by high interest rates. Srivastava (2003) also alludes to the impact of inflation fighting measures in the form of statutory reserve ratio hikes by showing that the power of banks to create credit is limited by the cash reserves which

they are required to keep against their total demand and time liabilities, hence to some degree the high statutory reserves imposed by the central bank in its inflation fighting efforts have negatively affected lending.

4.5.2 Investments

Banks hold an investment portfolio which includes securities held principally for income as opposed to those held for liquidity. Investments in securities typically take second place to loans and at times serve as substitutes for loans (Rose *et al.* 1993). During hyperinflationary episodes, loan demand generally weakens, resulting in banks typically expanding their investment portfolios. Srivastava (2003) states that banks also invest in securities with importance placed not only on the safety of the investment but on the possibility of conversion to cash without loss, with important principles guiding selection of securities for investment being safety of capital, easy marketability or liquidity, profitability or yield and stability of price. Banks operating in high inflation environments generally prefer government securities because repayment is assured, the yield is steady and reasonable and they can be easily sold without causing a “glut” in their market prices.

In contrast to the above, Goacher (2002) noted that inflation poses a “stealth” threat to investors because it chips away at real savings and investment returns. Most investors aim to increase their long-term purchasing power, but inflation puts this goal at risk because investment returns must first keep up with the rate of inflation in order to increase real purchasing power; however, actual returns become negative returns when adjusted for inflation. Investors, banks included, need, then, to protect their portfolios since inflation can be harmful to fixed-income returns in particular.

Banks also buy fixed-income securities because they want a stable income stream, which comes in the form of interest, or coupon payments. However, because the rate of interest, or coupon, on most fixed-income securities remains the same until maturity, the purchasing power of the interest payments declines as inflation rises. The huge gap

exposes banks and other fixed money market investors to shrinking income in real terms, putting pressure on margin and profitability. Makoni (2006) agreed with the view that hyperinflation lowers the real return on a variety of assets including treasury bills (TBs).

Howells and Bain (2002) highlighted that regulation is an alternative inducement to increase or decrease holdings of government debt. Requiring banks to hold more or less government debt has broadly similar effects on the money supply and on bank liquidity as those resulting from price. However, if the return on government securities is below the rate required to justify the holdings in the absence of regulation, then the regulation acts as a tax on banking and a subsidy on government debt. The requirement on banks to hold bonds as well as measures of lengthening tenor of government securities have all but exposed banks to sub-inflationary returns.

4.6 Summary

Chapter four has reviewed the literature relating to the impact of price changes on commercial banks' liquidity management. Bids to eliminate inflation have resulted in episodes of deflation. The benefits of inflation are the costs of deflation, with the converse being true. In some instances, countries have experienced hyperinflation and deflation. Inflation and deflation affect banks in managing their assets and liabilities. Of importance is the effect of inflation or deflationary conditions on interest rates. The main important variable in commercial banks' liquidity management is interest rates, which show the cost of money. Interest rates affect the banks in the sourcing and application of funds. The cost of funds determines the amounts of deposits a bank may have. When banks lend, this is mainly influenced by the lending rates. Interest rates thus play an integral part in liquidity management by banks. If there is high inflation or hyperinflation, it leads to negative real rates of interest, which discourage both savings and lending. High inflation rates affect the sources of funds, which comprise deposits from customers, and loans from other banks in the interbank market, which are important elements in liability management.

Liabilities can be used profitably to meet the uses of funds. The uses of funds are the bank's assets which include loans or advances and investments. Advances or loans conventionally represent the largest sources of the bank's total revenue. High inflation rates tend to drive down the real rate of return on these assets. The ultimate result is credit rationing which affects long run financial activity, with the core business of banks declining. When loan demand weakens, banks expand their investment portfolios, preferring to hold government securities and fixed assets. In a deflationary environment, corporate companies would have problems servicing their loan accounts due to reduced aggregate demand. This causes banks to reduce their lending to the corporate sector in preference to retail customers where the default risk would be low. In conclusion, high inflation and deflationary conditions pose challenges to commercial banks' liquidity management. The literature review has shown that previous research has provided much insight on high inflation and liquidity management. What remains to be established is how banks survive when there is hyperinflation. This study on Zimbabwean commercial banks will contribute to the body of literature. Not much work has been done on liquidity management by commercial banks in a multiple currency regime, which leads to a liquidity constrained environment and in some instances deflation. The findings of this research would go a long way in highlighting this issue.

The next chapter presents the research methodology employed for the thesis. It outlines the research design, model specification, diagnostic tests, research population, research sampling, data collection methods and the research instruments.

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 Introduction

Chapter five discusses the research methodology for the study. As outlined in chapter one under the objectives of the study, the thesis sought to accomplish three major tasks. The main objective of the study was to investigate all aspects of liquidity risk management by commercial banks in Zimbabwe. To achieve this, the researcher firstly econometrically investigated what explained commercial banks' liquidity risk in Zimbabwe in the Zimbabwean dollar era (2000-2008) and the multiple currency period (2009-2011). Secondly, the thesis sought to establish how commercial banks managed liquidity risk in the Zimbabwean dollar. It surveyed commercial banks' liquidity risk management in the Zimbabwean dollar era when there was high inflation, qualitatively through the use of interviews and documentary analysis. As a way of addressing the problem of hyperinflation, the government of Zimbabwe adopted a multiple currency regime and completely abandoned the local currency. The basis of the third objective was, then, to understand commercial banks' liquidity risk management in a multiple currency environment. To achieve this, a survey was carried using questionnaires. Chapter five is divided into three sections. The first section describes the research design and justifications for the selected designs. The second section provides the quantitative analysis of the study. Here, the model of the study is specified and justifications of the variables are given. The third section highlights the qualitative analysis where the research population, research sample, data collection methods and research instruments are outlined.

5.2 Research Design

To be able to understand liquidity risk management by Zimbabwe commercial banks in different operating environments, a highly structured approach is necessary. Accordingly, the researcher used explanatory and survey research designs. The study used an

explanatory research design by using panel regression analysis to estimate commercial banks' liquidity risk models and to establish causal relationships between variables. An explanatory approach is considered appropriate because of its ability to study situations or problems in order to explain the relationship between variables (Creswell, 1994; Creswell, 2003). The other advantage of this approach is the independence of the researcher from what is being researched, which ensures the application of controls to ensure validity of the data (Gujarati, 2003). The explanatory design also enabled the researcher to move from theory to data, ultimately giving clear insights on the subject matter. Panel data is preferred because it controls for individual heterogeneity; and there are fewer collinearity variables and track trends in the data, something which simple time series and cross sectional data cannot provide (Baltagi, 2008).

The survey research design was used to complement the explanatory research design. The survey approach is an inductive approach. The researcher is part of the research process, which allowed a close understanding of the research context. The survey strategy allowed the collection of a large amount of data from a sizeable population in a highly economical way. Often obtained by using a questionnaire, these data are standardised, allowing for easy comparison (Saunders *et al.*, 2007). In addition, the survey strategy was perceived as authoritative in general. The limitation of the survey strategy was the fact that data collected may not be as wide-ranging as those collected by other research strategies. There is a limit as to the number of questions that any questionnaire can contain if the goodwill of the respondent is not to be imposed on too much. To mitigate this weakness, questionnaires as well as personal interviews were used in the survey strategy.

The explanatory and survey designs were chosen because they allowed use of both qualitative and quantitative analysis methods and the use of both primary and secondary data. This brings the benefits of combined research approaches to the study. There are two major advantages in using multi-methods for this study. The first is the fact that each method would be used for a different purpose. In this study, the use of interviews enables the exposure of key issues on liquidity risk management before embarking on a

questionnaire. Secondly, multi-methods enable triangulation to take place. Since different methods have different effects, it makes sense to use different methods to cancel out the “method effect” (Saunders *et al.*, 2007). Different research methods led to greater confidence and credibility being placed in the conclusions. Although the quantitative and qualitative analysis overlap in practice the quantitative method identified and explained how certain variables behaved in the given circumstances. The qualitative method answered the question why the commercial banks behaved likewise in given circumstances.

The names of the commercial banks are not provided in the thesis for reasons of confidentiality. The researcher assigned a number to each of the 15 commercial banks (CB1...CB15).

5.3 Methods of Quantitative Analysis

This section examines the explanatory research design. Firstly, the theoretical construction of the liquidity risk model is outlined. This led to the development of the Zimbabwean commercial banks’ liquidity risk model. The liquidity risk model is derived from the modification of conventional bank behaviour models.

5.3.1 Banks’ Behaviour Models in a Competitive Banking Industry

From the various models of bank behaviour in economic literature, three alternatives suit this research (Agenor *et al.*, 2004; Diamond, 2007; Freixas and Rochet, 2008). The goal of commercial banks is to maximise the bank’s value as defined by its profitability and risk level (Diamond, 2007). In line with this, the research follows the model developed by Freixas and Rochet (2008). The main focus was on the bank’s liquidity on the asset and liability sides. There are four assumptions to their model relating to competitive banking deposits, which are:

- (i) Banks are risk neutral,
- (ii) Banks are price takers,
- (iii) Banks maximise profits, and

(iv) Banks have full information.

The model formulates a bank's profit as the output of total revenues from the asset side minus total expenditures from the liabilities side as follows:

$$\pi = r_L L + rM - r_D D - C(D, L) \quad (5.1)$$

where π is bank's profit; r_L is interest on loans; L is total outstanding loans; r is the money market rate; r_D is the interest on deposits; D is the total deposits; C is the total cost involved in managing both deposits and loans. M is the bank's net money market position and is formulated as:

$$M = (1 - \alpha)D - L \quad (5.2)$$

α is compulsory reserves required by the central bank.

Using equation (5.1) and equation (5.2) π can be rewritten as:

$$\pi(D, L) = (r_L - r)L + [r(1 - \alpha) - r_D]D - C(D, L) \quad (5.3)$$

Maximum profit is the first order condition of equation (5.3) such that:

$$\frac{\partial \pi}{\partial L} = (r_L - r) - \frac{\partial C}{\partial L}(D, L) = 0 \text{ and } \frac{\partial \pi}{\partial D} = [r(1 - \alpha) - r_D] - \frac{\partial C}{\partial D}(D, L) = 0 \quad (5.4)$$

Equation 5.3 and equation 5.4 mean that maximum profit is the condition where volume of loans and deposits are adjusted in such a way that $(r_L - r)$ and $[r(1 - \alpha) - r_D]$ equals marginal costs. For a bank, an increase in r_D will decrease the deposits and an increase in r_L will increase the supply of loans. According to Freixas and Rochet (2008), if there are different banks ($n = 1, \dots, N$) with typical deposits (D^n) and loans (L^n), and total amount of securities (T-Bills)(B) held, the functions of household saving and demand for investment from corporations are as follows:

Savings of household:

$$S(r_D) = B + \sum_{n=1}^N D^n(r_L, r_D, r) \quad (5.5)$$

Demand for investment from companies:

$$I(r_L) = \sum_{n=1}^N L^n(r_L, r_D, r) \quad (5.6)$$

Interbank Market:

$$\sum_{n=1}^N L^n(r_L, r_D, r) = (1 - \alpha) \sum_{n=1}^N D^n(r_L, r_D, r) \quad (5.7)$$

According to Ismal (2010), equation 5.7 assumes that aggregated position in the interbank market is zero ($M = 0$) and r is a controlled variable set by the central bank. By modifying equation 5.4 by these assumptions ($C_L \equiv \gamma L$ and $C_D \equiv \gamma D$) such that $r_L = r + \gamma L$ and $r_D = r(1 - \alpha) - \gamma D$. Putting them into equation 5.5, equation 5.6 and equation 5.7, the equilibrium equations with maximum profit and optimum liquidity balance are:

$$S[r(1 - \alpha) - \gamma D] - \frac{1(r + \gamma L)}{1 - \alpha} = B \quad (5.8)$$

$$I(r + \gamma L) = \sum_{n=1}^N L^n(r_L, r_D, r) = (1 - \alpha) \sum_{n=1}^N D^n(r_L, r_D, r) \quad (5.9)$$

Freixas and Rochet (1999) highlighted that equation 5.8 explains that liquidity on the liability side of the bank is determined by a reserve coefficient (α) or by open market

operation (B) on the equilibrium levels of r_L and r_D . On the other hand, the demand for investment from companies is influenced by cost of managing deposits and loans besides the money market interest rate. As a result, equation 9 is driven by a set of interest (r_L, r_D and r) in addition to the cost of managing loans, total deposits and liquidity reserves required by the central bank.

5.3.2 Reserve Management Models

Reserve management models deal with a bank's funding or liquidity risk to manage this type of risk and in deciding how much cash and other liquid assets they should hold. Banks internalise the fact that they can withdraw funds either from the interbank market or the central bank in case of unexpected contingencies (Agenor *et al.*, 2004). The economic literature presents various models of liquidity reserves for banks. Amongst these, Baltensperger (1980) and Agenor *et al.* (2004) best suit the purposes of this study. To start with, a simple model by Baltensperger (1980) is considered. Assume that there is only one representative bank whose deposits D are given exogenously. The bank must decide upon the level of liquidity, non-interest-bearing reserve assets R , and non-reserve assets, which take the form of illiquid loans, L . its balance sheet is given by:

$$R + L = D \quad (5.10)$$

Reserves are necessary because the bank is exposed to liquidity risk. Deposit flows $u \in (u_L, u_H)$ occur randomly according to a density function $\phi = \Phi'$. When the net outflows of cash exceed the reserves, $u \geq R$ the bank must face illiquidity costs that are taken to be proportional to the reserve deficiency $\max(0, u - R)$. This means that in the case of illiquidity the bank must borrow the missing reserves at a penalty rate q , with $q > r_L$, where r_L is the interest rate on loans. With r_D denoting the deposit rate, the bank's profit is thus:

$$\pi = r_L L - r_D D - q \max(0, u - R),$$

which implies that the bank's expected profit is:

$$E\pi = r_L L - r_D D - q \int_R^{uH} (u - R) \phi(u) du, \quad (5.11)$$

Using equation 5.10:

$$E\pi = (r_L L - r_D) D - r_L R - q \int_R^{uH} (u - R) \phi(u) du, \quad (5.12)$$

Assuming risk neutrality, the optimal level of reserves is determined so as to maximise expected profits. The necessary condition is thus:

$$\frac{\partial E(\pi)}{\partial R} = -r_L + q[1 - \Phi(R)] = 0 \text{ that is}$$

$$R^* = \Phi^{-1}\left(\frac{q - r_L}{q}\right) \quad (5.13)$$

According to Agenor *et al.* (2004), equation 5.14 implies that the marginal opportunity cost of holding an extra unit of reserves r_L , is equated to the marginal reduction in liquidity costs. Optimal reserves decrease with the lending rate r_L and increase with the penalty rate q . According to the early research conducted by Baltensperger (1980), Santomero (1984), and Swank (1996), reserve management models deal with a bank's funding or liquidity risk. Therefore for the purpose of this thesis, the simple reserves model in equation 5.14 is extended in several directions, and a panel regression Zimbabwe commercial banks' liquidity risk model is developed following in part Agénor *et al.* 2004; Aspachs and Tiesset, 2005; Bunda and Desquilbert, 2008; Shen *et al.* (2009) and Vodova (2011).

The panel regression model developed is:

$$LQR_{it} = c_i + \sum_{b=1}^B \beta_b \Pi_{it}^b + \sum_{s=1}^S \sigma_s \Pi_{it}^s + \sum_{m=1}^M \lambda_m \Pi_{it}^m + \varepsilon_t \quad (5.14)$$

Where LQR_{it} is the liquidity risk of the i th bank at time t , with $i = 1 \dots N$; $t = 1 \dots T_i$. $\Pi_{it}^b, \Pi_{it}^s, \Pi_{it}^m$ are bank specific, supervisory and macroeconomic variables. The most important task was to choose the appropriate explanatory variables for commercial banks in Zimbabwe in both the Zimbabwean dollar era and the multiple currency era. Extending equation (5.14) to reflect the variables, the model is formulated as follows:

$$LQR_{it} = c_i + \beta_1 CAD_{it} + \beta_2 SIZE_{it} + \beta_3 SPREADS_{it} + \beta_4 NPL_{it} + \sigma_1 RRR_t + \lambda_1 INFL_t + \varepsilon_i \quad (5.15)$$

where

LQR_{it} is the the financing gap ratio, a proxy for liquidity risk at bank i at time t . An alternative measure of liquidity, the liquid asset ratio (LQ) would be used for robustness checks.

CAD_{it} is the capital adequacy ratio at bank i at time t

$SIZE_{it}$ is the natural logarithm of total assets at bank i at time t

$SPREADS_{it}$ is the difference between interest rates on loans and interest rates on deposits at bank i at time t

NPL_{it} is non-performing loans at bank i at time t

RRR_t is the reserve requirement ratio that captures the regulatory effects at time t

$INFL_t$ is the inflation rate at time t that captures the macroeconomic effects

t = time period, c_i is the constant, β represent bank specific factors coefficients, σ represents the regulatory factors, and λ captures the macroeconomic factor coefficient.

Bank specific variables include capital adequacy ratio (CAD), size of the bank (SIZE), difference between interest rates on loans and interest rates on deposits (SPREADS), and non-performing loans (NPL). Supervisory effects have been captured by the reserve requirement ratio (RRR). Macroeconomic variables are captured by inflation (INFL).

5.3.3 The Dependent Variable

The dependant variable *LQR* captures liquidity risk. Liquidity risk is the risk that a bank will be unable to fund loan commitments or meet withdrawal demands at a reasonable cost. A large stock of liquid assets such as investment securities indicates a greater ability to meet unexpected liquidity needs and should therefore translate into a lower probability of safety and soundness problems. Liquidity risk depends on the bank's reliance on non-core funding. Core funding which includes checking accounts, savings accounts, and small time deposits is relatively insensitive to the difference between the interest rate paid by the bank and the market rate. However, non-core funding which includes large time deposits can be quite sensitive to interest rate differentials. All other things being equal, greater reliance on large time deposits implies a greater likelihood of a funding runoff or an interest expense shock and hence a future safety and soundness problem.

Generally, liquidity risk measures can be calculated from balance sheet positions. Traditional practices of liquidity risk measures focus on the use of liquidity ratios. The two most popular ratios are the loan-to-deposit ratio and the liquid asset ratio, where the higher the loan-to-deposit ratio (or the lower the liquid asset ratio) the less able a bank is to meet any additional loan demands. Both indicators have their shortcomings: the loan-to-deposit ratio does not take into account the other assets that may be available for conversion into cash to meet demands for withdrawals or loans, while the liquid assets ratio ignores the flow of funds from repayments, increases in liabilities and the demand for bank funds. However, Poorman and Blake (2005) indicated that it was not good enough to measure liquidity just by using liquidity ratios. This was shown after a large regional bank, Southeast bank of Miami, used over 30 liquidity ratios for liquidity measurement but finally failed due to liquidity risk. For that reason, the thesis adopts Shen *et al.* (2009) by employing alternative liquidity risk measures. The study captures liquidity risk with the financing gap ratio (LQR). The financing gap ratio is the ratio of financing gap to total assets. Financing gap is the difference between a bank's loans and customer deposits. This ratio indicates the extent to which a bank's deposit structure funds the loan portfolio. A high ratio suggests potential vulnerability to credit-sensitive

funds providers at less favourable points in the credit and economic cycles. For robustness check for the main findings, the research study uses more than one liquidity ratio. Therefore on the model specified in equation 5.15, a different dependent variable, liquid asset ratio (LQ) is used. In this research study, the liquid asset ratio is measured as the ratio of liquid assets to total assets. LQ is conversely related to the financing gap ratio (LQR) since the higher the share of liquid assets, the higher the capacity to absorb liquidity shock by a bank (Vodova, 2011).

5.3.4 Explanatory Variables

This section presents explanations of the independent variables and the manipulations thereof.

5.3.4.1 Capital Adequacy Ratio (CAD)

Capital requirement refers to the standardised requirements in place for banks, which determine how much capital is required to be held for a certain level of assets through regulatory agencies. Capital requirements are put in place to ensure that banks are not participating in or holding investments that increase the risk of default and that they have enough capital to sustain operating losses while still honouring withdrawals. Capital is the cushion that protects banks, their customers and shareholders against loss resulting from the assumption of risk. Given that the banking business is fraught with uncertainties, banking institutions should be adequately capitalised to ensure the continuation of a safe and efficient market able to withstand any foreseeable problems. The primary aim of capital adequacy requirements is therefore to limit risk-taking by banking institutions. Capital requirements thus play a key role in the supervision and regulation of banks. The Basel Accords published by the Basel Committee on Banking Supervision housed at the Bank for International Settlements sets a framework on how banks must calculate capital. The measure of a bank's capital is the capital adequacy ratio. It is expressed as a percentage of a bank's capital to its risk-weighted credit exposures. Therefore:

$$\text{CAR} = \text{Tier One Capital} + \text{Tier Two Capital} / \text{Risk Weighted Assets}$$

Two types of capital are measured: tier one capital, which can absorb losses without a bank being required to cease trading, and tier two capital, which can absorb losses in the event of a winding-up and so provides a lesser degree of protection to depositors. The ratio is used to protect depositors and promote the stability and efficiency of financial systems. Adequate capital supports future growth, fosters public confidence in the bank's condition, provides the capacity under the bank's legal lending limit to serve customers' needs, and protects the bank from unexpected losses.

The Reserve Bank of Zimbabwe (RBZ) has been constantly changing the minimum capital requirements for banks, with the last review being US dollar linked capital requirements. The capital adequacy ratio is included as an explanatory variable to determine the ways in which it influenced liquidity risk in Zimbabwean commercial banks. The literature (Diamond and Dybvig, 1983; Diamond and Rajan, 2000) notes that prudential capital requirements help prevent destructive bank runs. Capital requirements resolve the problem of moral hazard. When public confidence is high, depositors will be prepared to invest in the banking sector. A negative relationship between the capital adequacy ratio and liquidity risk is expected with the assumption that banks with sufficient capital adequacy would also be liquid. The converse is true on the liquid asset ratio.

5.3.4.2 Size of the Bank (SIZE)

Academics in finance differ regarding the way in which a bank's size should be measured. Therefore there is no definite proxy to measure the size of banks. It can be measured by the size of total assets; the total number of customers and in some instances the branch network. In their study of German commercial banks, Rauch *et al.* (2005) measured the size of banks by looking at the total number of customers. Akhtar (2010)'s study of Pakistan commercial banks used the logarithm of total bank assets to measure the size of a bank. Aspachs *et al.* (2005) measured the size of English banks by

considering the total assets of the bank. These empirical studies showed that large banks have an incentive to hold more loans, which increases bank illiquidity. At the same time, big banks have access to various sources of funds which can improve bank liquidity. Negative and positive influences are expected between size and liquidity risk. A negative influence is expected when the increase in bank size leads to the bank effectively managing the assets and liability and diversifying sources of funds which enhance liquidity and reduce liquidity risk. Large banks can reduce liquidity risk by diversifying across product lines and geographic regions. As the bank's size increases, it would be easy to source more funds and diversifying the sources, unlike the small banks. If the size increase of the bank implies that it has the incentive to hold more loans, which increases liquidity risk or higher financing gap ratio, a positive influence would be expected.

5.3.4.3 Difference between Interest Rates on Loans and Interest Rates on Deposits (SPREADS)

Interest rates are the cost of money. For a bank to be able to source funds, the cost of funds would determine the amount of deposits. Similarly, when the banks lend money, this would be determined by the rates of interest. A spread is a measure of the difference between two variables. The difference between the lending rate and the deposit rate is the interest rate spread. Interest rate spreads are considered because they clearly explain the sourcing and application of the funds. Banking spreads thus determine the bank's profitability and liquidity. Interest rate spreads are very important in the day-to-day management of liquidity risk by banks. If the differences are high, these would have effects on lending activities and savings mobilisation, making liquidity risk management a challenge. Therefore spreads might be big or small depending on the macroeconomic and bank specific conditions. If spreads are big, which is ideally for banks, it improves a negative relationship between interest rate spreads and liquidity risk is expected. If spreads are small, a negative relationship is expected. Positive or negative relationship between spreads and the financing gap ratio and spreads and the liquid asset ratio is expected.

5.3.4.4 Non-Performing Loans (NPL)

The model captures credit risk with loans past due or non-performing loans. Credit risk is the risk that borrowers will fail to make promised interest and principal payments. Credit risk is seen in the loan portfolio of non-performing loans. A non-performing loan is a loan that is not earning income and full payment of principal and interest is no longer anticipated, or the maturity date has passed and payment in full has not been made. There is no global standard to define non-performing loans at the practical level. Variations exist in terms of the classification system, the scope, and contents. This potentially adds to disorder and uncertainty in NPL issues. For example, as described by Park (2003), during the 1990s, there were three different methods of defining non-performing loans: the 1993 method based on banking laws; the “Bank’s Self-Valuation” of March 1996; and the “Financial Revival Laws-Based Debt Disclosure” of 1999. These measurements have gradually broadened the scope and scale of the risk-management method.

In their estimation of bank liquidity for emerging countries, Bunda and Desquilbert (2008) included the share of loan losses provision on net interest revenues as a measure of the risk behaviour of banks. Vodova (2011) included non-performing loans as an explanatory variable in a study of Czech commercial banks’ liquidity determinants. In this thesis non-performing loans are defined as all loans that are past due 90 days and non-current. If borrowers fail to pay back loans timeously, the lending bank would be exposed to liquidity risk. Positive influences of non-performing loans are expected on LQR and negative influences are expected on LQ.

5.3.4.5 Reserve Requirement Ratio (RRR)

The reserve requirement ratio occurs when the central bank regulates that each commercial bank sets the minimum reserves it must hold of customer deposits rather than lend out. It is normally in the form of cash stored physically in a bank’s vault or deposits made with a central bank. The reserve ratio is sometimes used as monetary policy tool to influence interest rates and inflation. Fielding (2005)’s study of Egyptian banks included the reserve requirement ratio as a determinant of liquidity. An institution that holds

reserves in excess of the required amount is said to hold excess reserves. A negative relationship is expected, with high reserve requirements reducing the bank's illiquidity. A positive relationship is expected on financing gap ratio and liquid asset ratio.

5.3.4.6 Inflation Rate (INFL)

Inflation refers to the general increase in price levels of goods and services in an economy. Inflation is usually measured by the CPI and the PPI. In this study, the CPI is used. The literature on the liquidity risk demand function revealed negative relationships. This could be explained by the fact that the countries studied are developed and normally have low inflation rates. In Zimbabwe, because of the hyperinflationary periods and the introduction of the multiple currency exchange rate regime positive or negative effects are expected in both periods.

5.3.5 Expectations of the Model

Table 5.1 below shows the expected relationship between commercial banks' liquidity and independent variables *a priori*.

Table 5.1: Summary of *A Priori* Expectations

Independent Variables	Symbol	Hypothesized Relationship	Hypothesized Relationship
		LQR	LQ
Capital Adequacy Ratio	CAD	-	+
Size of the Bank	SIZE	+/-	+/-
Difference Between Interest Rates on Loans and Interest Rates on Deposits	SPREADS	+/-	+/-
Non-performing Loans	NPL	+	-
Reserve Requirement Ratio	RRR	-	+
Inflation Rate	INFL	+/-	+/-

5.3.6 Diagnostic Tests

To minimise the potential for spurious regression, the cross-sectional time series data was checked to determine that it abides to econometric *a priori* postulation. The following diagnostic tests were carried out.

5.3.6.1 Unit Root Test

The first task was to examine whether the behaviour of the econometric variables were consistent with a unit root or not (non-stationary or stationary). Stationarity is a necessary condition to satisfy an assumption of classical econometrics. Unit root tests are formal way of diagnosing the data to determine whether the data is stationary (Maddala and Wu, 1999).

Since the work of Levin and Lin (1992, 1993), and Im, Pesaran and Shin (1997), it is now generally accepted that the commonly used unit root tests like the Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests lack the power to distinguishing the unit root null from stationary alternatives. Using panel data unit root tests is one way of increasing the power of unit root tests. Many tests have been developed to test for unit roots or stationarity in panel data sets (e.g. Maximum Likelihood with Homoscedastic, Maximum Likelihood with Heteroscedasticity; Levin-Lin-Chu, (1992); Im-Pesaran-Shin (1997); Harris-Tzavalis (1999); Breitung (2000); Breitung and Das (2005)). Some of these tests are discussed below.

(i) Maximum Likelihood Methods with Homoscedastic Errors

The model to be estimated is given with homoscedastic disturbances and without the time trend as:

$$y_{it} = \alpha_i + u_{it} \quad (5.16)$$

$$y_{it} = y_{i,t-1} + \varepsilon_{it} \quad \rho = 1$$

$$u_{it} = \rho u_{i,t-1} + \varepsilon_{it} \quad |\rho| < 1$$

$$\varepsilon_{it} \approx N[0, \sigma_\varepsilon^2]$$

(ii) Maximum Likelihood with Heteroscedastic Errors

In this case one takes care of heteroscedasticity. The implication is that variances of errors vary across firms; therefore estimating assuming homoscedasticity would likely produce wrong standard errors at the last.

(iii) Levin-Lin Test (LL)

The Levin-Lin is based on pooled regression. The test is based on the model estimated under the null hypothesis of a unit root (i.e where OLS can be used because there are no fixed effects) The LL test may have power when the true ρ is near unity (Levin and Lin, 1992; Levin and Lin, 1993). The LL test is based on the following model:

$$y_{it} = \sigma_t + \rho y_{i,t} + \varepsilon_{it} \quad i=1, \dots, N, t=1, \dots, T \quad (5.17)$$

where $\varepsilon_i = (\varepsilon_{i1}, \varepsilon_{i2}, \dots, \varepsilon_{iT})$

(iv) Harris-Tzavalis Test (H-T)

The test for unit root tests in panel data as proposed by Harris and Tzavalis (1999) begins with the observation that the “Nickel” bias in the estimated coefficient of the lagged endogenous variables using LSDV (within) estimation is of known magnitude under some simple assumption about the data generating process (Harris and Tzavalis, 1999). Using the fact that one can compute bias adjustments to both the estimated coefficient and standard errors analytically and using the corrected estimates to construct a test of known size for a unit root, the H-T considers the model in equation (22) and shows that under the H_0 , $\rho = 1$, the least squares dummy variable estimator, has a limiting normal distribution of the following form:

$$\sqrt{N}(\rho - 1 - \beta_2) \rightarrow N(0, C_2) \quad (5.18)$$

where $\beta_2 = -3(T+1)$

$$C_2 = 3(17 T^2 - 20 T + 17) / [5(T-1)(T+1)^3]$$

Using this fact, it is straightforward to base a t-test on the estimated ρ , standardised by

its mean and variance. Like the CMLE test, the H-T requires homoscedasticity and no serial correlation in the disturbances. It does not require normality since it is based on a least squares estimator.

(v) Im-Pesaran-Shin test (IPS)

Im, Pesaran and Shin (1997) suggested another approach to test panel data unit root tests. The IPS allows for more heterogeneity of behaviour than that allowed for by the conditional maximum likelihood or the Harris-Tzavalis test. The IPS assumes a heterogeneous version of the model:

$$y_{it} = (1 - \rho_i)\alpha_i + \rho_i y_{i,t-1} + \varepsilon_{it} \quad i=1, \dots, N, t=1, \dots, T \quad (5.19)$$

The IPS tests the null hypothesis that ρ_i s are less than one. Under the null hypothesis, there are no fixed effects while under the alternative hypothesis, each fixed effect is equal to $(1 - \rho_i)\alpha_i$. The IPS test propose tests based on the average over the individual units of a Lagrange-multiplier test of the null hypothesis that $\rho_i = 1$ as well as tests based on the average of the Augmented Dickey-Fuller statistics (Im, Pesaran and Shin, 1997). The IPS requires a balanced panel data.

Different researchers have used different tests, but the LL test is criticised as being very restrictive in its hypothesis which is rarely used in practical interests. The IPS is claimed to be a generalisation of the LL tests. However it is better viewed as a way of combining the evidence of several independent unit root tests. IPS is argued to be more powerful than the LL test but strictly speaking power comparison is not valid. The LL is based on pooled regression while the IPS is based on heterogeneity of the autoregressive parameter. The Levin-Lin test requires that the ratio of the number of panels to time periods tend to zero asymptotically, implying that it is not well suitable to datasets with relatively few time periods. The null hypothesis for all the tests is the same which is that the panels contain unit roots. The difference is in the alternative hypothesis. The Levin-Lin and the Im-Pesaran-Shin have the alternative hypothesis that some panels are

stationary. The Harris-Tzavalis has the alternative hypothesis that all the panels are stationary, which is preferable. For all these reasons this study chose the Harris-Tzavalis to examine whether the variables contain a unit root (Harris and Tzavalis, 1999; STATA, 2011).

5.3.6.2 Multicollinearity

According to Wooldridge (2003), multicollinearity exists when the independent variables in the model are correlated. Multicollinearity arises from the perfect linear relation among regressors, as this result in inflated standard errors and consequently inaccurate parameter estimations. The presence of multicollinearity can be detected using the high pair-wise correlation among regressors. The practical consequences of high multicollinearity are that although they are best linear unbiased estimators (BLUE), the estimators have large variance and covariance, making precise estimation difficult. If multicollinearity is proven to be present it is remedied by dropping some variable. As a rule of thumb the pair wise or zero order correlation coefficient is said to be high if in excess of 0.8, (Gujarati, 2003). The researcher used the correlation matrix to detect the presence of severe multicollinearity.

5.3.6.3 Heteroscedasticity

An important assumption necessary for validity of regression inferences is that the error term has constant variance for all levels of the independent variables. Regression disturbances whose variances are not constant across observations are heterogeneous. (Greene 2008). Heteroscedasticity does not result in biased parameter estimates. But if there is heteroscedasticity, estimates of the standard errors would be wrong. The result of this would be would be bias in test statistics. Assuming homoscedastic disturbances when there is heteroscedasticity will still result in consistent estimates of the regression coefficients. These estimates will not be efficient (Baltagi, 2008). Sometimes heteroscedasticity results from improper model specification. There may be subgroup differences. Effects of variables may not be linear. If these problems exist, there would be a need to deal with them first.

There are many tests for heteroscedasticity but here, the data was tested for heteroscedasticity using the Breusch-Pagan/Cook-Weisberg test. The Breusch-Pagan test is designed to detect any linear form of heteroscedasticity. The test is an option built in Stata (STATA, 2011). One runs a regression and then gives a command “hettest”. The Breusch-Pagan tests the null hypothesis that the error variances are equal *versus* the alternative that the error variances are a multiplicative function of one or more variables. In other words, this means that the error variances increase (decrease) as the predicted values of the dependent variables increased. A chi-square would be given. A larger chi-square would indicate that heteroscedasticity is present and a small chi-square would indicate that heteroscedasticity was not a problem.

When heteroscedasticity is present, the Hausman test cannot be conducted in the choice of either the random or fixed effects model because it violates the classical assumption of the OLS, thus signifying that the test could not assist much.

5.3.6.4 Model Specification Tests

The Ramsey reset test was conducted to ascertain whether the model was correctly specified. This test detects if there are variables that have been omitted, included variables that are not supposed to be included and tests the functional form of the model.

5.3.7 Data Sources and Characteristics

The study included semi-annual data from 2000 to 2008 and monthly data from March 2009 to October 2011 from 15 Zimbabwean commercial banks (Refer to appendix 3 and appendix 5). Data was collected from the banks’ annual reports and financial statements (half-year end and year-end reports), the Survey of Banks data base and the RBZ monetary policy statements. Data from these reports were used to estimate and evaluate the liquidity risk models. Secondary cross sectional time series in nature had the advantage that it was almost free from human errors or manipulation and did not have an

element of subjectivity, since it had not been smoothened, interpolated or extrapolated. However, it is not 100% bias-free, since the figures are averages which are estimates.

5.3.8 Robustness Checks

To check the robustness of the findings, models are run with a fresh set of explanatory variables for each of the sample. The best subset of explanatory variables was identified.

5.4 Methods of Qualitative Analysis

This section looks at the survey on liquidity risk management. The target population consists of all commercial banking institutions that operated in Zimbabwe from 2000 to 2011. The respondents include personnel involved in liquidity management and were drawn from treasury management, branch operations, corporate banking or credit risk divisions.

5.4.1 Sampling Technique and Sample Size

Sampling makes possible a higher overall accuracy than a census (Creswell, 2003). Some of the staff members in the respective departments have limited knowledge, and depending on their length of service, levels and grades, this makes it unnecessary for them to participate. A non-probability sampling technique was used for the study. More specifically, a purposive or judgmental sampling technique was chosen. This technique made it possible to use judgment to select respondents that best answer the research questions and meet the objectives (Collis and Hussey, 2003). Liquidity management centres mainly on the treasury department and the risk management department. Personnel responsible for the management of liquidity risk in the treasury division and in the risk division were considered to respond to the interviews or questionnaires. The studied period was 2000 to 2008 and 2009 to 2011. The researcher considered respondents who had been with the bank for at least 11 years for the 15 commercial banks. The consideration was to ensure that the responses were factual and not “thumb-sucked” by respondents who could have not been in the banking sector during the time of the two periods under study. The researcher did not target only the heads of the

specified departments. This was important because the fact that one is a head of department does not necessarily mean that they have the historical knowledge of that institution or has been working for the banking sector during the period under review. Two respondents from the treasury and risk division gave a total sample size of 30.

5.4.2 Data Collection Methods and Instruments

The collection of data to assess and investigate the process of liquidity risk management involved the use of both primary and secondary data sources. The study relied mainly on primary data collected through questionnaires and interviews. Furthermore, documentary analysis, a secondary data collection method, was also employed. Self-administered questionnaires were the main instrument of primary data collection from commercial banks for the multiple currency era. In-depth interviews were used for the Zimbabwean dollar era.

5.4.2.1 Primary Data Collection

The primary data collection method was the main source of data for qualitative analysis. This method was more accommodating as it unearthed the latest information despite the fact that it was costly and time consuming. Primary data collection was done through the use of questionnaires and interviews.

(i) Questionnaires, Construction and Design

Questionnaires are used as the primary instrument for data collection. There are various definitions of the term “questionnaire”. In this study, it is used to refer to a technique of data collection in which each participant is asked to respond to the same set of questions in a predetermined order. To maximise the response rate, individual questions were carefully designed. They were laid out in as clear a manner as possible. In the multiple currency regime questionnaire, questions addressed the years in business of banks; ownership; number of branches the banks have; the personnel responsible for liquidity risk management; major sources of funds; identification of the bank’s major investments and assets; how banks manage liquidity mismatches; funding liquidity profiles

assessments; charges on depositors for redemption of the investments; charging of investment rates; factors affecting banks' liquidity profile; lending activities; investment options; limits placed by banks; stress testing; policies and procedures; contingency plans; regulatory influence and survival strategies.

Nevertheless, questionnaires are usually not suitable for exploratory research that requires large numbers of open-ended questions (Saunders *et al.* 2003). This was mitigated by standardising questions that could be interpreted the same way by the respondents. The questionnaires were self-administered. Although interviewer-administered questionnaires usually have a higher response rate (Collis and Hussey, 2003), the questionnaires were self-administered to allow participants ample time to answer the questions.

The questionnaires were developed from the review of local and international literature on commercial banks' liquidity management. Informal discussions with treasury personnel and risk managers provided useful insights into the design of the questionnaire. Some elements were, however, adopted from the International Banking Standards guidelines on liquidity management. The questionnaires underwent several modifications until they were fit for the purpose for which they were used. The questionnaires were face, content and construct validated and necessary adjustments were effected. The researcher's supervisor and experts in commercial bank liquidity management were asked to comment on the face and content validity of the instrument. In addition, a pilot study was conducted in December 2011 on two banks which led to necessary modifications being made. The pilot study led to some initial questions being dropped, whilst other new questions were incorporated.

The major complaint raised during the pilot survey was the length of the multiple currency era survey questionnaires, with respondents highlighting that it was too long. While the length of the questionnaire was reduced, the researcher ensured that there were no compromises on the information to be gathered. In order to reduce the time spent

completing the questionnaire, easy to complete closed-ended questions were used. Both questionnaires comprised mainly of structured (or closed-ended) questions, with possible response options provided. Structured questions were deemed more appropriate for this study as respondents would simply circle the appropriate response faster than if an unstructured questionnaire were used.

The use of closed-ended questions would improve the questionnaire response rate, thus improving the representativeness of the results obtained. In addition, such questions allow detailed quantitative analysis of the responses collected as compared to their open-ended counterparts. Some sections employed a five-point likert scale. Refer to Appendix 8 for the questionnaires used to survey liquidity management during the multiple currency regime.

(ii) In-depth Interviews

These were conducted with the personnel of treasury and risk departments directly involved in liquidity risk management in the Zimbabwean dollar era. The researcher decided to interview two respondents from each bank because of the time period when the country was experiencing hyperinflation with the fact that some elements have since been forgotten. The interviews were done face-to-face and recorded. Some of the questions the thesis seeks to answer from the interviews are as follows: understanding whether the bank is locally owned or foreign owned and the year of establishment in Zimbabwe. To understand liability management, questions addressed the effects of inflation on fixed term products; deposit mobilisation from individuals *versus* corporate clients; inflation and the cost of funds; and major sources of funding for bank loans. The second part of interview addressed issues around asset management. It looked at lending, the lending tenors, preferences of lending to individuals or corporate clients and the measures taken in respect of the lending portfolio; and investments. In a bid to address the hyperinflationary trend, the central bank adopted a tight monetary policy stance which affected the bank's asset and liability management. The last section of the interview addressed the effect of the RBZ policies in relation to regulations on asset and

liability management by banks; accommodation rates; statutory reserve requirements; open market operations and the financial stabilisation bonds.

In-depth interviews in the form of open-ended questions allowed respondents to give spontaneous responses and avoid the bias that may result from suggesting responses for them (Gujarati, 2003). However, interviewee bias cannot be overruled, given the personal and confidential nature of the questions asked. Refer to Appendix 7 for the interview schedule.

5.4.2.2 Secondary Data Collection

Another important source of data in this study was secondary data. The main source was documentary secondary data. This included the financial statements of the commercial banks, minutes of meetings, reports to shareholders, correspondence and bank magazine articles. Survey based secondary data was also used. These were based on regular surveys; in Zimbabwe, this is mainly done by Banks and Banking Surveys. The monetary policy statements by the central bank, (RBZ) were important sources. Secondary data was chosen because it was less expensive, yet insightful. The availability was effortless, rapid and resulted in unforeseen discoveries. The reliability, accuracy and integrity of secondary data are uncertain (Collis and Hussey, 2003). To mitigate this, the researcher used multiple-source secondary data, where an amalgam of documentary and survey was considered. The other limitation was access to some of the internal reports as they were treated as confidential. Regardless of this, secondary data was complemented by primary data.

5.4.3 Validation and Reliability of Data

The reliability of the research was assessed by examining the Cronbach's Alpha coefficient. Results were considered as sound and reliable if the reliability coefficient measure was greater than 0.7.

5.4.4 Data Presentation and Analysis Strategy

Both qualitative and quantitative methods of data analysis were employed. This allowed

for the exploration of areas of interest from a variety of angles and benefitted from the unique insight offered by each approach. Data from the survey were analysed using STATA version 11. Tabulations were used to show percentages and frequencies of respondents in each response category, with cross-tabulation tables showing percentages and frequencies between two given categories. Cross-tabulations were computed together with correlation tests between two variables by using Pearson chi-square. The

dependency test formula is
$$\chi^2 = \sum \frac{(fo - fe)^2}{fe} \quad (5.20)$$

fo = frequency

fe = expected frequency

5.5 Summary

The chapter provided a detailed description of the research methods for the thesis. In order to understand liquidity risk management, a highly structured approach was necessary. To this end, quantitative and qualitative methods were used which brought in the benefits of combined research approaches. In particular an explanatory and survey research designs were chosen. The first section of the chapter presented the quantitative analysis with the construction of the liquidity risk model for commercial banks in Zimbabwe. Based on the theoretical construction of the liquidity risk models, a panel regression model is employed. The researcher pooled observations on a cross section of firms over time periods of 2000 to 2008 and March 2009 to October 2011 on 15 commercial banks in Zimbabwe. There are several benefits of using panel data as reviewed in chapter three and the researcher considered them for this research. When estimating liquidity risk by commercial banks, there might be a problem of banks being heterogeneous (Allison, 1994; Finkel, 1995; Gujarati, 2003; Wooldridge, 2002; Wooldridge, 2003; Greene, 2008). If one considers only time series analysis or cross sectional analysis without controlling for the heterogeneity, there would be risk of obtaining biased results.

Following the previous literature review, liquidity risk model is specified as a function of

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capital adequacy, size of the bank, differences between the deposit and lending interest rates, non-performing loans, reserve requirement ratio and inflation. The procedures of diagnostic tests for the thesis are explained, which include unit root tests, heteroscedasticity test, multicollinearity test, model specification tests and the Hausman test.

To complement the quantitative analysis, a survey is done which forms the basis of qualitative analysis. The research population is specified, which consists of all heads of treasury and risk management from the 15 commercial banks that operated from 2000 to 2011. A judgmental sampling technique is used to allow the researcher to use her judgment to select respondents that are best able to answer the research questions. The study makes use of both primary and secondary data. Furthermore documentary analysis, a secondary data collection method, is employed. Self-administered questionnaires were the main instrument of primary data collection from the commercial banks when there was use of multiple currencies. Observations provided supplementary information on issues that would not have been exhausted by the questionnaire. In-depth interviews were used to gather data when the country was using the Zimbabwean dollars. Prior to using the questionnaire and interview guide to collect data, the instruments were pilot tested. This was done in order to refine the questions so that the respondents would not have problems in answering questions and recording the data. Pilot testing enabled the assessment of the questions' validity and the likely reliability of the data to be collected. The reliability of the research would be assessed by examining the Cronbach's Alpha coefficient on the main objectives of the research.

Chapter 5 has set the platform for the forthcoming chapters that present the research findings. The next chapter presents the econometric investigation of commercial banks' liquidity risk determinants.

CHAPTER SIX

ZIMBABWEAN COMMERCIAL BANKS LIQUIDITY RISK DETERMINANTS

6.1 Introduction

Chapter six presents the empirical results on Zimbabwean commercial banks' liquidity risk determinants. The determinants encompass bank-specific, regulatory and macroeconomic factors. The analysis was conducted using an econometric analysis of pooled-cross sectional time series data of the 15 commercial banks. Liquidity risk models for 2000 to 2008 were run separately since the country was using Zimbabwean dollars. Balance semi-annual panel data was used. The country adopted the use of multiple currencies in 2009. Balance monthly panel data from March 2009 to October 2011 was used to investigate what determined liquidity risk in the multiple currency regime. The estimation technique is balanced panel regressions. The econometric analysis begins with descriptive statistics, followed by diagnostic tests, presentation of the results, interpretation and analysis of the results.

6.2 Liquidity Risk Determinants in the Zimbabwean Dollar

The first empirical evidence is on commercial banks liquidity and liquidity risk in the Zimbabwean dollar era. The dependent variables used are financing gap ratio and liquid asset ratio. Main findings are derived from the financing gap ratio as the measure of liquidity risk. The liquid asset ratio is used for robustness checks.

6.2.1 Model Diagnostic Tests

As a pre-requisite, in order to elicit efficient, consistent and reliable results from any model for any policy recommendation it must first of all abide by the econometrics *a priori* postulation underpinning the model. In econometrics in general and financial econometrics in particular, different data characteristics require different estimation procedures. The diagnostic test results found by the researcher before estimation of the

liquidity risk model in the Zimbabwean dollar era are provided below:

6.2.1.1 Unit Root Tests Results

Prior to the estimation, it is important to test for the stationarity of the variables so as to avoid spurious regression and where the variables are not stationary in levels, appropriate differencing has to be done until the variables become stationary. Harris-Tzavalis unit root tests were used and results are presented in table 6.1.

Table 6.1: Unit Root Test Results

VARIABLE	STATISTIC	Z	P-VALUE
LQR	0.4839	-7.8774	0.0000
LQ	0.5342	-6.7429	0.0000
CAD	-0.0868	-19.4191	0.0000
SIZE	-0.1070	-19.8491	0.0000
SPREADS	0.4575	-8.4731	0.0000
NPL	0.1203	-16.0748	0.0000
RRR	0.3505	-10.8847	0.0000
INFL	-0.0717	-20.4023	0.0000

The variables are stationary in levels as confirmed by the p-values. There was no problem of non-stationarity.

6.2.1.2 Multicollinearity Test Results

Multicollinearity arises from the perfect linear relation among regressors as this result in inflated standard errors and consequently inaccurate parameter estimations. The presence

of multicollinearity can be detected using the high pair-wise correlation among regressors. The practical consequences of high multicollinearity are that although best linear unbiased estimators (BLUE) are obtained, the estimators have large variance and covariance, making precise estimation difficult. As a rule of thumb the pair wise or zero order correlation coefficient is said to be high if in excess of 0.8 (Gujarati, 2003). The correlation matrix was used to detect the presence of multicollinearity and if present, the variable causing it was dropped. After running the correlation matrix, a summary of the results is presented in table 6.2.

Table 6.2: Correlation Matrix

	LQR	CAD	SIZE	SPREADS	NPL	RRR	INFL
LQR	1.0000						
CAD	-0.3394	1.0000					
SIZE	0.0411	-0.0194	1.0000				
SPREADS	-0.0265	-0.0142	-0.0773	1.0000			
NPL	0.0547	-0.0170	-0.0220	-0.0108	1.0000		
RRR	0.0422	0.2094	0.3399	0.0208	-0.1171	1.0000	
INFL	0.0648	-0.1501	0.0163	-0.0259	-0.0065	-0.246	1.0000

Various correlation matrices were carried out to check on multicollinearity. It was noted that Gross Domestic Product (GDP) and Return on Assest (ROA) variables had higher correlations with other variables and hence they were dropped (see appendix 4). After dropping these variables, there was no problem of multicollinearity between variables.

6.2.1.3 Model Specification Tests

Before the estimation, the model was tested to see if it was correctly specified. The

Ramsey reset test was used using powers of the fitted values of the depended variable. The results are as follows:

H_0 : model has no omitted variables

$$F(3, 244) = 1.42$$

$$\text{Prob} > F = 0.2375$$

The above result shows that the model is correctly specified and the null hypothesis that the model has no omitted variables is accepted.

6.2.1.4 Heteroscedasticity Results

The Breusch Pagan / Cook-Weisberg test for heteroscedasticity was done. The results are as follows:

H_0 : Constant variance

Variables: fitted values of liquidity risk

$$\chi^2(1) = 1.11$$

$$\text{Prob} > \chi^2 = 0.2918$$

The null hypothesis is that the error variances are all equal against the alternative that the variances are not constant. The chi-square is small. The null hypothesis is accepted, rejecting the problem of heteroscedasticity. Given this, it was possible to run the fixed effects model or random effects model. The next test was to decide on the best model to use.

6.2.1.5 Hausman Test for Fixed or Random Effects Model

To decide on the use of the fixed effects or random effects model, a Hausman test was used. The results are as follows:

$$\chi^2(6) = (b-B)' [V_b - V_B]^{-1} (b-B)$$

$$= 16\,356.77$$

$$\text{Prob}>\chi^2 = 0.0000$$

From the result above, H_0 was rejected that the two estimation methods were both acceptable and would yield the same coefficients. The differences between some of the coefficients were big. The decision was therefore to reject the random effects and use the fixed effects model to estimate the liquidity risk model for Zimbabwean commercial banks in the Zimbabwean dollar era.

6.2.3 Regression Results Presentation with Dependent Variable LQR

After running the panel regression model using Stata on the dependent variable liquidity risk (LQR), the results are presented in table 6.3 below; the full version is in Appendix 4.

Table 6.3: Regression Results, Fixed Effects (Within) Regression (LQR)

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	0.56386	0.0573	9.83	0.000
CAD	-0.2162	-0.0639	-3.38	0.001
SIZE	0.04972	0.0101	4.89	0.000
SPREADS	-0.1762	0.0699	-2.52	0.012
NPL	0.04166	0.0587	0.71	0.478
RRR	-0.0972	0.0530	-1.83	0.063
INFL	0.0664	0.0249	2.67	0.008
Number of observations:	255			
R ²	Within = 0.44	Between = 0.10	Overall = 0.30	

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$$F(6,236) = 38.93 \quad \text{Prob}>F = 0.0000$$

Having run the liquidity risk model, it is important to interpret the meaning of the results. The relationships are discussed in turn.

6.2.3.1 Capital Adequacy Ratio

Capital adequacy was a significant determinant of the liquidity risk of commercial banks in the Zimbabwean dollar era. The finding is in line with the expectation that capital adequacy has a negative relationship with liquidity risk. This conforms to theoretical and empirical evidence that capital has a positive effect on bank performance. Banks with a sound capital position have more time and flexibility to deal with problems because of unexpected loss (Machiraju, 2008). Besides, well capitalised banks face lower possibilities of going bankrupt as a result of the reduced cost of funding or less need for external funding, which enhances performance. Banks that are capitally adequate are not prone to liquidity risk. Banks with sufficient capital adequacy should also be liquid. This finding is in line with previous studies (Bunda and Desquilbet, 2008; Vodova, 2011).

6.2.3.2 Size

The size of the institution as measured by the logarithm of total assets was able to significantly explain Zimbabwean commercial banks' liquidity risk during this period. A positive relationship between bank size and liquidity risk implies that banking institutions that had large total assets held more loans, which consequently led to a higher financing gap ratio. This finding is in line with Shen *et al.* (2009), who found a positive effect of size to liquidity risk. The explanation was that large banks had the incentive to increase risk-taking and hold more loans, leading to bank illiquidity. This is in line with the "too big to fail" argument. The findings are also in line with Bunda and Desquilbet (2008) on the bank liquidity smile across exchange rate regimes from emerging countries.

6.2.3.3 Spreads

Spreads were significant explanatory variable of liquidity risk in Zimbabwe during the

2000-2008 period. The negative effect of spreads on liquidity risk highlights the fact that during this period, differences between the lending and deposit rates were high. This is also confirmed with the presentations in Appendix 2. These findings confirm the findings of Kosse (2002) on Ukraine.

6.2.3.4 Non-Performing Loans (NPL)

As expected, a rise in non-performing loans increases the liquidity risk of the bank. A non-performing loan is a loan that is not earning income and full payment of principal and interest is no longer anticipated, or the maturity date has passed and payment in full has not been made. Non-performing loans have a positive influence on liquidity risk as shown by Lucchetta (2007) on the study on European countries banks. Even though this is in line with theory on credit risk management and liquidity risk, non-performing loans were not significant explanatory variables in the Zimbabwean dollar era. The explanation could be that this was a period of high inflation, when banks could afford to do away with non-performing loans.

6.2.3.5 Reserve Requirement Ratio (RRR)

The reserve requirement ratio is where the central bank regulates that each commercial bank sets the minimum reserves it must hold of customer deposits rather than lend out. It is normally in the form of cash stored physically in a bank's vault or deposits made with a central bank. There is a negative relationship between the reserve requirement ratio and liquidity risk. High reserve requirements reduce a bank's illiquidity. This finding was in line with Fielding (2005) on the study of bank liquidity management in Egypt.

6.2.3.6 Inflation (INFL)

From the findings, inflation significantly explained commercial banks' liquidity risk in Zimbabwe. There was a positive relationship between inflation and liquidity risk. This concurs with theoretical information by Damodaran (2004) that inflation has a major impact on liquidity because it erodes the purchasing power of a currency and lowers the real rate of return on investments. The finding is in line with previous research (Bunda

and Desquillet, 2008; Vodova, 2011), which found that inflation negatively impacted on liquidity risk as inflation increased the vulnerability of banks to the nominal values of loans provided to customers.

6.2.3 Regression Results Presentation with Dependent Variable LQ

For robustness test, an alternative dependent variable, Liquid Asset Ratio LQ was used. Panel regression model results are presented in table 6.4. After the Hausman test, the use of random effects was rejected as the best model hence the presentation of the fixed effects model results.

Table 6.4: Regression Results, Fixed Effects (within) Regression (LQ)

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	10204	0.2650	4.55	0.000
CAD	0.2884	0.1609	1.79	0.074
SIZE1	-0.0374	0.0190	-1.79	0.05
SPREADS	-0.0107	0.0094	-1.13	0.258
NPL	-0.15933	0.0784	-2.03	0.043
RRR	0.1039	0.2378	0.44	0.663
INFL	-0.0075	0.121	-0.62	0.5360
Number of observations:	255			
R ²	Within = 0.16	Between = 0.25	Overall = 0.0143	
F(6,234)	= 7.64 Prob>F= 0.0000			

Opposite results are expected as LQ is conversely related to LQR. Results are interpreted

in reverse for bank illiquidity. From the results, it was evident that capital adequacy, size, non-performing loans were significant in explaining bank illiquidity as yielded by the LQ model. The differences were on spreads which had a different sign and not significant. Also reserve requirements and inflation were not significant explanatory variables in this model.

6.3 Liquidity Risk in the Multiple Currency Era

This section presents empirical results on the determinants of Zimbabwean commercial banks in the multiple currency regime. Monthly data was used from March 2009 to October 2011.

6.3.1 Model Diagnostic tests

The diagnostic test results found by the researcher before estimation of the model are provided below.

6.3.1.1 Unit Root Tests

Panel data unit root tests were done. The results are presented in table 6.5.

Table 6.5: Unit Root Tests

VARIABLE	STATISTIC	Z	P-VALUE
LQR	0.7704	-5.6486	0.0000
LQ	0.5391	-15.0696	0.0000
CAD	-0.0868	-19.4191	0.0000
SIZE	-000795	-38.9583	0.0000
SPREADS	0.3740	-21.0367	0.0000
NPL	0.3296	-23.6066	0.0000
RRR	0.7449	-6.6866	0.0000
INFL	0.3301	-23.5867	0.0000

The variables are stationary in levels as confirmed by the p-values. There was no problem of non-stationarity.

6.3.1.2 Multicollinearity

The results of the correlation matrix are presented in table 6.6.

Table 6.6: Correlation Matrix

	LQR	CAD	SIZE	SPREADS	NPL	RRR	INFL
LQR	1.0000						
CAD	-0.0957	1.0000					
SIZE	-0.0440	0.0204	1.0000				
SPREADS	0.2889	0.0743	0.2820	1.0000			
NPL	0.0690	0.0439	0.524	0.155	1.0000		
RRR	-0.3077	-0.1830	-0.3189	-0.6184	0.0323	1.0000	
INFL	0.1440	-0.0027	0.1314	-0.0172	-0.0172	-0.2631	1.0000

The variables GDP and ROA caused multicollinearity problems and were dropped. After this, there was no problem of multicollinearity as shown in table 6.6 above.

6.3.1.3 Model Specification Tests

Before the estimation of the model, the model was tested to see if it was correctly specified. Below are the results of the Ramsey Reset test using powers of the fitted values of the depended variable.

H_0 : model has no omitted variables

$F(3, 458) = 1.96$

Prob > F = 0.1189

The above result shows that the model was correctly specified and the null hypothesis that the model has no omitted variables is accepted.

6.3.1.4 Heteroscedasticity

The Breusch Pagan / Cook-Weisberg test for heteroscedasticity was used to check for the problem of heteroscedasticity. The following are the results:

Ho: Constant variance

Variables: fitted values of liquidity risk

$$\text{chi2}(1) = 0.96$$

$$\text{Prob} > \text{chi2} = 0.3268$$

The null hypothesis is that the error variances are all equal against the alternative that the variances are not constant. The results show that there is no heteroscedasticity. Similarly, as in the first model, it is possible to run the fixed effects model or random effects model.

6.3.1.5 Hausman Test for Fixed or Random Effects Model

The Hausman test was used to make a decision whether to use the fixed effects model or the random effects model. The following results were obtained:

$$\begin{aligned} \text{chi2} (6) &= (b-B)' [V_b - V_B]^{-1} (b-B) \\ &= 6.74 \end{aligned}$$

$$\text{Prob} > \text{chi2} = 0.3460$$

The null hypothesis of the Hausman test is that the two estimation methods are both acceptable and would yield the same coefficients. From the result above, the null hypothesis is accepted since the differences between the coefficients were not big (see Appendix 6). The use of both the fixed effects and random effects model was accepted to estimate the liquidity risk model for Zimbabwean commercial banks in the multiple currency era.

6.3.3 Regression Results Presentation

The following are the fixed effects and random effects results of Zimbabwean commercial banks' liquidity risk when there was use of multiple currency systems. The dependent variable is liquidity risk as measure by the financing gap ratio (LQR).

Table 6.7: Regression Results: Fixed Effects (within) Regression (LQR)

Variable	Coefficient	Std. Error	t-Statistic	P-value
C	1.0599	0.2656	3.99	0.000
CAD	-0.2634	0.0212	-12.43	0.001
SIZE	0.8431	0.3151	2.67	0.037
SPREADS	-0.0047	0.0011	-4.08	0.000
NPL	0.2577	0.0122	21.19	0.000
RRR	-0.3519	0.1750	-2.01	0.045
INFL	-0.0308	0.0098	-3.13	0.075
Number of observations:		480		
R^2	Within = 0.618	Between = 0.61	Overall = 0.5951	
F(6,459) = 124.09		Prob>F= 0.0000		

The results from the random effects model are presented in table 6.8

Table 6.8: Regression Results: Random Effects Regression (LQR)

Variable	Coefficient	Std. Error	Z-Score	P-value
C	1.2769	0.24988	5.11	0.000
CAD	-0.2797	0.0199	-14.03	0.00
SIZE1	0.8943	0.3076	2.91	0.004
SPREADS	-0.0044	0.0011	-3.86	0.000
NPL	0.2618	0.0119	21.9	0.000
RRR	-0.3995	0.1737	-2.30	0.022
INFL	-0.0308	0.0098	-3.14	0.002

Number of observations: 480

R^2 Within = 0.6181 Between = 0.6467 Overall = 0.6150

Wald $\chi^2(6) = 763.80$ Prob> $\chi^2 = 0.0000$

As in the Zimbabwean dollar era, there is a negative relationship between capital adequacy and liquidity risk. Again there is a positive relationship between size and liquidity risk. In the multiple currency era, the size of the bank and liquidity risk management could be explained by the less risky liquid assets banks held, which would positively relate to liquidity risk.

There is a negative significant influence of spreads on liquidity risk, as in the Zimbabwean dollar era. Non-performing loans significantly explain liquidity risk in Zimbabwe commercial banks. There is a positive relationship between non-performing loans and liquidity risk. Non-performing loans portfolio indicates the quality of the total

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

portfolio and that of the bank's lending decisions (Van Grueining and Bratavonic, 2003). Banks in Zimbabwe generally faced liquidity risk problems in the multiple currency regime as a result of non-performing assets in the multiple currency era.

The reserve requirement ratio is significant in explaining liquidity risk in the multiple currency regime. There was a negative relationship between reserve requirements and liquidity risk during this period. Inflation had a negative relationship with liquidity risk and was a significant explanatory variable unlike in the Zimbabwean dollar period.

Alternative Liquidity Risk Measure Results (LQ)

Table 6.9: Regression Results: Fixed Effects and Random Effects Regression (LQ)

Variable	Fixed effects	Random effects
C	-0.3692 (0.3382)	-0.642 (0.3018)
CAD	0.2307*** (0.0269)	0.2523*** (0.2430)
SIZE	-1.3199 (0.4011)***	-1.3349 (0.3846)***
SPREADS	-0.0010 (0.0014)	-0.0013 (0.0014)
NPL	-0.1920*** (0.0154)	-0.1989*** (0.0150)
RRR	0.5889*** (0.2228)	0.6427*** (0.2200)
INFL	0.0637***	0.6418***

		(0.0125)	(0.0125)
No of Observations		480	480
R ²	Within	0.4161	0.4152
	Between	0.6245	0.6494
	Overall	0.4935	0.5045
F(6)=54.51 Prob>F=0.0000		Wald chi2(6)=347.96 Prob>chi2=0000	

The starred coefficients are significant at 1% (*), 5% (**) and 10% (*).**

The results from the alternative dependent variable show that capital adequacy, size, non-performing loans, reserve requirement ratios and inflation behaved exactly the same in explaining bank illiquidity as in the LQR models. The only difference was on spreads which had an opposite influence and not significant in explaining liquidity risk.

6.4 Summary

The estimated liquidity risk models fit the requirement such as the Ramsey reset test for correctly specified equation. There were no problems of non-stationarity. Problems of multicollinearity were dealt with and variables that caused multicollinearity were dropped. The Breusch Pagan / Cook-Weisberg test for heteroscedasticity was used to check for heteroscedasticity. There were no problems of heteroscedasticity. The Hausman test was used to make a decision on whether to use the fixed effects model or the random effects model. For the 2000-2008 liquidity risk models, the differences between some of the coefficients were big, leading to the use of the random effects model being rejected. The fixed effects model was the best model to use in estimating the liquidity risk model in the Zimbabwean dollar period.

There was a negative relationship between capital adequacy and liquidity risk in the Zimbabwean dollar period and in the multiple currency period. The findings imply that banks with a sound capital position have more time and flexibility to deal with problems which aid in liquidity risk management. Besides, well capitalised banks face lower

chances of going bankrupt as a result of the reduced cost of funding or less need for external funding, which increases performance. Banks that are capitally adequate are not prone to liquidity risk. Banks with sufficient capital adequacy should also be liquid.

The size of the institution as measured by the total assets was able to significantly explain Zimbabwean commercial banks' liquidity risk. A positive relationship between bank size and liquidity risk implies that bigger banks increased their risk taking and hold more loans. In the multiple currency era, size negatively influenced liquidity risk as a result of bigger banks holding more or less risky liquid assets.

In the Zimbabwean dollar era, spreads were a significant explanatory variable of liquidity risk though with a negative effect of spreads on liquidity. In the multiple currency period, spreads had a positive relationship with liquidity risk. A rise in non-performing loans increases the liquidity risk of a bank. Despite this, non-performing loans were not a significant explanatory variable in the Zimbabwean dollar era. The explanation could be that this was a period of high inflation, in which banks could afford to do away with non-performing loans. There was a significant positive relationship between non-performing loans and liquidity risk in the multiple currency period.

The reserve requirement ratio negatively influences bank illiquidity in the Zimbabwean dollar period and in the multiple currency period. From the findings, inflation significantly explained commercial banks' liquidity risk in Zimbabwe. There was a positive relationship between inflation and liquidity risk in the Zimbabwean dollar era while inflation was negative in the multiple currency regime. For robustness test of the main findings, a liquid asset ratio was used.

CHAPTER SEVEN

LIQUIDITY RISK MANAGEMENT BY COMMERCIAL BANKS DURING THE ZIMBABWEAN DOLLAR ERA

7.1 Introduction

Chapter six econometrically investigated commercial banks' liquidity risk in Zimbabwe. To complement this, chapter seven presents primary data findings on liquidity risk management by commercial banks in the Zimbabwean dollar era. Primary data was collected through the use of interviews. The main enquiry was to understand how banks managed liquidity risk in the challenging operating environment, mainly hyperinflation. Of importance were the number of years banks had been in business; ownership; liquidity risk responsibilities; products offered; major sources of funds and applications; internal and external liquid instruments to manage liquidity; impact of inflation on liquidity risk management; the effect of the instruments introduced by the RBZ to fight inflation on commercial banks' asset and liability management functions and the survival strategies adopted by the banks.

7.2 Empirical Findings

A survey was done on 15 commercial banks in Zimbabwe that were in operation from 2000 up to the time the research was undertaken. Of these, 12 were locally owned commercial banks and three were internationally owned. Interviews were conducted at all 15 commercial banks primarily with the head of the treasury department and partly with the head of risk management.

7.2.1 Correlation Analysis

The following are summaries of the correlation analysis between two variables. The correlations presented are on the number of years and perceptions on liquidity risk; perceptions on liquidity risk and ownership; ownership and flight of deposits; ownership and considering other banks setting; doing nothing and the reliance on non-core banking

activities. These are then explained in relevant sections on the interpretation of the findings.

Table 7.1: Correlation Analysis between Two Variables

Correlation Between Two Variables	χ^2	P-value
Number of years; perceptions on liquidity position	1.02	0.378
Perceptions on liquidity position; ownership	16.73	0.01
Ownership; flight of deposits	25.14	0.01
Ownership; considering other banks setting	20.02	0.01
Do not do anything; relying on non-core banking activities	18.29	0.01

7.2.2 Years in Business for Commercial Banks

The years in business for commercial banks at the time the survey was conducted are provided in table 7.2.

Table 7.2: Zimbabwe Commercial Banks Years in Business

Bank	Years in Business
Commercial Bank 1	31
Commercial Bank 2	118
Commercial Bank 3	22
Commercial Bank 4	19
Commercial Bank 5	14
Commercial Bank 6	14
Commercial Bank 7	13
Commercial Bank 8	14

Commercial Bank 9	55
Commercial Bank 10	13
Commercial Bank 11	14
Commercial Bank 12	15
Commercial Bank 13	12
Commercial Bank 14	118
Commercial Bank 15	16

The averages of the commercial banks years in business are presented in table 7.3

Table 7.3: Tabulated Zimbabwe Commercial Banks Years in Business

Variable	Observation	Mean	Std Dev	Min	Max
Years in business	15	37.5333	40.2347	12	118

On average the banks had been in business for 38 years, but the period varied from 12 to 118 years.

7.2.3 Liquidity Risk Management and Responsibility

All the respondents stated that liquidity risk was managed daily by the treasury department and monthly by the Asset and Liability Committee. No guidelines on liquidity risk management were issued by the RBZ for the greater part of 2000 to 2008. Despite this, all banks had a liquidity risk management committee at part of their internal organisations during this period. This indicated that all banks had made internal efforts to manage liquidity risk.

7.2.4 Perceptions on Liquidity Position

Based on the survey, all the respondents were satisfied with the liquidity position of the banks from 2000 to 2002. Major problems were cited from 2003 to 2008 when the economic crisis in Zimbabwe deepened. This was mainly attributed to the operating

environment where there were high demands for cash withdrawals for transactions by depositors. Generally there were concerns of liquidity risk problems from the locally owned banks as compared to the internationally owned banks. The differences in the results of locally owned banks and internationally owned banks were real and statistically significant at 1% as shown by $\chi^2 = 16.73 (P < 0.01)$. This means that more respondents from the locally owned banks felt at risk than those from the internationally owned banks. This could be attributed to the flight of deposits that was experienced by the banks that failed to meet money or withdrawal demands. Generally, clients moved away from the locally owned “exposed” banks to the internationally owned, expected “safe havens”. A $\chi^2 = 25.14 (P < 0.01)$ supports that there was statistically significant difference between ownership and flight of deposits at a 5% level of significance.

7.2.5 Liability Management

One of the important issues in liquidity risk management as highlighted in chapters two and four is liability management. In the survey, on liability management, the main concern was to understand the sources of funds for banks in the Zimbabwean dollar era. Enquiry was made about products that were being offered, the behaviour of banks in interest rate setting and how to safeguard unnoticed withdrawals on investments by clients (early redemption of investments).

7.2.5.1 Major Sources of Funding

From the survey, the major sources of funds were deposits from new clients, retention of existing clients, interbank borrowings, shareholders, offshore lines and the lender of last resort facility offered by the RBZ.

7.2.5.2 Products Offered

The products that were being offered in the Zimbabwe dollar era are tabulated below:

Table 7.4: Zimbabwe Commercial Banks' Products

Market	Products
Money Market	Treasury bills, bankers acceptances, Zesa bonds, Grain Marketing Board bills, RBZ financial bills, promissory notes, lendings, commercial paper, certificate of deposit, PTC bonds,
Foreign Exchange Market	Foreign currency
Equity Market	Shares, bonds
Derivatives	Swaps, options, commodity trading, futures, forward contracts etc

From the presentation above, it is evident that there was a wide variety of financial market instruments when the country was using its own currency.

The interviews also sought to understand the strategies that commercial banks took to safeguard early redemption of investments by clients. From the responses, all banks (100%) would charge a penalty for early redemption by clients. The respondents noted that some penalty rates would even cost the clients part of their principal amounts invested, which further discouraged them from doing so.

In the Zimbabwean dollar era, banks would consider the bank position, amount of money being invested, the tenor of investment and the money market position when showing interest rates on investments. Few banks (2, 13.33%) would consider if the client was rolling over the investment. In addition some banks (4, 26.66%) would consider client relationships whilst the rest (11, 73.33%) would not. From the interviews, 80% of the banks were sensitive to what other market players were doing in rate setting. In order to maintain competitive in liability management, these banks would then be cautious of what other banks were giving. Of the respondents, 20% were not considering what other banks were offering. There was significant difference in terms of ownership and considering other banks' rates as shown by the χ^2 statistic of 20.02 ($P < 0.01$). This means that the internationally owned banks only considered their position, the money

market and the Reserve Bank accommodation rates in rate setting. The trend then was that for the risk averse, regardless of the low rates offered by these banks, they would still place their investments with them. Only the risk loving would place their investments with the locally owned banks because of the high rates these banks were offering. The implication confirms the finding that the internationally owned banks were perceived by clients as a “safe haven”.

The survey also sought to establish what banks would do to manage demand for liquidity from depositors. Initially banks relied on cash reserves to fulfill daily liquidity withdrawals, and regularly calculated and analysed patterns of liquidity withdrawals in order to anticipate future demand. But there were periods when the economy was faced with cash shortages, and then the banks relied on daily limits set by the RBZ.

7.2.6 Asset Management

Asset management mainly focuses on the applications of funds by banks. The interviews then sought to establish how banks, after implementing efforts to manage liquidity on the liability side, would carry out managing the asset side. Overall, banks were considering the operating environment and depositors’ behaviour (e.g. liquidity withdrawals for transaction needs). Because of the challenges posed in the Zimbabwean dollar era as explained in chapter one, figure 7.1 reflects on the aggregate balance sheet position of the banks.

Figure 7.1: Composition of the Banks' Balance Sheets

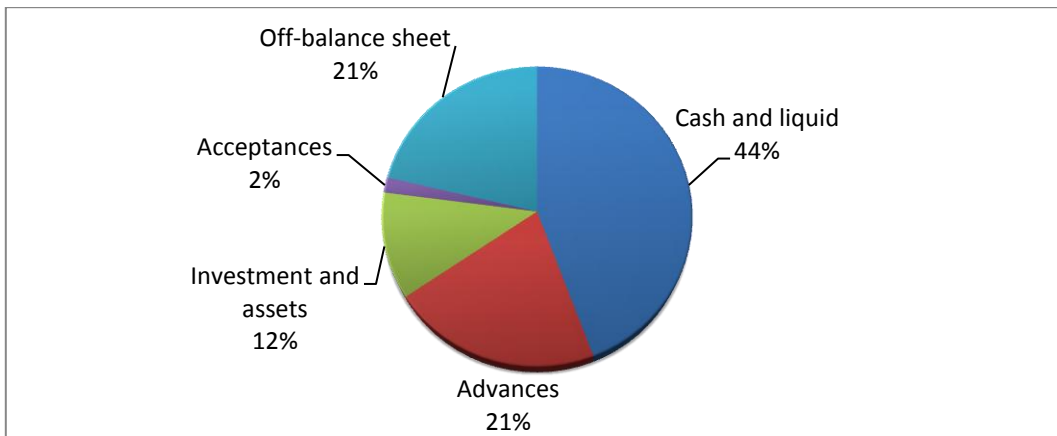
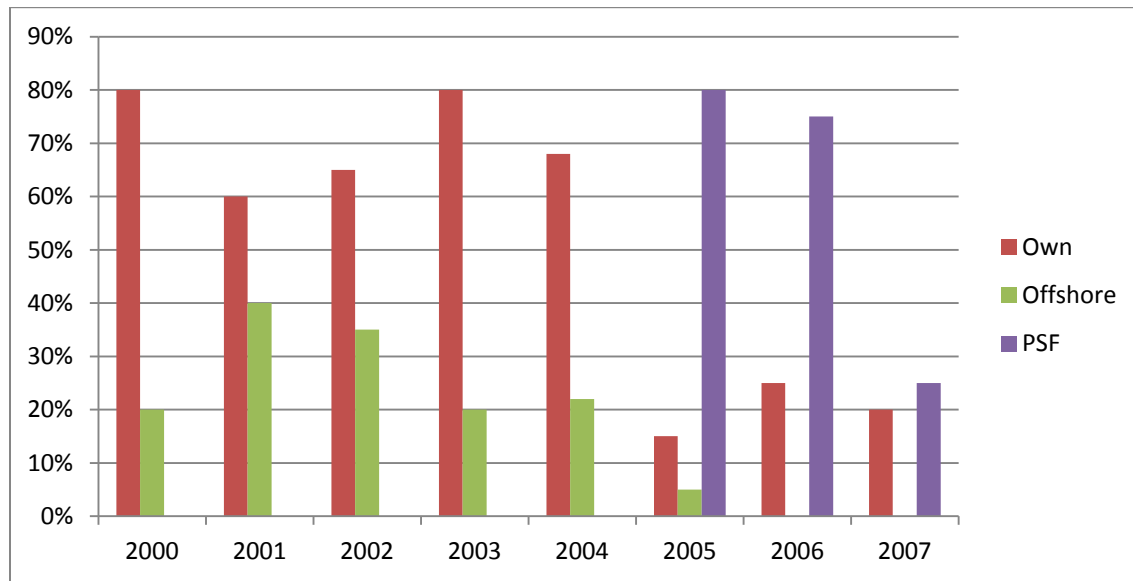


Figure 7.1 above shows the trend where banks were lending less as shown by advances and acceptances. Generally banks held the majority of their assets in cash and liquid as shown above. This was as a result of the challenges posed by the operating environment.

7.2.6.1 Source of Funds for Bank Loans

Lending is a vital activity for commercial banks and a major revenue generating asset as well as a component of the balance sheet under stable conditions. For prudential reasons, banks themselves may utilise their own funds or facilitate concessional lending. Figure 7.2 below presents the major sources of funding for bank loans from 2000-2008.

Figure 7.2: Major Sources of Funding for Bank Loans



From 2000 to 2004, the sources of funds for lending were banks' own and off shore lines of credit. The major source of funds advanced in 2005 and 2006 was the Productive Sector Funds (PSF). From the survey, a small proportion of banks using their own funds made loans to high quality borrowers for short periods not exceeding one year. In 2007, as a result of the significant drop in the state supported facilities only a few banks, which were predominantly government controlled, were involved in significant lending to the agricultural and other sectors of the economy. The operating environment increased the riskiness of long term lending. Banks were not keen to put more of their funds at risk and hence limited their lending with own funds to high quality borrowers for shorter periods of time. In 2008, banks were no longer lending because of the extremely challenging operating environment.

The asset management side also captured Zimbabwean commercial banks' financing strategies and actions to protect funds from default and maximise profit. In the survey of rating of the set questions on lending from most preferable, to preferable, less preferable and not preferable, revealed the following:

Table 7.5: Ratings on Lending Preferences in the Zimbabwean Dollar

Preferences When Lending	Rating
Proposals of high net worth clients financed before	Most preferable
Lend based on financial statements	Most preferable
Lend to clients with account with the bank	Preferable
Lend based on collateral	Preferable
Lend short term	Preferable
Lend for long term	Not preferable
Welcome to new project proposals	Not preferable

Because of the operating environment, banks preferred to lend using their own money on the proposals of high net worth clients and based on financial statements for the corporate clients. Lending to clients of the bank and lending based on collateral were rated as preferable. Bank respondents rated lending on short term during the period as preferable whilst lending for long term and funding new project proposals were not preferable.

7.2.6.2 Banks' Strategies When Clients Defaulted

The following table presents respondents' ratings of remedies when clients defaulted during the Zimbabwean dollar era. The most preferred strategy was loan work-out plans and the least was liquidation of collateral.

Table 7.6: Ratings on Bank Preferences

Preferences When Client Defaulted	Rating
Loan-workout	Most preferable
Foreclosure	Preferable
Liquidate	Less preferable

7.2.7 Asset and Liability Management

The survey also enquired how banks managed assets and liabilities in the Zimbabwean dollar era. The interview asked respondents to rate the priorities of banks on ways to deal

with a deficit position. The findings are summarised in table 7.7.

Table 7.7: Banks Actions When the Bank's Position was Down

Options to deal with a deficit position	Final Result
Pick new funds	1 st priority
Retention of maturing investments	2 nd priority
Redeem investments placed with other banks	3 rd priority
Borrow from the interbank market	4 th priority
Sell securities owned in the secondary market	5 th priority
Use bank capital to cover liquidity needs	6 th priority
Borrow from the RBZ on lender of last resort facility	7 th priority
Request counterparties or depositors to wait for extra days	8 th priority

Banks faced with a due by position would prefer picking new funds from those with excess funds for investment. The next best strategy was to retain maturing investments. The third priority was to redeem investments placed with other banks. The fourth priority was to borrow from the interbank market. The fifth priority was selling securities owned in the secondary market. Banks would borrow from the RBZ if all the above options fail to meet the liquidity needs. The last option was to request counterparties or depositors to wait for extra days. However the last option meant putting the bank at risk of facing bank runs as a result of reputational risk.

7.2.8 Effects of Inflation on Liquidity Risk Management

7.2.8.1 Demand Deposit Tenors

Demand deposits are the core of commercial banks' liabilities in the normal course of business. The tenor of the demand deposits determines the stability or volatility of the core deposit base. The goal of banks is to have a greater proportion of their deposit funding in stable accounts which are predictable and enhance their liquidity risk management. Table 7.8 below presents the responses on the trends of demand deposit

tenor in the Zimbabwean dollar era. Unfortunately on this question, the majority of the respondents could not provide information for 2000 to 2004; hence the reporting on 2005 to 2008.

Table 7.8: Trends in Demand Deposit Tenors

Response	Percentage (2005)	Percentage (2006)	Percentage (2007)	Percentage (2008)
< 14 Days	50 %	60 %	70 %	85 %
>14 < 30 Days	25 %	20 %	20 %	10%
Over 30 Days	25 %	20 %	10 %	5 %

The table above shows an increasing percentage of core demand deposits, exhibiting a trend towards the shorter end of the spectrum to a high of 85 % estimating the tenor to be withdrawn within a fortnight. The respondents indicated that on the retail side of the demand deposit market, the number of active and new accounts had dropped significantly, in line with a shrinking deposit market size. For the accounts that remained active, the consensus was that of a general shortening of tenor as volatility of these accounts increased, although the more elite banking institutions had relatively stable accounts. The main reason cited was the problem of hyperinflation. High inflation eroded customers' disposable incomes; their income failed to keep pace with the loss in purchasing power. The direct result was a significant drop in income which could be saved as most of it was consumed on basic goods and other necessities. Bank accounts were reduced to conduits for people to receive their incomes and banks had to contend with the challenge of being awash with funds during very short periods of time, the bulk of which was withdrawn within a few days.

7.2.8.2 Fixed Term Products

Apart from the demand deposits, commercial banks offered investment accounts which were generally termed “fixed” or “term” deposits, which are customer deposits with a contractual maturity date. These accounts typically earned more interest income for

depositors than the demand and savings accounts. The ability of the yields paid on these accounts to be competitive in offering real returns and availability of alternative investments determined the level of these deposits.

Fixed term deposit products were popular with minimum impact when inflationary pressures subsided following a period of monetary tightening in 2005, when real interest rates were generally maintained during the first half of the year. Comparatively, the firm stance was reversed in the second half of 2007 and early 2008, when the fixed term products became unattractive due to highly negative returns. The respondents from the banks that indicated no impact attributed this to the high quality nature of their clientele, mainly deposits from counterpart financial institutions and high net worth individuals. The few who noted a positive impact attributed this rather unusual trend to customer relations management and superior returns on differentiated term products as possible reasons for their bucking the trend. The high inflation environment resulted in deposit rates paid by banking institutions being largely negative as a result of low investment rates on government securities, which banks were investing in as well as low lending opportunities. Furthermore, rampant parallel activities owing to shortages of basic commodities and foreign currency trading availed quick and very high returns and the bullish stock market had all but attracted the majority of investible funds as economic agents were seeking higher returns for their excess funds. Inflationary pressures on disposable incomes and earnings saw a reduction in available savings. Banks themselves, on the other hand, were reluctant to take more deposits for short periods demanded by investors when their investments were predominantly long term, which exposed them to very high levels of funding mismatches and ultimately liquidity risks.

7.2.8.3 Corporate Sector Deposit Mobilisation

The corporate sector was a major player in the banking industry. The high value nature of the transactions and relationship management initiatives made their funds relatively stable as they were easily rolled over. Though relatively expensive, corporate sector funds allowed banks more flexibility in their fund management and higher utilisation of

deposit products.

From the interviews conducted, inflation had significant negative effects on the banks' deposit mobilisation efforts from the corporate sector. Inflation posed tremendous challenges to both the revenues and costs side of clients' operations and in most cases resulted in shrinking bottom-line growth in real terms. The result were downsizings, closures; relocations by key multinational clients and the small- to medium-sized enterprises did not use formal banking channels; hence a decline in the corporate clientele base. This development led to a reduction in the size of the corporate deposit market and hence increased intensity in competition for little viable business. Corporate clientele deposits' tenor also shortened, with increasing volatility as transactions moved more towards cash business on the back of shrinking investible income and hence funds had a high velocity, with banks increasingly becoming conduits for fund movements. However, for a few banks, the limited capital investments owing to inflation induced high borrowing costs and an unviable exchange rate which constrained export capacity leading to more funds being invested by corporate clients. A general decline in the diversity of investment and deposit products targeted at corporate clients also emerged across the board as most cash rich clients had turned to acquisitions and alternative investment markets to earn real returns.

7.2.8.4 Cost of Funds

The cost of funds to banks is the interest it pays on deposits and other borrowings which is more a matter of supply of and demand for funds in the money market. Generally, retail deposits, especially demand deposits and to some extent savings, are regarded as cheap sources of funds as less interest is paid relative to wholesale funds in the interbank market or from large corporate depositors. Banks seek to minimise their cost of funds. Inflation increased the banks' cost of funds. The increase in the cost of funds was a result of the negative correlation that existed between inflation and disposable income, which resulted in low cost retail deposits shrinking as a percentage of total deposits. The reduction in the number of feasible deposit accounts that banks could profitably offer in

the hyperinflationary environment reduced the ability of the banks to lower their overall cost of funds through combining a diverse set of deposit rates applicable to a wide array of accounts. The increased volatility of retail demand deposits resulted in banks being forced to increasingly rely on the interbank and wholesale deposit markets for funding; sources which were relatively expensive. It was interesting that there were few banks that actually saw the overall cost of funds decreasing due to an increase in retail deposits on their balance sheets in 2006 and 2007, largely as a result of the “flight to quality” that resulted in the deposit flow being largely in favour of the big institutions at the expense of their weaker rivals. Higher deposit rates demanded by corporate clients in view of the high inflation had the effect of adding to the cost of funds.

7.2.8.5 Investment Portfolio

The investment portfolio was affected by hyperinflation, which had an impact on the desire by financial market users of funds, especially the private sector, to raise funds for their investment purposes. High inflation reduced attractive investment opportunities for corporates, which led to low business confidence. Government emerged as the single largest borrower depressed yields, to cushion its interest expense, thus yields which normally move in tandem with benchmark rates failed to move in line with inflation.

High inflation resulted in very low activity in the higher yielding corporate paper market as blue chip clients who were the major issuers had significantly curtailed borrowing in its various forms. The situation resulted in government being the single largest borrower from the local markets, with rates obtained being lower than market rates. This led to a lack of variety in tenor of the government assets, which negatively affected the flexibility of investment tenors to deposits which could be matched by the relevant investment assets. These banks indicated that their margins deteriorated as a result of the predominantly sub-inflationary yields.

7.2.9 Liquidity Risk Management and Reserve Bank of Zimbabwe Policies

The regulatory environment was not favorable to the banking sector especially the tools

of special treasury bills and compulsory non negotiable certificates of deposit issued on surpluses at end of day in their clearing accounts. High statutory reserve ratios were also too taxing on the sector and were responsible for the marked increase in the cost of funds for most players especially among the larger institutions who now command the lion's share of retail deposits.

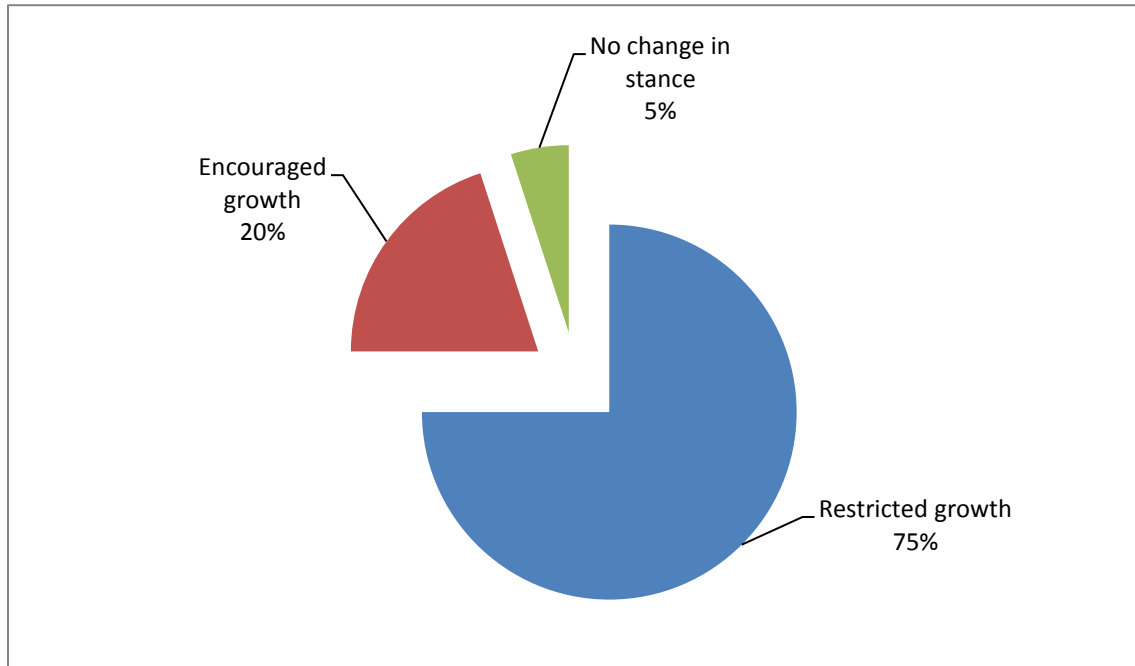
The financial sector stabilisation bonds had a negative impact on bank balance sheets through locking away a significant proportion of bank funds for longer periods of time, a factor contrary to the short term nature of assets investors would want to invest in given the hyperinflationary scenario. The drain of bank resources put them in a vulnerable position in the face of the high possibility of demand for funds which typically called for highly liquid balance sheets. Moreover, the rates offered by this instrument are based on highly unrealistic inflation projections, which they dismissed as desperate measures to subsidise government's huge borrowing needs.

The interest rate policy inconsistency was a factor that made financial planning very difficult due to the sudden policy reversals and lack of continuity in policy from one monetary policy cycle to the next. The reversal that was instituted from then until the end of the review period saw the RBZ maintaining a one-for-one link between accommodation rates and inflation whilst at the same time delinking this relationship for Treasury bill yields' hence the double standards alluded to.

7.2.10 Measures Taken by Banks

When asked what banks did in the face of the challenges posed to them, the respondents identified the following. In response to the challenging operating environment, banks themselves took strategic moves to shape their stance towards the growth of the lending book. Figure 7.3 below shows the measures banks put in place with respect to the growth of their lending book.

Figure 7.3: Bank Measures to the Growth of the Lending Book



The majority of respondents (approximately 75%) took the conservative stance of restricting the growth of the loan book in view of the high interest rate and credit risk, most of which fell outside their risk tolerance limits. Twenty percent of the respondents encouraged growth of the loan book as part of broader strategies to support the real sectors of the economy. Five percent did not change their stance; this was as a result of clients' proposals not meeting the minimum lending criteria.

When asked what stance the banks took when the economic crisis deepened, some respondents reported that the banks did not do anything (26.6 %) whilst (73.4 %) reported that they relied on non-core banking activities. There was a statistically significant difference as shown by the $\chi^2 = 18.29$ ($P < 0.01$). The commercial banks that turned to non-core activities invested in fixed assets (buildings, bricks and cars) to hedge against interest rate risk. Banks also invested on the stock market.

7.3 Potential Liquidity Problems

The potential liquidity problems can be summarised as (i) operating environment (ii) depositors' withdrawal behaviour in terms of transaction motives (iii) short term deposits (iv) hyperinflation (vi) RBZ policies in a bid to arrest inflation.

7.4 Summary

The chapter looked at how commercial banks managed liquidity risk in Zimbabwe during the use of its own currency from 2000-2008 when there were economic challenges. A survey was done on 15 commercial banks that were in full operation during the time period under study. Of the banks, 12 were locally owned and three were internationally owned. For the greater part of the time period, (2000-2006), there were no regulatory guidelines on liquidity risk management. Banks were relying on internal efforts and guidelines.

Based on the survey, there were general concerns regarding liquidity risk on the part of locally owned banks compared to the internationally owned banks. The sources of funds for banks were deposits from new clients, retention of existing clients, interbank borrowing, shareholders, offshore lines of credit and the RBZ's lender of last resort function. The products offered ranged from the money market, to the equity market, foreign exchange market and derivatives market.

In an endeavour to manage liquidity risk, banks would guard against unnoticed withdrawal of investments by clients. Banks achieved this by imposing a penalty on early redemption of investments. In rate setting on sourcing of funds, banks would consider the bank's position, the money market position amounts being invested, tenor, the central bank accommodation rates and the rates trends of other banks. In asset management, banks considered the operating environment and depositors' behaviour. At the onset, banks were lending, but this declined gradually with an increase towards investing in government securities. The various sources of funds for lending varied across the time period. From 2000-2004, the main source was banks' own funds and offshore lines of

credit. From 2005-2007, it was from the productive sector facility of the RBZ. Banks used their own funds to lend to high quality borrowers. No lending activities took place in 2008.

In asset and liability management, when banks were faced with a deficit position, they would adopt various options. In terms of preferences, banks would meet the need by sourcing new funds from clients, retain maturing investments, redeem investments placed with other banks, and borrow from the interbank market. If still in need, banks would sell securities owned in the secondary market, use bank capital or finally, borrow from the RBZ. The last thing banks would do was to ask counterparties owed to, or depositors to wait for extra days.

During the period, inflation had a significant impact on liquidity risk management by banks. From the survey, the tenor of demand deposits was affected, leading to volatility of the core deposits base. Only the elite banking institutions had relatively stable accounts. Hyperinflation eroded customers' disposable incomes which led to reductions in savings. Bank accounts were reduced to being conduits for clients to receive incomes which were withdrawn within few days. High inflation had negative effects on deposit mobilisation efforts by the corporate sector. This was due to the cost side of these clients' operations, which resulted in downsizing, closures and relocations. The result was a reduction in the size of the corporate clients' deposits market. Corporate clients' deposits tenors also shortened with increasing volatility as transactions were mainly cash business.

Hyperinflation increased the banks' cost of funds as a result of low cost retail deposits shrinking as a percentage of total deposits. Inflation had a major impact on the affordability of commercial loans and the tenor of loans. High inflation did not only affect the banks' ability to lend, but also affected loan demand as a result of high interest costs which were not sustainable. The other challenge was the time periods it took for clients to get loan applications approved. Banks in turn took strategic moves to shape their stance towards the growth of the lending book and it was mainly restricted.

The government was the single largest borrower from the local market because of low activity in the corporate paper market. The result was a lack of variety in tenor of government assets which affected the flexibility of investment tenors to deposits which could be matched by the relevant investment assets. The analysis also indicated that the tools used by the central bank to fight inflation had negative impacts on commercial bank liquidity management.

To survive the challenges imposed by the operating environment, banks took various stances. Some invested on the capital markets and turned to non-core banking activities to invest on fixed assets. Others did nothing.

In response to the challenging operating environment as a result of hyperinflation, the government of Zimbabwe completely abandoned the country's currency and adopted the multiple currency system in 2009. The next chapter looks at how commercial banks in Zimbabwe managed liquidity in a multiple currency environment.

CHAPTER EIGHT

LIQUIDITY MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS IN A MULTIPLE CURRENCY REGIME

8.1 Introduction

Zimbabwe experienced macroeconomic challenges with the worst being hyperinflation. In a bid to curb this, the government introduced the multiple currency exchange rate regime in February 2009. Chapter eight presents primary data findings on how Zimbabwean commercial banks managed liquidity risk during the multiple currency regime. A survey conducted using questionnaires looked at the number of years banks had been in business; ownership; liquidity management responsibility; how often liquidity was managed; perceptions on bank liquidity positions; liability management issues; asset management issues; asset and liability management; challenges posed by the multiple currency era; the role played by the RBZ in liquidity management; and benchmark analysis of commercial banks' liquidity risk management and the RBZ liquidity management guidelines. Finally the chapter presents summaries of the potential sources of liquidity problems from the survey and what the banks did in the face of the challenging operating environment.

8.2 Empirical Findings

This section presents findings on Zimbabwe commercial banks liquidity risk management after dollarisation. Responses from the questionnaire are summarised in appendix 9. The findings are presented and discussed in turn in the following sections. These are in line to the questions in the questionnaire in appendix 8.

8.2.1 Summary of Correlation Analysis between Variables

The correlation analyses are provided in table 8.1.

Table 8.1: Correlation Analysis between Two Variables

Correlation Between Two Variables	χ^2	P-value
Ownership of the bank; number of branches	1.5	0.378
Number of branches; liquidity position	5.85	0.210
Liquidity position; ownership	36.21	0.001
Years in business; liquidity position	40.2	0.001
Ownership; management of liquidity	4.88	0.181
Charge of penalty and ownership	2.679	0.605
Ownership; considering rates offered by other banks	38.25	0.001
Following policies and procedures; ownership	35.01	0.001
Adherence to set limits; ownership	17.26	0.001

The correlations between two variables are referred to in various sections of empirical findings.

8.2.2 Years in Business for Commercial Banks

The number of years commercial banks had been in business at the time the survey was done is provided in table 7.2 presented in chapter seven earlier on. On average the banks had been in business for 38 years, but this varied from 12 to 118 years.

8.2.3 Commercial Banks' Branch Networks

From the survey statistics, the banks had an average of 17 branches, although the number of branches varied from one to 60, as shown in the table 8.2.

Table 8.2: Zimbabwe Commercial Banks Branch Networks as of 2011

Bank	Number of Branches
Commerial Bank 1	60
Commerial Bank 2	26
Commerial Bank 3	32
Commerial Bank 4	10
Commerial Bank 5	19
Commerial Bank 6	3
Commerial Bank 7	21
Commerial Bank 8	15
Commerial Bank 9	7
Commerial Bank 10	4
Commerial Bank 11	36
Commerial Bank 12	17
Commerial Bank 13	8
Commerial Bank 14	18
Commerial Bank 15	21

The above table presents the number of years the commercial banks were in business. The minimum number of brances was four with the maximum number of bank branches was 60.

8. 2.4 Liquidity Risk Management and Responsibility

Based on the survey, banks' liquidity was managed daily with the responsibility being allocated to the treasury and risk division for all commercial banks. Liquidity decisions

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

were centralised with the head office for all banks.

8.2.5 Perceptions on Liquidity Risk

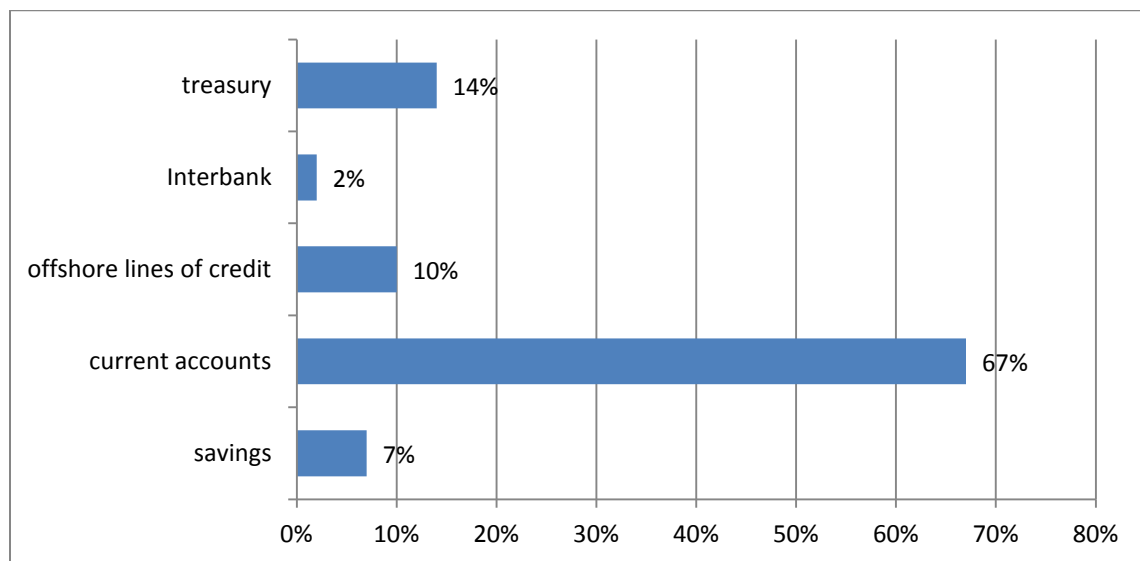
Generally, in the multiple currency regime banks were not satisfied with bank liquidity management. Among the respondents, 73.3% were not satisfied, 6.7% were satisfied and 20% were very satisfied with their liquidity positions. There was a statistically significant difference between ownership and level of satisfaction as shown by the χ^2 statistic of 36.21 ($P < 0.001$). This means that the difference in respondents' level of satisfaction with liquidity position between locally owned banks and internationally owned banks was statistically different from zero at 1% level of significance. The locally owned banks had challenges with liquidity management compared to the respondents from internationally owned banks.

8.2.6 Liability Management

8.2.6.1 Sources of Funding

The multiple currency environment posed challenges to commercial banks' sourcing of funds. Figure 8.1 presents the various sources of funds.

Figure 8.1: Funding Structure of Banks as at 30 June 2011



Banking institutions in Zimbabwe were funded mainly by current accounts which constituted 67% of the total deposit base. Treasury activities constituted 14%, offshore lines of credit 10%, savings deposits 7% and interbank market activities 2% percent. Banks mainly relied on current accounts which were transitory in nature and not much came from the savings accounts, making liquidity risk difficult to manage. From the above presentation, it is evident that there was more reliance on current accounts than the interbank market, capital market or global financial markets. Savings were very low. Banks may need to come up with products and devices that encourage clients to embrace a savings culture.

8.2.6.2 Products Offered

Further to the primary data, secondary data was used to make a comparison between Zimbabwean banks and other banks on product ranges. Table 8.3 below presents a comparison of Zimbabwe banks with world banks.

Table 8.3: Zimbabwe Commercial Banks *versus* Foreign Banks

Product	Zimbabwean Banks	Other Banks
Money Market Products	Bankers' acceptances, promissory notes, lending	Bankers' acceptances, promissory notes, lending, commercial paper, certificate of deposit, bonds, notes
Foreign Currency	Plain vanilla switches	Switches, proprietary trading, client trading, hedging structures etc
Derivatives Market Products	None	Swaps, options, commodity trading, futures, forward contracts, etc
Capital Management	None	Capital modeling and allocation, etc

In the multiple currency exchange rate system, Zimbabwean commercial banks offered a narrow product range to clients unlike in the Zimbabwean dollar era as shown earlier on. The products that were offered were fixed deposits accounts, savings accounts, current

accounts, bankers' acceptances and negotiable certificates of deposits. In the foreign exchange market, banks were only involved in currency switches. Nothing was offered in the capital market and derivatives markets. There is need to offer more tailor made products to depositors. The primary reason for the limited progression in product offering by local treasuries was the unavailability of the products and the challenging operating environment. Lack of skills was also a cause but some proactive banks had already begun to train their employees to be able to develop and trade in a much wider range of products. The limited product range adversely affected clients; for example, some gold mining clients were exploring relationships with South African banks for their hedging needs. Commercial banks' treasuries usually invested in treasury bills to earn a return and still comply with liquid ratios. However in Zimbabwe in the multiple currency regime, no treasury bills were issued. To manage liquidity risk, some commercial banks' treasuries therefore had to hold cash as liquid assets. The problem with this strategy is that of reduced income.

8.2.6.3 Charging of Penalty

During the study period, 80% of the banks charged penalty on early termination of investments. The remaining 20% were not charging penalty as a marketing tool to lure clients to place funds with them. Generally, internationally owned banks largely charge penalties but from the survey, the differences in ownership and charging of penalty rate is statistically insignificant, since $\chi^2=2.69$ (P=0.605), meaning that the difference between locally owned banks and internationally owned banks and charging of penalty was not different from zero.

8.2.6.4 Considerations when setting money market rates

Banks considered amounts being invested and the tenor of investment when setting the rates. Fifty three percent of the banks considered if the client was rolling over and 47% did not consider if the investment was being rolled over. From the survey, 80% of the banks considered what other banks were giving, whilst 20% did not. Noteworthy was the difference between respondents from locally owned banks and internationally owned banks as reflected by the $\chi^2=38.25$ ($P<0.001$) meaning that the difference between ownership and considering other banks rates was different from zero. All banks considered client relationships. Over and above these considerations, banks considered their bank position and the LIBOR rate.

8.2.6.5 Liquidity demand by depositors

To manage liquidity demand from clients, 66.7% of the banks relied on cash reserves as the first choice. Twenty percent would use this as second choice, while 33.3% cited it as the third choice. On the option of communicating with big clients on withdrawal schedules, 26.7% used it as first choice, 26.7% as second choice and 46.7% as third choice. In terms of calculating the withdrawal pattern, 6.7% chose it as first choice, 60% as second choice and 33.3% as third choice. The final ratings are presented in table 8.4.

Table 8.4: Ratings on Managing Liquidity Demand by Clients

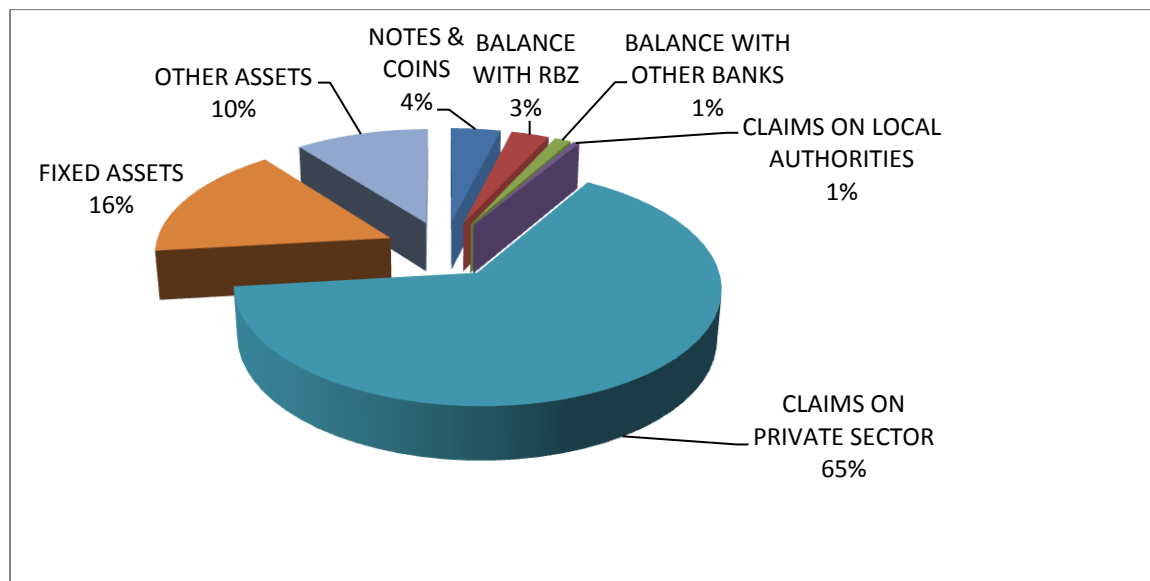
Option	Final Rating
Rely on cash reserve ratio	1 st priority
Calculate pattern of withdrawal	2 nd priority
Communication with big clients on withdrawal schedules	3 rd priority

8.2.7 Asset Management

8.2.7.1 Application of Funds

When banks source funds, there is need for strategic application with consideration of profitability and liquidity. Figure 8.2 presents allocation of assets by commercial banks in Zimbabwe during the multiple currency environment.

Figure 8.2: Allocation of Assets by Zimbabwean Commercial Banks



On average, commercial banks had 65% claims on the private sector, 16% on fixed assets, 4% notes and coins, 3% balances with the RBZ, 1% balances with other banks, and 1% claims on local authorities. From the survey carried out, all banks had bad corporate loans books. Corporate clients were failing to service their loan accounts, ultimately becoming hard-core defaulters. The result was banks lending more to individuals in the form of personal loans which were serviced by salaries on a monthly basis. Other banks stopped lending, especially the internationally owned banks, while locally owned banks were aggressive in their lending activities. Despite this, as a percentage of total assets, claims on the private sector had the greatest share. The small percentage of balances with other banks clearly indicated that there were limited activities in interbank activities. The above presentation illustrates that banks were not very keen to lend to the public sector. As a strategic position banks were lending for short tenures to enable them to deal with and manage credit risk which feeds back to liquidity risk.

8.2.7.2 Lending Activity

Twenty percent of the respondents indicated that banks found it most preferable to lend to

high net worth clients who they had previously financed, 13.3% preferred this option and 66.7% did not concern themselves with this option and lent money based on other factors. Of the respondents, 80% of the banks preferred lending based on financial statements while 20% did not prefer financial statements. All banks would prefer lending when there was security; and 53.4% would most prefer lending to existing bank customers; whilst 33.3% preferred and 13.3% did not prefer this option. The banks that did not prefer bank customers only were the banks that were aggressive in lending and market share driven. All banks preferred to lend for a short time. No banks were keen to lend for a long time given the transitory nature of deposits. The ratings are presented in table 8.5.

Table 8.5: Ratings on Preferences when Lending

Preferences When Lending	Rating
Lend short term	Most preferable
Lend to clients with account with the bank	Most preferable
Lend based on collateral	Preferable
Lend based on financial statements	Preferable
Proposals of high net worth clients	Preferable
Lend for long term	Not preferable

8.2.7.1 Causes of Non-Performing Loans

In the multiple currency regime, one of the major causes of liquidity risk was non-performing loans. The survey revealed various reasons why banks had non-performing loans; these are summarised below:

(i) Poor credit appraisal. Commercial banks that were aggressive in lending acknowledge that they were not thorough in the credit appraisal. A point in case was conducting site visits to confirm what the client would have provided. Banks were relying on the documentation they received from clients.

(ii) Wrong products offered to clients. One of the major findings was that banks were not correctly advising clients on the type of facilities suitable to their circumstances and needs. A point in case would be clients requesting working capital when in reality they

need order finance or offshore funding. The conditions of these products are different; for instance, with offshore funding, it was cited as being cheaper and having a grace period of up to six months to a year, payable after five years.

Furthermore, banks in pursuit of business adjusted the clients' requirements. If a client needed say, \$100 000, they would give half the amount. The loan provided would not be adequate to complete the intended project, leaving the client stuck. It was better not to give than to adjust.

(iii) Lending based on balance sheet strength instead of cash flow based.

(iv) Banks took too much comfort in security when lending.

(v) Information asymmetry as a result of there being no credit bureau in Zimbabwe. Banks cited the problems of clients not disclosing their status. The clients would apply for a loan whilst having a number of bad debts. These would not be reflected on the financial statements. The borrowed money would be used to settle outstanding loans. This would lead to the client failing to repay the loan until it became a non-performing loan. This created serious problems of bad debtors hoping from one bank to another.

(vii) Economic environment. Low levels of aggregate demand. Low disposable incomes.

(viii) Inadequate supervision by the RBZ, leading to gross violation of prudential guidelines. Insider lending and lending to connected parties and prudential lending limits not monitored. Lending to associates, which were companies directly related to the lending banks.

8.2.7.2 Commercial Banks and Options to Deal with Non-Performing Loans

There are various ways in which commercial banks can deal with non-performing loans. Despite this, it was clear from the findings that commercial banks have different preferences when it comes to resolution. Table 8.6 presents the various ways in which Zimbabwean commercial banks dealt with non-performing loans.

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

Table 8.6: Ratings on Preferences when Clients Defaulted

Preferences When Client Defaulted	Rating
Loan-workout	Most preferable
Foreclosure	Preferable
Liquidate	Less preferable

8.2.8 Asset and Liability Management

The ratings of what banks would do when the bank position was down are shown in table 8.7.

Table 8.7: Banks Actions when the Bank's Position was Down

Options to deal with a deficit position	Final Result
New investments	1 st priority
Retention of maturing investments	2 nd priority
Redeem investments placed with other banks	3 rd priority
Borrow from the interbank market	4 th priority
Borrow from the holding company	5 th priority
Use bank capital to cover liquidity needs	6 th priority
Request counterparties or depositors to wait for extra days	7 th priority

The most preferred source of finance was funds from new clients. The reason could be the cost of these funds that are cheap. Similarly retaining these clients thus become favourable. The third preferred strategy was commercial banks redeeming their investments placed with other institutions. Banks could also borrow from interbank market. But these funds are more expensive as compared to other sources of funds. It was not very ideal to borrow from the holding company maybe because this would signal serious liquidity problems of a particular bank. The last thing banks would do was to ask of counterparties or depositors to wait for extra days. This could be a sign of illiquidity and also would negatively impact on the reputation of the bank leading to loss of public confidants.

8.2.9 Challenges Posed by the Multiple Currency Exchange Rate System

(i) Transitory nature of deposits

There were increases in deposits for all commercial banks from March 2009 to June 2011. The respondents cited this as the cumulative benefits of the multiple currency regime and the growth in confidence from the clients' perspectives. Regardless of this positive trend, banks cited the transitory nature of deposits as the major challenge in asset and liability management. The survey established that more funds remained in the informal sector, with estimations approximating \$2.5 billion.

(ii) Capital inadequacy

Banks need to be capitally adequate. Capital is the cushion that protects banks and their customers and shareholders against losses resulting from the assumption of risk. Adequate capital supports future growth, fosters public confidence in the bank's condition, provides the capacity under the bank's legal lending limit to serve customers' needs, and protects the bank from unexpected losses. Figure 8.3 shows commercial banks' capitalisation in Zimbabwe as of June 2011.

Figure 8.3: Banking Sector Capitalisation as at June 2011

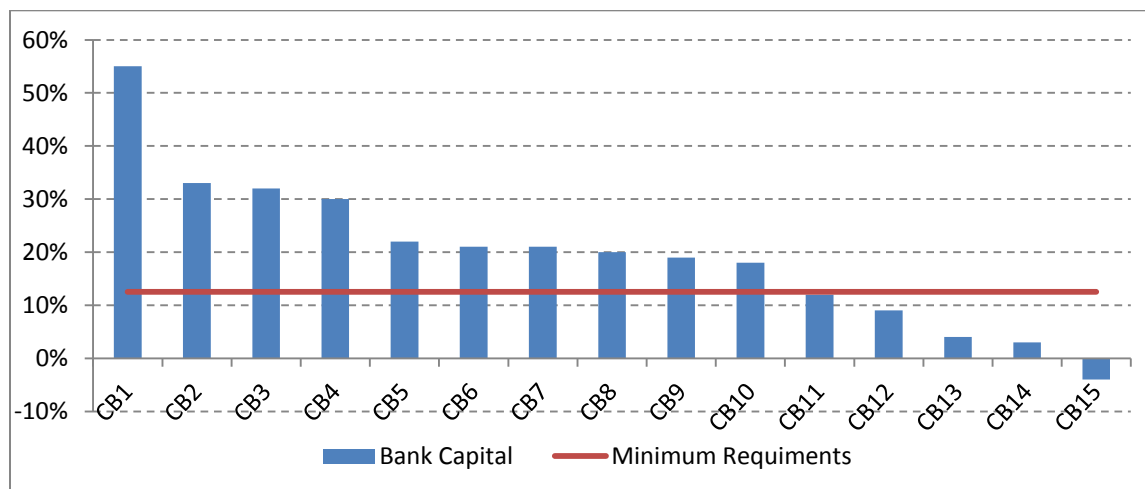


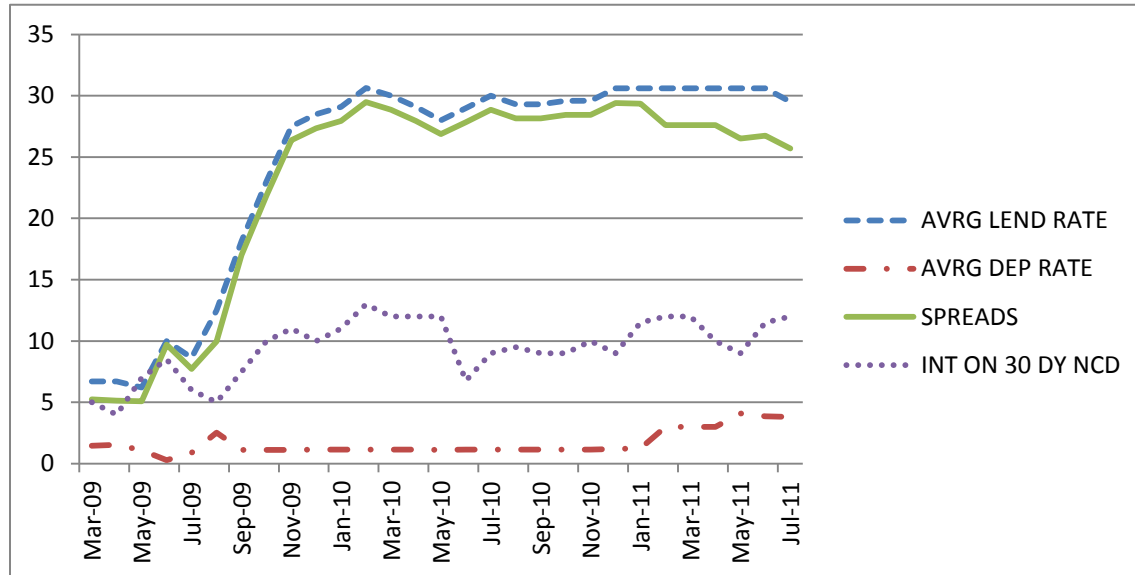
Figure 8.3 shows that some banking institutions in Zimbabwe were struggling to raise the minimum capital requirements required to cushion perceived shocks in the economy,

which include liquidity. As at June 2011, four banking institutions were undercapitalized which defeated the primary objective of capital adequacy requirements, which is to limit risk-taking by banking institutions. Given that banking business is fraught with uncertainties, the banking institutions that were not adequately capitalised could not protect small and uniformed depositors. Significantly this was one of the important reasons why there was still no confidence by public depositors, killing the savings culture and making liquidity management a problem.

(iii) High disparities in the rates of return

Again respondents picked on the disparities between the depositors' rates and lending rates. As a way of preventing massive withdrawal demands, banks may consider revising the rates of return on depositors' funds. The reason why account holders would not keep their money in the banking sector is the low rates of return. This is indicated by figure 8.4 which presents trends in various interest rates.

Figure 8.4: Various Interest Rates in Zimbabwe's Commercial Banks



Source: Reserve Bank of Zimbabwe, 2011

Commercial banks borrow at low prices and lend at high prices. The differences between

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

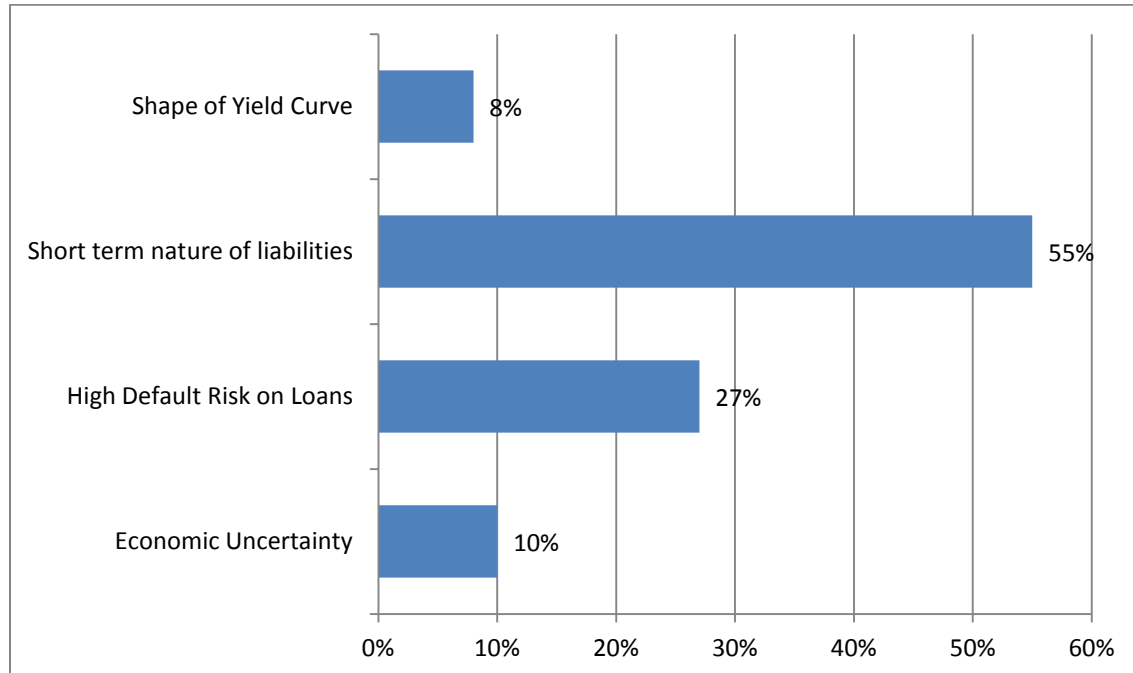
these prices are what constitute the banks' gross profit. There were wide spreads between lending rates and deposit interest rates in Zimbabwe during the multiple currency era. The banks were benefiting at the cost of the depositors, considering the low levels of inflation as a result of the multiple currency system. Ideally, lending rates should be linked to inflation in a manner that results in positive real rates as well as taking into consideration the risk premium of the borrowing clients. Banks managed to maintain the high lending rates because the RBZ was pursuing moral suasion and not controlling interest rates in the economy.

Some of the factors were limited money market instruments; limited offshore lines of credit; non-performing loans and no lender of last resort as already explained.

8.2.10 Reasons Banks Invested on the Short End of the Market

During the multiple currency era, banks generally invested on the short end of the market. The presentation below shows the reasons why banks adopted this strategic measure.

Figure 8.5: Reasons Banks Invested on the Short End of the Market



The above figure shows the reasons why banks invested on the short end of the market. Respondents cited increasing default risks in lending activities, and therefore the need to extend short-term credit. The increasingly short-term nature of deposit liabilities caused substantial maturity gaps on the short end, therefore requiring that banks invest more funds in short-dated assets in order to reduce the asset-liability mismatches.

However, the 15% of the respondents who expressed neutrality argued that the participation of banks on the short end was not always out of choice. Respondents cited the stacked shape of the yield curve as tantamount to absence of the risk free instruments. Lack of alternative assets on the market was also cited as limiting the choices available to banks, as banks were highly limited to fixed income securities and working capital finance.

8.2.11 Reserve Bank of Zimbabwe and Liquidity Risk Management

The RBZ sets the capital and statutory reserves thresholds. Over the multiple currency period, statutory and liquidity ratios were changed by the RBZ as detailed in table 8.8 below:

Table 8.8: Zimbabwe Statutory Reserve Ratios and Liquidity Ratios

	Zimbabwe Statutory Reserves	Zimbabwe Liquidity Ratio	International Statutory Reserves
Feb 2009 – Dec 2009	10%	10%	Risk and Asset based
Jan 2010- June 2010	5%	10%	Risk and Asset based
July 2010- Dec 2010	0%	20%	Risk and Asset based
Jan 2011- June 2011	0%	25%	Risk and Asset based

Source: Reserve Bank of Zimbabwe, 2011

The statutory reserves ratio shows the percentage of deposits that are kept at the central bank. The ratio was pegged at 10% in 2009 and reduced to 5% from January to June 2010. From July to December 2010 statutory reserves kept at the central bank were scrapped to 0% as a result of the liquidity challenges the banks were facing. Statutory reserves remained at 0% from January to June 2011. The lowering and scrapping off of statutory reserves meant that the banks had more funds directly available for use to settle withdrawals. The prudential liquidity ratio was pegged at 10% in 2009, increased to 20% in 2010 and further increased to 25% in 2011. This was as a result of the challenges of liquidity that were posed by the new regime which meant that banks as a regulatory activity were meant to increase their holding in liquid assets to avoid liquidity risk.

8.2.12 Zimbabwe Commercial Banks' Liquidity Risk Management versus RBZ Risk Management Guidelines

A benchmark analysis was conducted on how commercial banks were managing liquidity risk with respect to the RBZ liquidity risk management guidelines. Liquidity management in Zimbabwe was guided by the Risk Management Guideline (BSD-04 2007) issued by the RBZ in 2007. The Guideline was formulated to strengthen liquidity risk management of commercial banks and safeguard the safe and sound operation of commercial banks in accordance with the Zimbabwean Banking Act 24: 20 and Banking Regulations. The whole process of liquidity risk management that includes identification, measurement, monitoring and control of liquidity risks is detailed in the published guideline and this research study considers them sufficient even in the multiple currency regime. All commercial banks were required to follow the principle of prudence and fully recognise, effectively measure, constantly monitor and properly control liquidity risks of the whole bank, and various products, business lines, business links and multilevel organisations, to ensure that commercial banks had sufficient funds to cope with asset increases and the payment of matured debts, whether under normal business conditions or under stress.

8.2.12.1 Board and Senior Management Oversight

Commercial banks were required to put an effective governance structure of liquidity risk management in place. The survey revealed that all the banks had board and senior management oversight in place which was in line with the RBZ liquidity risk guidelines and also in line with international banking standards. The Board of Directors and senior management, special committees and relevant banking departments are responsible for the management of liquidity risk and formulate a proper assessment and accountability mechanism so as to improve the effectiveness of liquidity risk management.

8.2.12.2 Policies and Procedures

Based on the survey, all banks had liquidity risk management policy and procedure manuals. According to the RBZ liquidity risk guidelines, banks are supposed to have comprehensive policy and procedure manuals which covered various aspects of liquidity and funds management in detail. Commercial banks would measure and determine their own liquidity risk tolerance in the light of the bank's business strategy, business characteristics and risk appetite, and formulated management strategy, policy and procedures of liquidity risk. Risk tolerance would be expressed in quantitative terms, such as the unmitigated liquidity risk level that the banks could bear under normal conditions and stress.

The strategy, policy and procedures of liquidity risk management covered various on-and off-balance-sheet business of the bank, business agencies, branches and affiliates that may exert a significant effect on its liquidity risk both home and abroad, including liquidity risk management in normal conditions and under stress. Organisational structure, main business line, breadth and diversity of product and market, the regulatory requirements of home and host country, were taken into consideration when formulating commercial banks' liquidity risk management strategy. In terms of documentation, the research revealed that this was comprehensive. The main flaw was that the majority (80%) of the banks was not adhering to the set policies and procedures, which exposed them to liquidity risk. Only 20% indicated that they were strictly following the policies

and procedures. There was a statistically significant difference in ownership and adherence to policies and procedures as shown by the $\chi^2=35.01$ ($P<0.001$), thus underscoring that a larger proportion of locally owned banks were not adhering, while respondents from internationally owned banks were strict in their adherence.

8.2.12.3 Liquidity Risk Limits

The research revealed that all commercial banks had set liquidity risk limits in accordance with regulatory requirements and internal liquidity risk management policy, and determined corresponding monitoring frequency in accordance with the nature of limits. The limits were designed to take into consideration the asset-liability structure, the business development situation, asset quality, financing strategy, management experience and market liquidity.

Eighty percent of the banking institutions had established internal static liquidity benchmarks to manage exposure to liquidity risk. Table 8.9 reflects typical liquidity benchmarks that were being used by 80% of the banking institutions in Zimbabwe. These benchmarks acted as early warning signals or triggers for any liquidity crisis.

Table 8.9: Liquidity Benchmarks

Benchmark	Limit
Depositor Concentration Ratio per customer	2.5%
Medium Term Mismatch	25%
Total Undrawn Commitments	25%
Liquidity Ratio	30%
Unmatched Treasury Deposits to Treasury Assets	25%

Bank Position against Market Position	10%
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Despite the fact that these were in place, at one point or another, 73.3% of the commercial banking institutions were violating the set liquidity benchmarks whilst 26.7% of the respondents were not. Violation of set limits contributes to banks' experiencing problems in liquidity risk management. There was a statistically significant difference in ownership and violation of set limits as shown by the $\chi^2=17.26$ ($P<0.001$). Internationally owned banks were strict in following limits, whilst locally owned banks violated the set limits.

8.2.12.4 Internal Controls

According to the RBZ guidelines, commercial banks were required to formulate proper internal control systems to ensure the integrity and effectiveness of liquidity risk management procedures. Commercial banks were expected to incorporate liquidity risk management into the scope of internal audit, and review and evaluate the sufficiency and effectiveness of liquidity risk management on a regular basis. All banks had documented internal control systems and internal audit departments. This was in line with the RBZ liquidity risk guidelines.

8.2.12.5 Stress Testing of Liquidity Positions

All commercial banking institutions were required to regularly conduct stress tests as part of their liquidity risk management. This was in order to help them assess their capability to withstand stress incidents and to consider and prevent future possible liquidity crises, so as to promote their ability to perform repayment responsibilities under the circumstances of liquidity stress. The survey revealed that 40% of the banks were regularly undertaking stress tests whilst 60% were not undertaking regular stress tests on their liquidity positions to assess whether they would be able to withstand stressed conditions. The banks only prepared profiles of their cash-flows under normal business

conditions. The research study viewed this as inadequate with the implication that banks would not be able to plan for crises and may be unable to withstand stressed conditions should they occur.

8.2.12.6 Contingency Liquidity Plan

All banking institutions had comprehensive Liquidity Contingency Plans in place which outlined trigger points or conditions required to activate the plan, key contact personnel and their contact details, action points in the event of a crisis or an impending crisis, procedures for making out cash flows shortfalls in crisis situations and sources of funds and the priority in which these funds would be accessed. In most institutions surveyed, the contingency plans only covered a name specific crisis but did not specify steps to be taken in the event of a market-wide crisis. Again, no player had created a fictitious crisis to try and test if their plans would work.

8.2.12.7 Management Information Systems

Most commercial banks in Zimbabwe made use of the Deal Manager system for treasury functions which was not interfaced with the core banking system, and consequently liquidity risk management reports were being produced manually. This seriously undermined the timely production of reports and also exposed the banks to high operational risk through human errors, leading to liquidity risk.

8.2.13 Banks' Actions in the Face of Increasing Challenges

Banks adopted some strategies in the face of increasing challenges. Some banks stopped lending and relied on income from bank charges. Some restricted lending to only high net worth clients. In general, banks were lending for very short terms in response to the transitory nature of deposits. Generally, banks were not keen to lend to corporate clients because of the high default rate. This saw a move to banks preferring to lend to individuals and insuring the loans with third parties in case of default.

8.3 Potential Sources of Liquidity Risk

In the multiple currency regime, sources of liquidity risk emanated from depositors, borrowers, banks' behaviour and the RBZ. Banks themselves had high margins and aggressive lending, especially on the part of locally owned banks, worsened the problem of liquidity risk. Sources of liquidity risk include:

- (i) the transitory nature of deposits
- (ii) lack of public confidence
- (iii) low rates of return on deposits and investments
- (iv) limited capital markets
- (vi) non-performing loans
- (vii) limited access to off-shore lines of credit
- (viii) limited role of the lender of last resort function
- (ix) not adhering to policy and procedures
- (x) violating risk limits
- (xi) not conducting stress tests
- (xii) not testing contingency plans

8.4 Summary

At the onset of the multiple currency regime, liquidity ratios for banks were high, but and the loan to depositors ratio was low. The trend indicated that initially, banks were not keen to lend. By the end of 2009, the trend changed with banks' loan to depositors' ratio high and low liquidity ratios. As at June 2011 13.3% of the banks had liquidity ratios of below 20% against a benchmark of 25% by the RBZ and international best banking practices.

In the multiple currency regime commercial bank liquidity was managed daily. The responsibility for liquidity management lay with the banks' treasury and risk divisions. All banks centralised liquidity management decisions at their head offices. The survey revealed that respondents from locally owned banks were not satisfied with the liquidity

positions of their banks whilst respondents from the internationally owned banks were satisfied.

Banks had major problems in sourcing funds in the dollarised environment. Banks were mainly funded by current accounts. Little came from treasury activities, savings accounts, interbank activities and offshore lines of credit. The findings reveal that commercial banks in Zimbabwe during this period offered a narrow range of products as compared to the Zimbabwean dollar era or to other world banks. Of great concern was that there no treasury bills were issued, which forced banks to have cash as liquid assets at the cost of income.

To avoid unnoticed demand by the few who had invested with the banks, the majority of the banks were charging penalty rates on early redemption of investments. A few banks were not charging any penalty as a marketing strategy to lure new clients. In setting the rates on the few investments, banks would consider the amount of money, the tenor, whether the client was rolling over, client relationships, what banks were doing and the LIBOR rate. In managing liquidity demand from clients, banks made use of the cash reserve ratio, and calculated the withdrawal pattern of the clients. Some banks would liaise with their big clients on withdrawal schedules.

On asset management, banks were limited in their applications of funds. The asset allocations included notes and coins, balance with the RBZ, balances with other banks, claims on local authorities, claims on the private sector and fixed assets. The majority of the banks were very active in lending. Generally, banks preferred to lend for short periods to their clients, based on security, based on financial statements. The few banks which were market share driven, preferred to lend to high net worth clients only. Problems of non-performing loans were cited during the study period. The findings reveal some of the cited causes of non-performing loans. The causes ranged from poor credit appraisal, to wrong products offered to clients, lending based on balance sheet strength and not cash

flow based, banks taking too much comfort in security, information asymmetry due to the absence of a credit bureau, the economic environment and inadequate supervision by the RBZ. To deal with problem loans, banks had the option to produce loan workout plans, foreclosure or liquidation.

When banks were in a deficit position, there were few options to deal with this. Banks relied on new investments, retention of maturing investments, borrowing from the interbank market, redeeming investments placed with other banks, borrowing from the holding company or using the bank's capital to cover liquidity needs. There was no lender of last resort function by the RBZ. To complement various efforts to access funds, some banks accessed offshore lines of credit whilst some banks failed because of the conditions set by the foreign lenders.

The challenges that were posed by the multiple currency regime were cited to be the transitory nature of deposits, limited money market instruments, capital inadequacy, limited access to offshore lines of credit, and no lender of last resort function.

A benchmark analysis of commercial banks' liquidity risk management in relation to the RBZ guidelines to ascertain the sufficiency of liquidity management during the multiple currency era included the methods of identification, measurement, monitoring and control of liquidity risk. The survey revealed that all banks had board and senior management oversight in place. All banks had comprehensive policy and procedure manuals, but some banks were not adhering to these. Commercial banks in Zimbabwe had set liquidity risk limits in accordance with the supervisory guidelines. These were meant to act as warning signals or triggers for any liquidity crisis. The survey established that banks violated the set liquidity benchmarks in one way or another. Commercial banks were required to formulate proper internal control systems to ensure the integrity and effectiveness of liquidity risk management procedures. These were deemed to be satisfactory for all commercial banks.

As part of liquidity management, banks were required to conduct stress tests. The majority of banks were not performing stress tests to assess whether they would be able to withstand stressed conditions. This was not in line with the regulatory requirements and international best practice. All banks used the funding gap analysis to manage daily liquidity in compliance with the RBZ guidelines. Commercial banks had negative cumulative liquidity gaps as a result of the nature of the banks' sources of funds. The survey also revealed that all banks had comprehensive liquidity contingency plans in place. These were intended to identify the sources of funds during crisis situations. These contingency plans only outlined a specifically named crisis and not market wide crisis. No banks were testing if their contingency plans would work. Management information systems were in place in accordance with regulatory requirements. Most banks used the dealer manager system for the treasury function which was not interfaced to the core banking system, leading to manual production of reports and banks being exposed to operational risk and ultimately, liquidity risk. In conclusion, liquidity management during the multiple currency regime was complex and it called for the banks, the private sector, the central bank and the government to work together to avoid yet another banking crisis in the near future. The next chapter provides a summary, conclusions and recommendations on how commercial banks could manage liquidity risk given challenging operating environments.

CHAPTER NINE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

9.1 Introduction

This chapter provides a summary of the research, conclusions and recommendations. This study has revealed potential areas for future research on liquidity risk management, especially if the operating environment in Zimbabwe remains challenging.

9.2 Research Summary

While there is a paucity of analysis of liquidity risk, liquidity and liquidity risk is one of the key ingredients in the safety of a bank. Accordingly, this thesis examined how commercial banks in Zimbabwe managed liquidity risk during the Zimbabwean dollar and multiple currency eras. Of importance were the 2000-2008 periods and 2009-2011 periods. This was prompted by financial market and regulatory developments from 2000-2011 that led to an increase in many banks' overall exposure to liquidity risk. The main objective was to identify the key determinants of liquidity risk and to provide an assessment of the adequacy of liquidity risk management techniques consistent with economic fundamentals.

The study began with literature review on liquidity risk issues. Liquidity risk is defined as the risk that the firm will not be able to efficiently meet both expected and unexpected current and future cash flows without this impacting on the financial condition of the firm. Although liquidity risk dynamics vary according to a bank's funding market and balance sheet, the most common signs of illiquidity include rising funding costs, rating downgrade, decrease in credit lines and reductions in the availability of long-term funds. There are four main theories of bank liquidity management: the commercial loans theory, shiftability theory, anticipated income theory and the liquidity management theory. The literature review on liquidity risk issues revealed various causes of liquidity risk that are categorised as external and internal causes. Again, liquidity risk is linked to various types of risk which include operational risk, market risk, credit risk, reputational risk and risk

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

of concentration. It is evident that supervisors and bankers understand how a bank's exposure to other risks may affect bank liquidity. There are various ways in which banks can manage liquidity mismatches; these include utilisation of new deposits, maturing assets, interbank borrowings and borrowing from the central bank.

Chapter two elaborates on international banking standards. The Bank for International Settlements recommends liquidity risk management processes. These processes comprise the liquidity management policies of the Board of Directors and senior management, policies and procedures, internal controls, effective information systems and contingency plans.

Regardless of the size and complexity of the bank, a well managed bank must be able to identify, measure, monitor and control liquidity risk in a timely and comprehensive manner. In this regard, the literature reviewed in chapter three centered on liquidity risk measures and determinants. Bank illiquidity can be measured in several ways. A particular focus was the traditional use of various balance sheet ratios. Of late, research has revealed the inadequacies of these measures and the need for alternative ways of measuring liquidity risk. These include financing gap ratios, financing requirements methods and liquidity index methods. Various studies have revealed that liquidity risk determinants can be categorised as bank specific (capital adequacy ratio, return on assets, size of the bank, share of non-performing loans); supervisory (reserve requirement ratios, support by the central bank) and macroeconomic (gross domestic product, inflation and interest rates).

The literature on inflation and liquidity management was also reviewed since this posed the major challenge the country faced. High inflation leads to negative real interest rates, which discourages saving and lending; and thus banks' management of assets and liabilities.

The research methodology for this study consisted of quantitative and qualitative analysis. In particular, explanatory and survey research designs were used. This

methodological approach yielded the benefits of combined research approaches to the study.

Econometric investigations were presented in chapter six. The Zimbabwean dollar and the multiple currency periods were investigated separately. Two dependent variables were used for robustness checks. The results from the econometric analysis suggest that in the Zimbabwean dollar era, liquidity risk was explained by capital adequacy ratio, size of the bank, differences in deposit and lending rates, reserve requirement ratios and inflation. Non-performing loans were not significant. In the multiple currency environment, the estimated model finds that liquidity risk was explained by capital adequacy, size, differences between deposits and lending rates and non-performing loans, reserve requirement ratio and inflation.

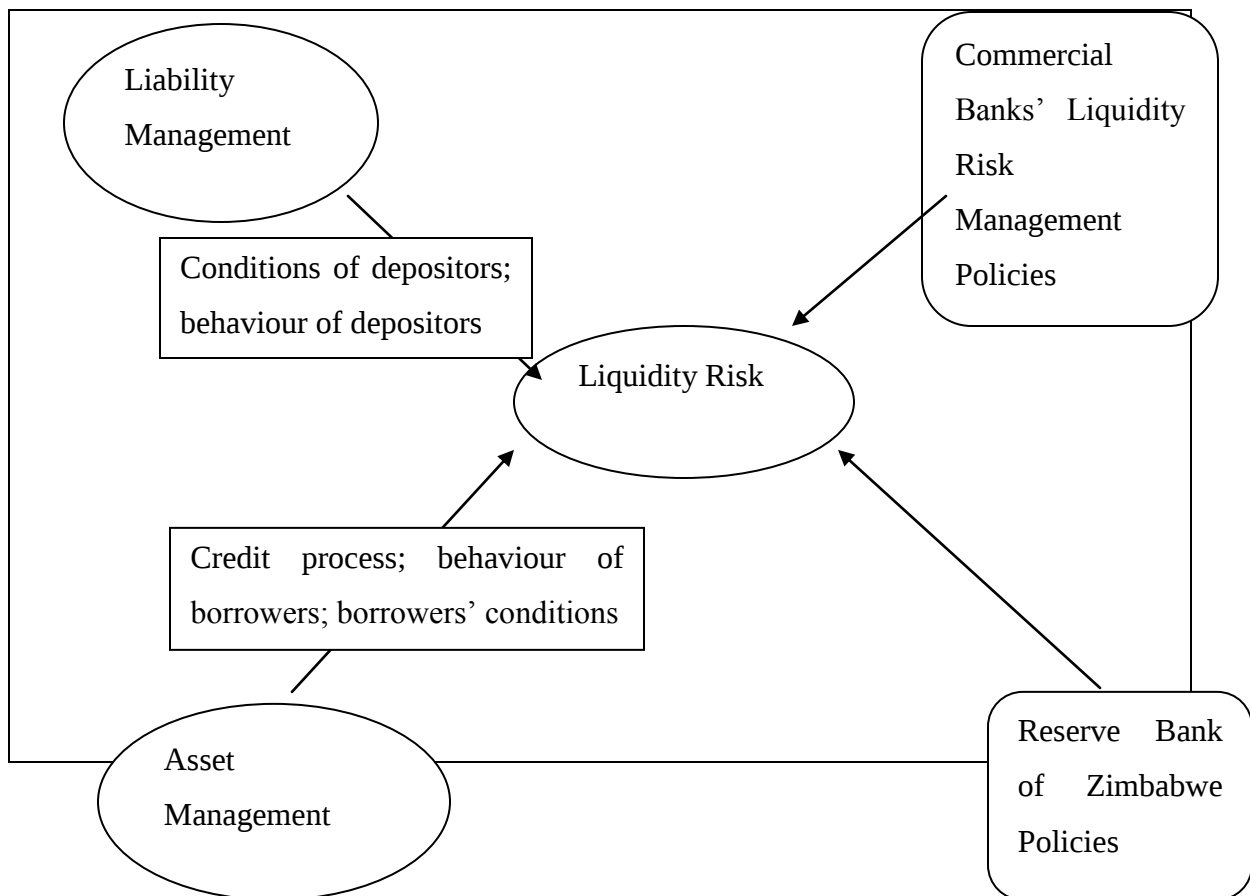
The survey results on liquidity risk management in the Zimbabwean dollar era were presented in chapter seven. During the greater part of the studied period, no regulatory framework by the central bank was in place to guide liquidity risk management in Zimbabwe. Banks relied on internal efforts. General concerns regarding illiquidity were expressed by respondents from locally owned banks as compared to internationally owned banks. The result was the flight of deposits from locally owned banks to internationally owned banks, which were perceived as safe havens. During this period, banks offered diverse products that included money market, capital market, foreign exchange market and derivatives market products. There were active interbank activities and the lender of last resort, the Reserve Bank of Zimbabwe. Asset and liability management became an issue as a result of hyperinflation and RBZ policies aimed at arresting inflation. Inflation had negative effects on the tenor of deposits, cost of funds and deposit mobilisation from individuals and corporate clients.

The survey results on liquidity risk in the multiple currency regime reveal that liquidity risk management was very complex. Banks were struggling to meet the minimum capital requirements, which negatively affected public confidence. There were limited money

market instruments, limited investment products, limited interbank activities, and limited access to offshore lines of credit, volatile and transitory deposits. In addition there was no lender of last resort function by the central bank. Regarding liquidity risk management policies, a benchmark analysis reveals that banks had board and senior management oversight, policies and procedures, risk limits, information systems and contingency plans in place. This was in line with the RBZ guidelines. The survey revealed specific problems, with some banks not adhering to set policies and procedures, some banks violating risk limits, and some banks not conducting stress tests regularly. Furthermore, none of the banks had tested their contingency plans.

9.2.1 Output of Empirical Research Chapters

Figure 9.1: Summary of Thesis Output



9.3 Conclusions

Based on the theoretical models and application of panel data techniques, the research has provided empirical evidence that in the Zimbabwean dollar era, liquidity risk was determined by capital adequacy, the size of the bank, spreads, reserve requirement ratio and inflation. In the multiple currency, liquidity risk was explained by capital adequacy, size of the bank, spreads, non-performing loans and inflation. Results suggest that there is need for commercial banks and regulators in Zimbabwe to consider banks capitalisation, the size of the banks, spreads reserve requirements and inflation in management of liquidity risk. There is need for improved credit risk analysis in the multiple currency environment if banks are to have good financial assets given the problem of non-performing loans.

From the survey results, a comparison of the Zimbabwean Dollar and the Multiple Currency Regime shows the following:

- (i) In the Zimbabwean dollar era when there was high inflation, there were problems of a shrinking in the deposit market and volatility of deposits. In the multiple currency regime, there were major problems concerning the transitory nature of deposits. In both instances only generally internationally owned banks had stable accounts.
- (ii) There were problems of low disposable income as a result of inflation in the Zimbabwean dollar era. In the multiple currency regime, there were low disposable incomes as a result of the dollarised regime which brought about liquidity challenges in the economy.
- (iii) There were various money market instruments in the Zimbabwean dollar era unlike in the multiple currency era
- (iv) The capital market was active in the Zimbabwean dollar era, whilst it was not active in the multiple currency regime.

(v) In the Zimbabwean dollar era, there were problems of negative rate of return due to high inflation and in the multiple currency regime, there were problems of high lending rates and low deposit rates by the banks.

(vi) The corporate sector was a major role player with high value and stable funds in the Zimbabwean dollar era. This was not so in the multiple currency era, the corporate sector was struggling with capacity utilisation and recapitalising.

(vii) In the Zimbabwean dollar era, the cost of funds was high due to high inflation whilst in the multiple currency regime, the cost of funds was low as a result of low inflation.

(viii) In the 2000-2008, all banks took a restrictive growth stance when faced with high levels of inflation. In the multiple currency era, there were clear distinctions in terms of ownership, with internationally owned banks being passive on lending and locally owned banks aggressive on lending. Banks that were lending aggressively had problems of non-performing loans.

(ix) There was a lender of last resort function by the central bank in the Zimbabwean dollar whilst in the multiple currency regime, the lender of last resort function was lost.

(x) To manage and survive, many banks turned to non-core banking activities in the Zimbabwean dollar era, whilst in the multiple currency regime, some banks turned instead to non-funded income which saw bank charges increasing.

(xi) In the Zimbabwean dollar era, the regulatory environment was very strict lead to high levels of mismatches and funding gaps. There were high accommodation rates; statutory reserves and financial sector stabilisation bonds which were bids to arrest inflation making liquidity risk management a major challenge. In the multiple currency regime, the regulatory environment was not exacting with regulators adopting a relaxed stance on capital adequacy ratios, reserve requirement ratios, interest rate policies and prudential guidelines. The RBZ only used moral suasion on interest rates which saw banks experiencing huge margins between the lending and deposit rates.

(xi) In both eras, there was no savings culture in Zimbabwe.

9.4 Recommendations

In making recommendations, the following questions need to be asked: What were the main determinants of liquidity risk in the Zimbabwean dollar and in the multiple currency environments? How were Zimbabwean commercial banks managing liquidity risk in the Zimbabwean dollar era? How were Zimbabwean commercial banks managing liquidity in the multiple currency era? How efficient were the liquidity risk policies used by banks as compared to the RBZ? What additional measures could be incorporated by the RBZ and commercial banks in evaluating and assessing liquidity risk? What other survival strategies could be adopted by banks to cope with liquidity risk management in challenging operating environments?

9.4.1 General Recommendations

- The Reserve Bank of Zimbabwe may not need to be too strict or too relaxed but to be moderate in ensuring an enabling regulatory environment that would facilitate banks managing liquidity risk and at the same time protecting deposits in any challenging operating environment.
- The Reserve Bank of Zimbabwe might consider tightening capital adequacy requirements which will render banking unattractive to unsound agents.
- There is the need to always have central bank guidelines in line with the international best banking practices.
- After the crafting of liquidity risk guidelines by the Reserve Bank of Zimbabwe in 2007, research findings show that commercial banks had comprehensive policies, procedures and risk limits in place. Despite this, banks in Zimbabwe were exposed to liquidity risk because of their failure to adhere to these policies and procedures and violating risk limits. This calls for the Reserve Bank supervision department to device ways that ensures adherence to all set guidelines by commercial banks.

- Banks in Zimbabwe should be obliged to do stress testing so that they are prepared for any adverse occurrence.
- Despite the fact that all the banks have contingency liquidity plans, there is need for them to periodically create a fictitious crisis and test the set plans.
- The results of this research suggest the need for increased emphasis on liability management, which involves managing a bank's deposits and other borrowings in order to meet the bank's funding needs and avoid an over-reliance on a few funding sources.
- Bank treasurers might consider maintaining a well-managed positive gap over the interest rate cycle and develop switching strategies that will enable them to dispose of their earning assets at optimal prices to boost liquidity. The positive gap would enable the banks to benefit from rising short-term rates.
- Locally owned banks should seriously consider technical partnerships with regional or international banks. This would facilitate their access to external sources of funding.
- Development of retail strategies: To be able to survive in a competitive environment in which all banks are aggressively mobilising deposits, the smaller banks with relatively weaker balance sheets might develop strategies that enable them to tap into market segments which are too small for the larger banks to enter into. It is also important that banks promote a culture of financial innovation; the constant introduction of new products that satisfy customer needs and which enable banks to stay afloat and be able to compete with other banking institutions. Increased financial innovation will result in increased efficiency, which would attract individuals who were not previously banking their money.

9.4.2 Recommendations on Non-performing Loans

In the multiple currency environment, one of the major causes of liquidity risk from both econometric and survey results is non-performing loans. It is in line of this that we recommend the following in dealing with problem loans in Zimbabwe.

- There is need for proper credit appraisal and monitoring by commercial banks. Credit analysts should be trained in credit intelligence and equipped with adequate skills in loan management
- In terms of accounting standards all companies are treated as small- to- medium sized enterprises. In this regard, in credit risk management, banks may consider adopting the same when lending. In Zimbabwe, commercial banks were found to be relying mainly on financial statements analysis when extending loan facilities. These have been predicted by clients and the banks systems have been overtaken. Given this scenario, it may be necessary for banks to perform judgmental lending and treat each facility request differently. The bank would need to know the nature of the business of the client and identify key drivers or key performance indicators of the business and check on the state of the company's plant and raw materials. The banks may request the client's debtors' book and references from their suppliers. Account turnovers may then be linked to the receipt book of monthly business. A judgmental approach would look at all the important behavioural aspects and lenders would lend based on the calculated weighted average risk.
- There is need to consider the operating environment when lending. The strong banks in Zimbabwe were the ones that considered the operating environment and did not lend aggressively. The internationally owned banks had very good loan books. This was achieved by the values driven credit culture the banks adopted.
- Banks should only lend when it safe: It is better not to lend when the result is default by the client.
- There is need for the urgent setting up of a Credit Bureau that would help in the dissemination of information.
- Commercial banks in Zimbabwe may consider adopting the Bai (meaning "buy and sell") mechanism from Islamic banking. Here banks would purchase goods and services on behalf of clients and sell to them to them. Conventional banking believes in funding the

customers directly which would be difficult to monitor after the funds have been disbursed.

9.4.3 Recommendations on the Liquidity Risk Framework

- The Reserve Bank of Zimbabwe banking supervision should avoid overreliance on ratio analysis to measure liquidity. While ratio analysis may convey a glimpse of the institution's current funding position, regulators need to look behind the numbers and understand the bank's overall funding strategy. Over-reliance on the liquidity ratio to evaluate a bank's liquidity should be avoided. At a minimum, the following qualitative and quantitative factors should be evaluated in assessing liquidity and commercial bank funding practices particularly in a challenging operating environment.

(i) Qualitative Factors

The qualitative factors would look at the diversified sources of funding that together provide the bank's needs under a variety of conditions; a well-devised liquidity and funds management policy that covers both routine and emergency needs; established limits governing the types and amounts of liquid assets to hold, and limits regarding types and amounts of non-core funding. Finally qualitative factors may include defined responsibilities for monitoring, measuring, and management reporting of liquidity risk matters.

(ii) Quantitative Factors:

There is need to undertake somewhat if analysis for all banking institutions and those found to be violating the liquidity indicators will be advised to increase their holdings of liquid assets. Examiners need to continually assess banking institutions' liquidity risk and give institutions with meaningful reliance on non-core funding sources an appropriate level of supervisory attention. In assessing the volatility of funding sources, some long standing views regarding the volatility of non-core funding versus core funding should be re-evaluated.

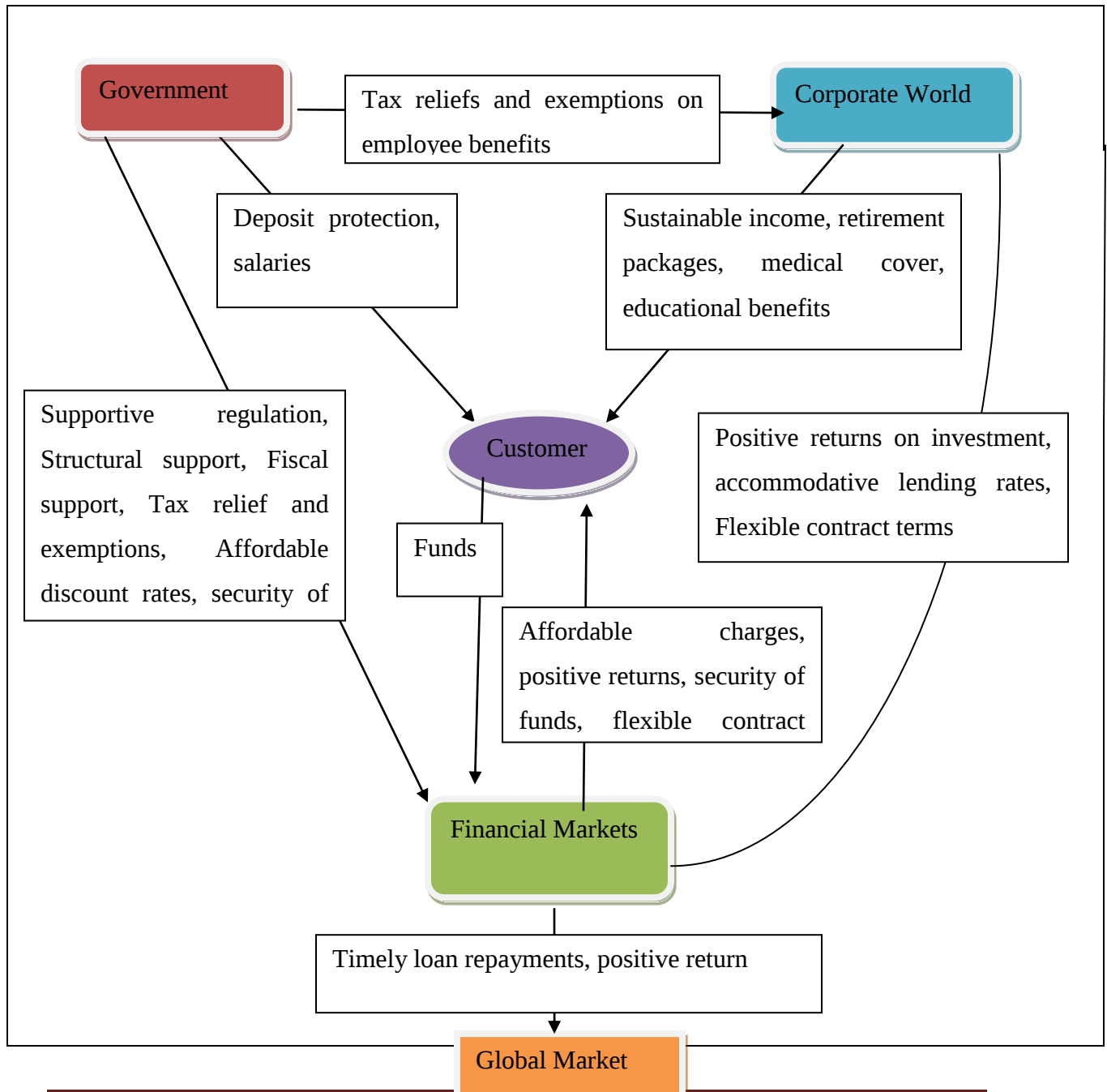
- Having a liquidity crisis management framework: All banking institutions should be required to put in place a comprehensive liquidity crisis management framework that

should be endorsed by supervisors. This will facilitate dealing with illiquidity in a manner that is less disruptive and can help make any future crisis less painful. The framework should clearly take into consideration the complexity of the process, establish which level of authority will make decisions, to provide for the delegation of responsibility once the broad principles have been determined at the political level.

9.4.4 Recommendations on Promoting a Savings Culture

In both eras, banks became conduits for clients to receive incomes which would be withdrawn instantly. This made liquidity risk management complex and pointed to the need to devise ways of promoting a saving culture.

Figure 9.2: Savings Culture Model



Promoting a culture of saving in Zimbabwe, calls for the government and the corporate and financial sectors to work together. The role of public and private companies in the non-financial sector in savings mobilisation could be to engage in corporate social responsibility programmes in order to make the lives of local residents easier. Such programmes would help to reduce the cost of living of households by, for example, sponsored medical aid, food aid, educational benefits and housing programmes. Again, every employer might give employees bonuses and a share of the profits when company profits are growing. Such incentives contribute to uplifting standards of living and encourage employees to save a portion of their income. Employment creation and offering job contracts that may be permanent or temporary also have an impact on savings. Most individuals' ability to save emanates from the nature of the job contract. Those who are contracted on a short-term basis would find themselves saving more as a precautionary measure to prepare for the time when they are unemployed. Therefore, if firms offered short-term contracts, this would promote a culture of saving. However, a permanent solution is required to deal with unemployment, that is, opening new industries and increasing production.

The government needs to improve its reputation and stability through enabling regulatory and supervisory practices. Strong consumer protection should be also a major concern of the government alongside the financial institutions in ensuring a friendly savings environment. Further to this, the government should come up with legislative measures such as the Deposit Protection Bill and create a financial services authority to regulate the financial sector. If this is fully implemented it would strengthen corporate governance and possibly lead to improved confidence in the financial sector.

The banks could promote a culture of saving by offering affordable charges, positive returns and security of funds to their customers.

9.5 Limitation of the Study

Liquidity information by its nature is highly “confidential” and this resulted in limited

disclosure of some data. There was a lack of critical and objective information as bank personnel were not permitted to divulge certain information to the public in order to protect bank credibility and maintain a competitive advantage over their counterparts. To counteract this, supplementary information from secondary data sources (Global Credit Rating; RBZ bank reports; RBZ monetary policy statements; MOF budget statements; IMF global reports company bulletins and banking sector surveys) were used to enhance the accuracy and relevance of the study. Zimbabwe is one of the very few developing countries that have operated in hyperinflationary environment, completely abandoning its own currency and adopting a multiple currency regime. There is not much literature from a developing nation point of view. Real comparative analysis with other countries' experiences became a challenge. Short sample sizes were used partly as the result of the different exchange rate regimes as well as lack of data. This could not allow panel co-integrated panel estimation where both short run and long run dynamics could be studied.

9.6 Suggestions for Future Research

It might be useful to examine the Zimbabwean economy after full dollarisation, when the monetary policy stance was not determined by the RBZ. It would be interesting to know if the results would be affected as lending rates were determined exogenously. The research partly covers a very distressed time in the banking sector in Zimbabwe and the world. There might be a need to investigate how this impacts or not does impact the results. If more data become available, researchers could undertake a co-integration panel estimation where both short-run and long-run dynamics could be studied. It may also be necessary to use the General Moments Method to capture a liquidity risk dynamic model where lagged variables of the dependent variables are also included as explanatory variables.

The sources of funds are critical in banks asset and liability management. It will take a lot of effort to attract deposits back into the system in Zimbabwe after many people lost their savings in the banks due to hyperinflation. It would be important to gain insight into on savings behaviour by individuals in Zimbabwe. The use of micro-economic tools has

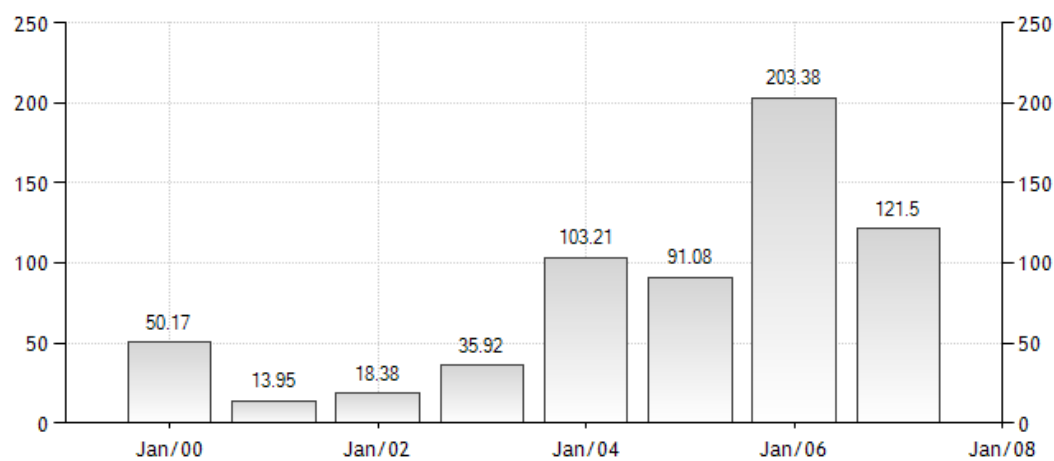
remained rudimentary. Micro-economic analyses are therefore the way forward in future research on commercial banks' liquidity risk management and liabilities management. A micro-econometric approach which takes account of individual heterogeneity might be adopted. A logit model could be used with the selected individual characteristics inputted in the savings predictors being income, gender, educational level, age, age squared, marital status and loan facility. This would help to understand which variables authorities and banks may need to target in order to promote a culture of saving. Secondly, such a study might investigate, using a sample of depositors, what determines the number of times an individual deposits money in the bank by use of the Poisson regression model. This would assist in the formulation of a savings prediction model to be able to identify targeted customers based on their individual characteristics and help banks to manage liquidity risk from the depositors' side.

APPENDIX 1: REGIONAL COMPARATIVES

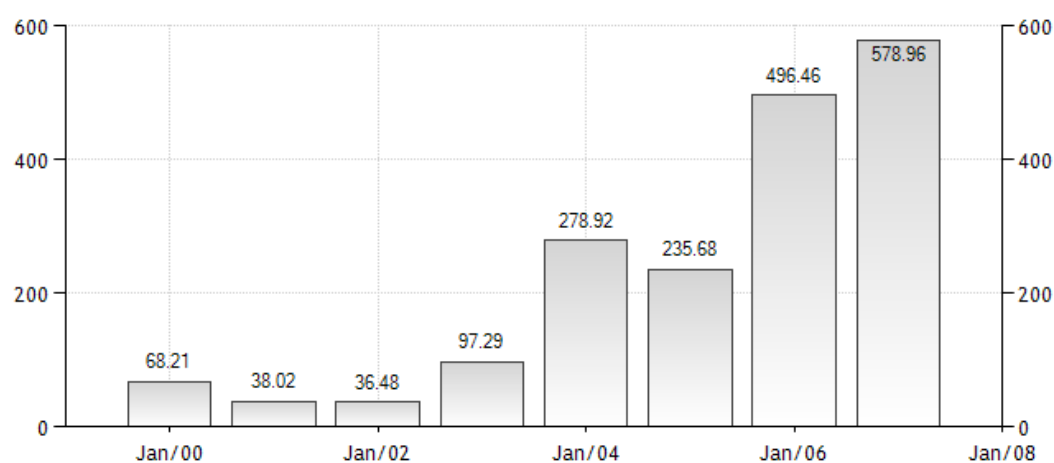
Ratio	Botswana	Ghana	Kenya	Nigeria	Uganda	Zimbabwe
Cost to income ratio	42%	68%	58%	61%	51%	88.93%
Loans /Deposit ratio	50%	67%	75%	72%	64%	81.03%
NIR/Total income	32%	40%	39%	36%	37%	36.72%
NI Margin	6%	12%	11%	7%	12%	5.69%
Impairments Ratio						0.56%

APPENDIX 2: DEPOSIT AND LENDING RATES IN ZIMBABWE 2000-2008

Deposit Rates 2000-2008



Lending Rates 2000-2008



APPENDIX 3: ZIMBABWEAN DOLLAR PERIOD DATA

bank	YEAR	LQR	LQ	CAD	SIZE	SPREADS	NPL	RRR	INFL	SIZE1
1	1	0.3	0.7	0.122	2.90E+06	0.3	0.08	0.1	101	14.88594
1	2	0.6001	0.3999	0.1865	3.30E+06	0.5	0.2	0.1	145	15.01798
1	3	0.6231	0.3769	0.1632	3.60E+06	0.4	0.2	0.1	210	15.10849
1	4	0.6463	0.3537	0.1025	4.20E+06	0.2223	0.2	0.15	233	15.24483
1	5	1.2004	0.002	0.0188	9.70E+06	0.1605	0.4183	0.2	560	16.08792
1	6	1.0972	0.0009	0.047	8.40E+06	0.2006	0.3038	0.2	741	15.94458
1	7	0.9677	0.0323	0.036	1.00E+07	0.1663	0.3074	0.2	1952	16.14433
1	8	0.9368	0.0632	0.07	1.10E+07	0.1654	0.2914	0.4	2650	16.16828
1	9	0.452	0.548	0.17	9.20E+06	0.1255	0.2084	0.4	16486	16.03873
1	10	0.4019	0.5981	0.15	1.40E+07	0.0793	0.1559	0.3	315254	16.47952
1	11	0.3705	0.6295	0.16	2.20E+07	0.093	0.1483	0.3	4.60E+06	16.92703
1	12	0.5816	0.4184	0.2301	3.80E+07	0.0651	0.1385	0.4	1.80E+07	17.45539
1	13	0.6786	0.3214	0.1667	1.50E+08	0.1249	0.19	0.4	2.90E+07	18.79498
1	14	0.7962	0.2038	0.3327	2.40E+08	0.113	0.1078	0.5	3.80E+07	19.28538
1	15	0.96	0.04	0.5113	2.90E+08	0.099	0.1547	0.5	4.60E+07	19.47606
1	16	1.4291	0.0001	0.4	5.20E+08	0.1016	0.4917	0.5	1.80E+07	20.06069
1	17	0.96	0.04	0.25	2.90E+08	0.099	0.1547	0.6	2.30E+08	19.47606
2	1	0.4067	0.5933	0.1	3.00E+07	0.0793	0.1672	0.1	101	17.20931
2	2	0.3859	0.6141	0.06	3.50E+07	0.0923	0.1964	0.1	145	17.35772
2	3	0.3813	0.6187	0.06	4.20E+07	0.1238	0.2238	0.1	210	17.55711
2	4	0.5374	0.4626	0.1351	4.50E+07	0.1286	0.2172	0.15	233	17.62368
2	5	0.5192	0.4808	0.1394	5.30E+07	0.1109	0.1493	0.2	560	17.79379

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2	6	0.4338	0.5662	0.1308	5.80E+07	0.1311	0.1391	0.2	741	17.86807
2	7	0.3605	0.6395	0.1435	6.50E+07	0.1064	0.113	0.2	1952	17.99166
2	8	0.6139	0.3861	0.1569	8.90E+07	0.0958	0.1059	0.4	2650	18.3045
2	9	0.561	0.439	0.1705	1.20E+08	0.0307	0.0436	0.4	16486	18.62341
2	10	0.5543	0.4457	0.1412	2.00E+08	0.0191	0.013	0.3	315254	19.10549
2	11	0.4477	0.5523	0.1317	2.50E+08	0.014	0.0072	0.3	4.60E+06	19.35003
2	12	0.3629	0.6371	0.1411	5.00E+08	0.0104	0.0094	0.4	1.80E+07	20.02027
2	13	0.5299	0.4701	0.134	7.50E+08	0.0137	0.001	0.4	2.90E+07	20.43161
2	14	0.2323	0.7677	0.2211	1.60E+09	0.0173	0.1991	0.5	3.80E+07	21.18931
2	15	0.4885	0.5115	0.2824	2.20E+09	0.0827	0.2424	0.5	4.60E+07	21.514
2	16	0.6572	0.3428	0.3319	2.40E+09	0.1507	0.2828	0.5	1.80E+07	21.58834
2	17	0.6103	0.3897	0.3625	3.10E+09	0.1595	0.2919	0.6	2.30E+08	21.84581
3	1	0.3914	0.6086	0.2198	4.00E+06	0.1386	0.3834	0.1	101	15.19379
3	2	0.4449	0.5551	0.15	5.90E+06	0.1095	0.2592	0.1	145	15.58645
3	3	0.1851	0.8149	0.2	7.90E+06	0.0925	0.26	0.1	210	15.88654
3	4	0.1762	0.8238	0.2	8.60E+06	0.0899	0.3884	0.15	233	15.96567
3	5	0.126	0.874	0.012	1.20E+07	0.1278	0.4856	0.2	560	16.32227
3	6	0.3873	0.6127	0.1908	2.20E+07	0.0754	0.2944	0.2	741	16.90381
3	7	0.5002	0.4998	0.1673	2.80E+07	0.07	0.5928	0.2	1952	17.13787
3	8	0.4146	0.5854	0.1516	4.40E+07	0.054	0.124	0.4	2650	17.59886
3	9	0.4401	0.5599	0.1123	6.30E+07	0.0483	0.093	0.4	16486	17.96483
3	10	0.4269	0.5731	0.1077	8.40E+07	0.0253	0.0643	0.3	315254	18.25223
3	11	0.357	0.643	0.1441	1.20E+08	0.0281	0.0759	0.3	4.60E+06	18.58406
3	12	0.5984	0.4016	0.0972	2.00E+08	0.036	0.0894	0.4	1.80E+07	19.10299
3	13	0.01	0.821	0.2063	3.00E+08	0.0822	0.4196	0.4	2.90E+07	19.51475
3	14	0.0049	0.82	0.3264	3.30E+08	0.141	0.4311	0.5	3.80E+07	19.6296

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

3	15	0.0056	0.8	0.3836	4.70E+08	0.2134	0.4292	0.5	4.60E+07	19.97801
3	16	0.4051	0.5949	0.3409	5.20E+08	0.2931	0.6567	0.5	1.80E+07	20.07657
3	17	0.6651	0.3349	0.4126	6.50E+08	0.3746	0.7108	0.6	2.30E+08	20.29935
4	1	0.4587	0.5413	0.2109	1.30E+07	0.1645	0.4	0.1	101	16.34248
4	2	0.6252	0.3748	0.2612	1.30E+07	0.1608	0.6811	0.1	145	16.39176
4	3	0.2897	0.7103	0.129	2.10E+07	0.1034	0.5629	0.1	210	16.86647
4	4	0.1503	0.8497	0.1161	2.70E+07	0.1062	0.2	0.15	233	17.11143
4	5	0.4865	0.5135	0.1344	3.00E+07	0.1245	0.2	0.2	560	17.22747
4	6	0.6367	0.3633	0.1513	3.40E+07	0.0602	0.6075	0.2	741	17.33747
4	7	0.9214	0.0786	0.1789	4.90E+07	0.0557	0.4303	0.2	1952	17.69899
4	8	0.5967	0.4033	0.1243	6.80E+07	0.0367	0.2	0.4	2650	18.03078
4	9	1.0558	0.05	0.1625	8.20E+07	0.0372	0.8255	0.4	16486	18.22346
4	10	0.7998	0.2002	0.1356	8.70E+07	0.0039	0.8637	0.3	315254	18.28205
4	11	0.8809	0.1191	0.1896	1.30E+08	0.1627	0.8013	0.3	4.60E+06	18.67873
4	12	0.7409	0.2591	0.2099	2.30E+08	0.0812	0.2342	0.4	1.80E+07	19.24226
4	13	0.9051	0.0949	0.1547	2.90E+08	0.0528	0.1994	0.4	2.90E+07	19.48374
4	14	1.3039	0.001	0.1275	2.60E+08	0.069	0.0645	0.5	3.80E+07	19.37383
4	15	0.7934	0.2066	0.0983	5.10E+08	0.0704	0.1832	0.5	4.60E+07	20.04851
4	16	0.4592	0.5408	0.1032	6.40E+08	0.0972	0.2047	0.5	1.80E+07	20.27344
4	17	0.1832	0.8168	0.12	1.10E+09	0.101	0.1861	0.6	2.30E+08	20.85249
5	1	0.5928	0.4072	0.1667	1.30E+07	0.0797	0.6239	0.1	101	16.36239
5	2	0.6267	0.3733	0.1987	1.70E+07	0.0695	0.5252	0.1	145	16.66139
5	3	0.5452	0.4548	0.1981	1.40E+07	0.0581	0.4001	0.1	210	16.48832
5	4	0.6455	0.3545	0.1682	1.90E+07	0.0593	0.3828	0.15	233	16.76738
5	5	0.4964	0.5036	0.1488	1.50E+07	0.0506	0.4448	0.2	560	16.52466
5	6	0.4101	0.5899	0.1259	1.70E+07	0.0402	0.1042	0.2	741	16.66575

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

5	7	0.3459	0.6541	0.1249	1.90E+07	0.0274	0.0575	0.2	1952	16.74832
5	8	0.3855	0.6145	0.1424	2.80E+07	0.017	0.0196	0.4	2650	17.14219
5	9	0.3851	0.6149	0.1277	3.50E+07	0.0222	0.162	0.4	16486	17.37158
5	10	0.5672	0.4328	0.1304	6.70E+07	0.0212	0.1557	0.3	315254	18.01502
5	11	0.5823	0.4177	0.1883	8.70E+07	0.0175	0.0052	0.3	4.60E+06	18.28034
5	12	0.6421	0.3579	0.1469	1.70E+08	0.0297	0.2627	0.4	1.80E+07	18.96898
5	13	0.3314	0.6686	0.2169	2.20E+08	0.0442	0.4	0.4	2.90E+07	19.21247
5	14	0.9841	0.0159	0.3238	9.80E+08	0.0622	0.4	0.5	3.80E+07	20.70606
5	15	0.8891	0.1109	0.668	1.40E+09	0.1965	0.0814	0.5	4.60E+07	21.05039
5	16	1.1346	0.013	0.5591	1.70E+09	0.2994	0.1987	0.5	1.80E+07	21.26636
5	17	1.1281	0.12	0.4285	1.80E+09	0.278	0.0383	0.6	2.30E+08	21.33375
6	1	0.4851	0.5149	0.1586	3.80E+07	0.0666	0.1342	0.1	101	17.45938
6	2	0.6455	0.3545	0.2039	3.30E+07	5	0.1109	0.1	145	17.31037
6	3	0.8346	0.1654	0.2114	4.70E+07	0.0651	0.1758	0.1	210	17.67056
6	4	0.7522	0.2478	0.2353	5.20E+07	0.0589	0.1937	0.15	233	17.7754
6	5	0.8526	0.1474	0.1674	6.00E+07	0.0447	0.125	0.2	560	17.90729
6	6	0.3513	0.6487	0.1838	6.60E+07	0.03	0.1273	0.2	741	17.9992
6	7	0.3841	0.6159	0.1905	7.00E+07	0.0174	0.0641	0.2	1952	18.05939
6	8	0.3002	0.6998	0.2259	1.10E+08	0.0231	0.0513	0.4	2650	18.51383
6	9	0.4958	0.5042	0.2441	1.50E+08	0.0215	0.0681	0.4	16486	18.82916
6	10	0.323	0.677	0.2062	3.20E+08	0.0125	0.1	0.3	315254	19.57716
6	11	0.4591	0.5409	0.1965	3.70E+08	0.014	0.0552	0.3	4.60E+06	19.73533
6	12	0.39	0.61	0.1755	5.80E+08	0.0085	0.0311	0.4	1.80E+07	20.18645
6	13	0.3995	0.6005	0.2	5.80E+08	0.0107	0.0223	0.4	2.90E+07	20.18576
6	14	0.7057	0.2943	0.2	1.80E+09	0.011	0.0521	0.5	3.80E+07	21.28991
6	15	1.026	0.02	0.16	2.60E+09	0.0091	0.0614	0.5	4.60E+07	21.66423

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

6	16	0.8538	0.1462	0.14	3.10E+09	0.0092	0.0503	0.5	1.80E+07	21.86695
6	17	0.673	0.327	0.4	4.10E+09	4	0.2985	0.6	2.30E+08	22.12838
7	1	0.3073	0.6927	0.212	1.20E+07	0.0863	0.2241	0.1	101	16.33539
7	2	0.4507	0.5493	0.2163	1.40E+07	0.1104	0.2599	0.1	145	16.41982
7	3	0.425	0.575	0.2086	1.50E+07	0.1062	0.2721	0.1	210	16.5096
7	4	0.2674	0.7326	0.2685	1.80E+07	0.1134	0.5257	0.15	233	16.6885
7	5	0.3461	0.6539	0.2	1.80E+07	0.0684	0.1551	0.2	560	16.70842
7	6	0.3589	0.6411	0.19	2.10E+07	0.0696	0.2117	0.2	741	16.86993
7	7	0.2883	0.7117	0.2019	2.60E+07	0.068	0.1015	0.2	1952	17.08541
7	8	0.3091	0.6909	0.1883	3.20E+07	0.0621	0.0743	0.4	2650	17.28785
7	9	0.3935	0.6065	0.1807	4.50E+07	0.0393	0.0331	0.4	16486	17.62608
7	10	0.2247	0.7753	0.1693	7.80E+07	0.0429	0.016	0.3	315254	18.17423
7	11	0.2256	0.7744	0.198	1.00E+08	0.0272	0.0153	0.3	4.60E+06	18.41961
7	12	0.3192	0.6808	0.276	1.80E+08	0.0562	0.0194	0.4	1.80E+07	19.02196
7	13	0.6824	0.3176	0.1566	4.40E+08	0.0502	0.0053	0.4	2.90E+07	19.90827
7	14	0.3862	0.6138	0.3018	5.80E+08	0.0475	0.0065	0.5	3.80E+07	20.1751
7	15	0.5487	0.4513	0.21	8.70E+08	0.1642	0.2166	0.5	4.60E+07	20.5851
7	16	0.4865	0.5135	0.13	1.20E+09	0.1759	0.3093	0.5	1.80E+07	20.89603
7	17	0.5873	0.4127	0.12	1.70E+09	0.1476	0.2744	0.6	2.30E+08	21.23587
8	1	0.7702	0.2298	0.14	1.00E+07	0.0522	0.0041	0.1	101	16.13476
8	2	0.7702	0.2298	0.2	1.00E+07	0.0522	0.0041	0.1	145	16.13476
8	3	1.1361	0.013	0.14	1.00E+07	2	0.0048	0.1	210	16.15973
8	4	0.7129	0.2871	0.1	1.10E+07	0.045	0.0052	0.15	233	16.2073
8	5	0.6535	0.3465	0.17	1.20E+07	0.0507	0.0045	0.2	560	16.31624
8	6	0.5958	0.4042	0.1	1.40E+07	0.0436	0.0041	0.2	741	16.44072
8	7	0.6311	0.3689	0.1	1.70E+07	0.0367	0.0033	0.2	1952	16.6386

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

8	8	0.62	0.38	0.26	1.90E+07	0.0165	0.0028	0.4	2650	16.78076
8	9	0.6749	0.3251	0.25	2.40E+07	0.0146	0.0028	0.4	16486	17.01308
8	10	0.7318	0.2682	0.1	3.50E+07	0.0069	0.0026	0.3	315254	17.37779
8	11	0.7617	0.2383	0.18	4.00E+07	0.011	0.0019	0.3	4.60E+06	17.50214
8	12	0.7492	0.2508	0.2	5.10E+07	0.0087	0.0031	0.4	1.80E+07	17.74808
8	13	0.8408	0.1592	0.2	9.30E+07	0.0055	0.0015	0.4	2.90E+07	18.34328
8	14	0.7261	0.2739	0.1	1.20E+08	0.0022	0.0025	0.5	3.80E+07	18.58063
8	15	0.554	0.446	0.1	1.20E+08	0.0108	0.0048	0.5	4.60E+07	18.63087
8	16	0.6683	0.3317	0.1	1.70E+08	0.0101	0.029	0.5	1.80E+07	18.96174
8	17	0.7247	0.2753	0.08	2.50E+08	0.0714	0.0547	0.6	2.30E+08	19.34052
9	1	1.2016	0.02	0.05	2.20E+07	0.0597	0.3049	0.1	101	16.88666
9	2	1.2229	0.002	0.12	2.30E+07	0.0567	0.4075	0.1	145	16.94677
9	3	0.9699	0.0301	0.06	2.10E+07	0.0558	0.4337	0.1	210	16.87526
9	4	1.2083	0.02	0.25	2.40E+07	0.0501	0.245	0.15	233	16.98235
9	5	1.1498	0.0014	0.14	2.30E+07	0.043	0.134	0.2	560	16.95993
9	6	1.0782	0.078	0.12	2.70E+07	0.0366	0.0427	0.2	741	17.11332
9	7	1.0629	0.062	0.1	3.10E+07	0.0379	0.1849	0.2	1952	17.25819
9	8	1.038	0.038	0.12	3.60E+07	2.3	0.0644	0.4	2650	17.40298
9	9	0.9029	0.0971	0.14	4.10E+07	0.0265	0.0754	0.4	16486	17.52385
9	10	0.9297	0.0703	0.12	5.10E+07	0.0231	0.2	0.3	315254	17.74743
9	11	0.9654	0.0346	0.14	5.60E+07	0.0249	0.0248	0.3	4.60E+06	17.84677
9	12	0.861	0.139	0.07	9.80E+07	0.0103	0.0315	0.4	1.80E+07	18.40246
9	13	0.9481	0.0519	0.05	1.30E+08	0.0002	0.0349	0.4	2.90E+07	18.69263
9	14	0.7127	0.2873	0.05	1.70E+08	0.0076	0.0086	0.5	3.80E+07	18.92529
9	15	0.7934	0.2066	0.09	2.70E+08	0.0755	0.0002	0.5	4.60E+07	19.42389
9	16	0.9058	0.0942	0.08	3.60E+08	0.0032	0.0002	0.5	1.80E+07	19.71301

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

9	17	0.6985	0.3015	0.09	4.80E+08	0.0134	0.001	0.6	2.30E+08	19.9885
10	1	0.69	0.31	0.24	6.70E+06	0.0262	0.2292	0.1	101	15.71732
10	2	0.7701	0.2299	0.16	6.70E+06	0.0364	0.2742	0.1	145	15.71123
10	3	0.76	0.24	0.2	6.90E+06	0.0323	0.2389	0.1	210	15.74741
10	4	0.7519	0.2481	0.11	8.10E+06	2	0.2667	0.15	233	15.91045
10	5	0.6952	0.3048	0.13	7.70E+06	0.0409	0.247	0.2	560	15.86263
10	6	0.75	0.25	0.2	1.00E+07	0.0788	0.0636	0.2	741	16.13031
10	7	0.7723	0.2277	0.23	1.40E+07	0.0104	0.0487	0.2	1952	16.45316
10	8	0.7275	0.2725	0.12	1.60E+07	0.0185	0.0552	0.4	2650	16.61751
10	9	0.7101	0.2899	0.21	2.10E+07	0.0147	0.0702	0.4	16486	16.83957
10	10	0.7367	0.2633	0.25	2.50E+07	0.0137	0.0818	0.3	315254	17.01973
10	11	0.8235	0.1765	0.12	4.50E+07	0.0112	0.1024	0.3	4.60E+06	17.62861
10	12	0.9152	0.0848	0.16	5.60E+07	0.0039	0.0903	0.4	1.80E+07	17.84604
10	13	1.13	0.0013	0.18	5.80E+07	0.0046	0.4	0.4	2.90E+07	17.86969
10	14	1.4821	0.0014	0.12	2.50E+08	0.033	0.4	0.5	3.80E+07	19.34339
10	15	0.6439	0.3561	0.17	6.40E+07	0.0046	0.3	0.5	4.60E+07	17.97655
10	16	0.9657	0.0343	0.18	1.30E+08	0.001	0.3602	0.5	1.80E+07	18.66319
10	17	0.95	0.05	0.09	1.40E+08	0.001	0.2611	0.6	2.30E+08	18.76485
11	1	0.4433	0.5567	0.08	2.60E+06	0.0108	0.057	0.1	101	14.75542
11	2	0.4715	0.5285	0.07	2.60E+06	0.0108	0.2	0.1	145	14.7612
11	3	0.5117	0.4883	0.1	2.70E+06	3	0.4	0.1	210	14.8016
11	4	0.6564	0.3436	0.15	2.90E+06	0.0036	0.6795	0.15	233	14.88756
11	5	0.6303	0.3697	0.2	3.00E+06	0.0076	0.7486	0.2	560	14.90883
11	6	0.585	0.415	0.15	2.80E+06	4	0.4961	0.2	741	14.85705
11	7	0.6615	0.3385	0.24	3.20E+06	2	0.5294	0.2	1952	14.97253
11	8	0.6875	0.3125	0.21	3.20E+06	0.0069	0.3661	0.4	2650	14.96958

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

11	9	0.6875	0.3125	0.15	4.80E+06	0.0047	0.0225	0.4	16486	15.38008
11	10	0.875	0.125	0.19	5.70E+06	0.0096	0.0271	0.3	315254	15.55783
11	11	0.87	0.13	0.25	7.80E+06	0.019	0.1862	0.3	4.60E+06	15.8717
11	12	0.856	0.144	0.13	9.50E+06	0.0017	0.0355	0.4	1.80E+07	16.06999
11	13	0.9564	0.0436	0.14	1.70E+07	0.0016	0.0567	0.4	2.90E+07	16.64176
11	14	0.7773	0.2227	0.1	1.90E+07	0.0148	0.0576	0.5	3.80E+07	16.77468
11	15	0.7812	0.2188	0.1	2.00E+07	0.0125	0.1041	0.5	4.60E+07	16.811
11	16	0.9242	0.0758	0.05	3.80E+07	7.9975	0.18	0.5	1.80E+07	17.45394
11	17	0.91	0.09	0.09	2.90E+07	0.064	0.1401	0.6	2.30E+08	17.16807
12	1	0.3118	0.6882	0.15	2.40E+07	0.0757	0.2558	0.1	101	16.99279
12	2	0.4183	0.5817	0.1176	2.50E+07	0.0642	0.2883	0.1	145	17.04645
12	3	0.3809	0.6191	0.0932	2.80E+07	7	0.2482	0.1	210	17.13684
12	4	0.4117	0.5883	0.0913	3.40E+07	5	0.1925	0.15	233	17.35001
12	5	0.4208	0.5792	0.1563	3.70E+07	0.0579	0.1575	0.2	560	17.42399
12	6	0.3797	0.6203	0.1242	4.40E+07	0.0588	0.1474	0.2	741	17.59698
12	7	0.3918	0.6082	0.1496	5.00E+07	0.0499	0.3665	0.2	1952	17.73507
12	8	0.4037	0.5963	0.1442	6.40E+07	0.0483	0.0901	0.4	2650	17.9789
12	9	0.457	0.543	0.1454	7.30E+07	0.0426	0.0659	0.4	16486	18.1109
12	10	0.5994	0.4006	0.117	1.30E+08	0.0295	0.0361	0.3	315254	18.68229
12	11	0.6298	0.3702	0.1317	2.80E+08	0.0274	0.0322	0.3	4.60E+06	19.45739
12	12	0.529	0.471	0.1418	3.30E+08	4.2	0.039	0.4	1.80E+07	19.60262
12	13	0.4858	0.5142	0.1347	5.00E+08	0.0201	0.0495	0.4	2.90E+07	20.02393
12	14	0.4242	0.5758	0.2287	1.00E+09	0.0392	0.0913	0.5	3.80E+07	20.72535
12	15	0.4653	0.5347	0.3539	1.70E+09	0.0643	0.0073	0.5	4.60E+07	21.24816
12	16	0.7787	0.2213	0.2376	2.10E+09	0.0867	0.3198	0.5	1.80E+07	21.44789
12	17	0.4801	0.5199	0.3046	2.50E+09	0.06	0.1422	0.6	2.30E+08	21.63489

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

13	1	0.3264	0.6736	0.1878	2.10E+06	0.0532	0.2274	0.1	101	14.54561
13	2	0.6263	0.3737	0.2629	2.00E+06	0.119	0.1891	0.1	145	14.50231
13	3	0.7495	0.2505	0.1838	2.40E+06	0.1123	0.2712	0.1	210	14.69459
13	4	0.7398	0.2602	0.2052	2.30E+06	0.1231	0.1801	0.15	233	14.65225
13	5	0.7184	0.2816	0.2042	2.50E+06	0.1232	0.2358	0.2	560	14.72072
13	6	0.6999	0.3001	0.2211	2.60E+06	4.5	0.2787	0.2	741	14.75453
13	7	0.7614	0.2386	0.1391	3.40E+06	0.0653	0.1241	0.2	1952	15.0262
13	8	0.7901	0.2099	0.1572	4.00E+06	0.0538	0.1126	0.4	2650	15.19446
13	9	0.5899	0.4101	0.2263	3.10E+06	0.032	0.1034	0.4	16486	14.95844
13	10	0.452	0.548	0.1426	5.30E+06	0.0186	0.07	0.3	315254	15.47754
13	11	0.534	0.466	0.1086	8.80E+06	0.0165	0.0187	0.3	4.60E+06	15.9876
13	12	0.7431	0.2569	0.1778	1.90E+07	0.0269	0.0864	0.4	1.80E+07	16.7739
13	13	0.295	0.705	0.1557	1.70E+07	0.0377	0.0507	0.4	2.90E+07	16.66423
13	14	0.7419	0.2581	0.1565	1.80E+07	0.1547	0.3378	0.5	3.80E+07	16.72865
13	15	0.86	0.14	0.1041	8.10E+07	0.1752	0.4444	0.5	4.60E+07	18.21313
13	16	1.2	0.002	0.377	1.60E+08	0.1138	0.3783	0.5	1.80E+07	18.89039
13	17	1.022	0.022	0.336	2.30E+08	5.3	0.4202	0.6	2.30E+08	19.25021
14	1	0.5636	0.4364	0.1458	1.50E+06	0.0139	0.008	0.1	101	14.22382
14	2	0.4887	0.5113	0.1356	2.10E+06	0.0115	0.008	0.1	145	14.53934
14	3	0.4809	0.5191	0.1471	2.30E+06	0.011	0.0059	0.1	210	14.6547
14	4	0.6428	0.3572	0.1355	3.80E+06	0.0107	0.7929	0.15	233	15.15795
14	5	0.3448	0.6552	0.05	6.50E+06	0.0123	0.0145	0.2	560	15.68027
14	6	0.3259	0.6741	0.12	1.00E+07	0.0087	0.0113	0.2	741	16.16047
14	7	0.16	0.84	0.2	1.50E+07	0.0105	0.0031	0.2	1952	16.54416
14	8	0.352	0.648	0.3123	2.20E+07	0.013	0.0065	0.4	2650	16.89528
14	9	0.356	0.644	0.2751	2.90E+07	0.0109	0.0031	0.4	16486	17.19733

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

14	10	0.393	0.607	0.1447	4.20E+07	0.0122	0.0022	0.3	315254	17.56231
14	11	0.2307	0.7693	0.1372	4.30E+07	0.0168	0.0003	0.3	4.60E+06	17.58703
14	12	0.3549	0.6451	0.2299	3.20E+07	0.0341	0.0261	0.4	1.80E+07	17.26814
14	13	0.55	0.45	0.17	2.60E+07	4.2	0.1213	0.4	2.90E+07	17.07604
14	14	0.6837	0.3163	0.15	3.70E+07	4.2	0.0578	0.5	3.80E+07	17.4183
14	15	0.86	0.14	0.17	3.80E+07	4.2	0.1679	0.5	4.60E+07	17.44533
14	16	0.44	0.56	0.15	2.90E+07	5.5	0.0517	0.5	1.80E+07	17.1982
14	17	0.75	0.25	0.23	3.50E+08	4.5	0.1069	0.6	2.30E+08	19.6841
15	1	0.1148	0.8852	0.07	6.60E+06	0.1428	0.1812	0.1	101	15.69714
15	2	0.1416	0.8584	0.16	7.50E+06	0.2527	0.2909	0.1	145	15.83366
15	3	0.1331	0.8669	0.18	7.90E+06	0.2836	0.4063	0.1	210	15.88259
15	4	0.1913	0.8087	0.19	6.70E+06	0.3258	0.2356	0.15	233	15.72289
15	5	1.4755	0.0047	0.2	6.20E+06	0.2541	0.2202	0.2	560	15.64114
15	6	0.93	0.07	0.21	9.40E+06	0.202	0.1408	0.2	741	16.05274
15	7	0.6954	0.3046	0.19	1.30E+07	0.1725	0.0999	0.2	1952	16.35814
15	8	0.4827	0.5173	0.15	1.60E+07	0.0967	0.0326	0.4	2650	16.56043
15	9	0.342	0.658	0.1	1.30E+07	0.1064	0.04	0.4	16486	16.35803
15	10	0.26	0.74	0.13	2.90E+07	0.042	0.0154	0.3	315254	17.17911
15	11	1.0933	0.0012	0.1821	5.10E+07	0.0227	0.0012	0.3	4.60E+06	17.74877
15	12	1.1076	0.001	0.2522	5.00E+07	0.0223	0.0009	0.4	1.80E+07	17.71989
15	13	1.1701	0.0017	0.2	6.60E+07	0.0186	0.0006	0.4	2.90E+07	17.99796
15	14	1.1073	0.01	0.2	2.70E+08	0.0218	0.0001	0.5	3.80E+07	19.41474
15	15	0.85	0.15	0.1496	4.40E+08	4.2	0.0001	0.5	4.60E+07	19.89807
15	16	0.6124	0.3876	0.1851	4.80E+08	5.1	0.2672	0.5	1.80E+07	19.98436
15	17	0.54	0.46	0.1868	4.70E+08	5.4	0.1554	0.6	2.30E+08	19.96922

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

APPENDIX 4: ZIMBABWEAN DOLLAR ERA PANEL REGRESSIONS RESULTS

_____ (R)

/____/ /____/

____/ /____/ /____/ 11.2 Copyright 2009 StataCorp LP

Statistics/Data Analysis

StataCorp

4905 Lakeway Drive

Special Edition

College Station, Texas 77845 USA

800-STATA-PC

<http://www.stata.com>

979-696-4600

stata@stata.com

979-696-4601 (fax)

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Nelson Mandela Metropolitan

sum lqr lq cad size spreads nplrrr infl

Variable	Obs	Mean	Std. Dev.	Min	Max
-----+-----					
lqr	255	.6263224	.2800594	.049	1.4821
lq	255	.3901835	.2400579	.001	.8852
cad	255	.1747686	.0845681	.012	.668

size	255	17.64859	1.807218	14.22382	22.12838
spreads	255	.4400694	1.280723	.0002	7.9975
-----+-----					
npl	255	.184702	.181939	.0001	.8637
rrr	255	.3147059	.1572694	.1	.6
infl	255	14.39504	3.033832	9.159047	19.25793

. xtunitroot ht lqr

Harris-Tzavalis unit-root test for lqr

```

-----
Ho: Panels contain unit roots          Number of panels =      15
Ha: Panels are stationary              Number of periods =     17
AR parameter: Common                  Asymptotics: N -> Infinity
Panel means:   Included                T Fixed
Time trend:    Not included

```

	Statistic	z	p-value
rho	0.4839	-7.8774	0.0000

xtunitroot ht lq

Harris-Tzavalis unit-root test for lq

Ho: Panels contain unit roots	Number of panels =	15
Ha: Panels are stationary	Number of periods =	17
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

```
. xtunitroot ht cad
```

Ho: Panels contain unit roots	Number of panels =	15
Ha: Panels are stationary	Number of periods =	17
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

Statistic	z	p-value

rho	-0.0868	-19.4191
		0.0000

Harris-Tzavalis unit-root test for size

	Statistic	z	p-value
rho	-0.1070	-19.8491	0.0000

Harris-Tzavalis unit-root test for spreads

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

Time trend: Not included

	Statistic	z	p-value
rho	0.4575	-8.4731	0.0000

. xtunitroot ht npl

Harris-Tzavalis unit-root test for npl

Ho: Panels contain unit roots	Number of panels =	15
Ha: Panels are stationary	Number of periods =	17
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

	Statistic	z	p-value
rho	0.1203	-16.0748	0.0000

. xtunitroot ht rrr

Harris-Tzavalis unit-root test for rrr

Ho: Panels contain unit roots	Number of panels =	15
Ha: Panels are stationary	Number of periods =	17
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

```
. xtunitroot ht infl
```

Ho: Panels contain unit roots	Number of panels =	15
Ha: Panels are stationary	Number of periods =	17
AR parameter: Common	Asymptotics: N -> Infinity	
Panel means: Included	T Fixed	
Time trend: Not included		

Statistic	z	p-value

rho	-0.0717	-20.4023 0.0000

```
-----
```

```
. corr lqr cad size spreads npl rrr infl
```

```
(obs=255)
```

	lqr	cad	size	spreads	npl	rrr	infl
lqr	1.0000						
cad	-0.3394	1.0000					
size	0.0411	-0.0194	1.0000				
spreads	-0.0265	-0.0142	-0.0773	1.0000			
npl	0.0547	-0.0170	-0.0220	-0.0108	1.0000		
rrr	0.0422	0.2094	0.3399	0.0208	-0.1171	1.0000	
infl	0.0648	-0.1501	0.0163	-0.0259	-0.0065	-0.0246	1.0000

```
. reg lqr cad size spreads npl rrr infl
```

Source	SS	df	MS	Number of obs =	255
				F(6, 247) =	16.29
Model	3.59667662	7	.513810946	Prob > F =	0.0000

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

```

Residual | 20.1617784 247 .081626633 R-squared = 0.1514
-----+-----
Total | 23.758455 254 .093537225 Root MSE = .2857

```

```

-----
lqr | Coef. Std. Err. t P>|t| [95% Conf. Interval]
-----+-----
cad | -.2743353 .0500256 -5.48 0.000 -.1758041 .3728664
size | 3.00e-11 3.41e-11 0.88 0.380 -3.72e-11 9.72e-11
spreads | .0185121 .0580444 0.32 0.750 .1328371 .095813
npl | .0115333 .0125346 0.92 0.358 -.0131551 .0362217
rrr | -.1643953 .0789031 -2.08 0.038 -.0089866 -.319804
infl | .0564349 .0275246 2.05 0.041 .1106478 .0022221
_cons | .5529535 .0375535 14.72 0.000 .4789877 .6269194

```

```
. ovtest
```

Ramsey RESET test using powers of the fitted values of lqr

Ho: model has no omitted variables

F(3, 244) = 1.42

Prob > F = 0.2375

rrr	-.0972312	-.0530858	-1.83	0.067	-.0068151	.2012774
infl	.0664681	.024928	2.67	0.008	.1153261	.0176102
cons	0.563869	.0573368	9.83	0.000	.4514126	.6763254

-----+-----

. est store fe

. xtreg lqr cad size npl rrr infl, re

Random-effects GLS regression	Number of obs	=	255
Group variable: bank	Number of groups	=	15
R-sq: within = 0.1475	Obs per group: min	=	17
between = 0.0193	avg	=	17.0
overall = 0.0812	max	=	17
	Wald chi2(6)	=	38.93
corr(u_i, Xb) = 0	Prob > chi2	=	0.0000

-----+-----

lqr	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
cad	-.1749001	.0740494	-2.36	0.019	-.0290179 -.3207824
size	.0578195	.0104264	5.55	0.000	.0372788 .0783602
spreads	.0451192	.0263273	.1.71	0.087	.0967198 .0064814
npl	.0666133	.0251656	2.65	0.009	.1161912 .0170354

```

rrr |    -.112885   .0560925   -2.01   0.045   -.0023723   .2233989

infl |    -.1241368   .0531628   -2.34   0.020   -.0194026   .228871

_cons |   -.4190591   .1846574   -2.27   0.024   -.7828465   -.0552717

-----+-----
-----

```

```
. est store re
```

```
. hausman fe re
```

```

      ---- Coefficients ----
      |      (b)      (B)      (b-B)      sqrt(diag(V_b-V_B))
      |      fe      re      Difference      S.E.
-----+-----
      cad |    -.2162776   -.1749001   -.0413774   .0373003
      size |    .0497281   .0578195   .0080914   .0022793
      spreads|  -.0578195   .0451192   .0080914   .0022793
      rrr |    .097271   .0666133   .0080914   .0022793
      npl |   -.016688   -.112885   .0001452   .0034501
      infl |   -.066133   .1241368   .0269056   .0028598

-----

```

b = consistent under Ho and Ha; obtained from xtreg

CAD		.2884882	.1609332	1.79	0.074	.5611723	.0701958
SIZE1		-.0374981	.0190107	-1.97	0.050	-.0749522	-.000044
SPREADS		-.0107549	.0094844	-1.13	0.258	-.0294406	.0079309
NPL		-.1593337	.0784168	-2.03	0.043	-.3138269	-.0048406
RRR		.1039031	.2378566	0.44	0.663	f-.364711	.5725172
INFL1		-.0075355	.0121482	-0.62	0.536	-.0314693	.0163984
_cons		1.204813	.2650428	4.55	0.000	.6826374	1.726988

-----+-----

F test that all u_i=0: F(14, 234) = 13.60 Prob > F = 0.0000

APPENDIX 5: MULTIPLE CURRENCY ERA DATA

bank	year	Lqr	lq	cad	size	size1	spreads	npl	rrr	infl	gdp
1	1	0.30228	0	0.09	8.20E+07	18.22032	5.25	0.03	0.1	-2.1	0.5
1	2	0.474138	0.578087	0.09	1.40E+08	18.78845	5.15	0.024	0.1	-1.1	0.5
1	3	0.662212	0.524122	0.09	1.90E+08	19.05284	5.1	0.01	0.1	-1	0.5
1	4	0.464128	0.567522	0.09	3.00E+08	19.52197	9.7	0.018	0.1	0.6	0.5
1	5	0.488958	0.533305	0.09	3.20E+08	19.59421	7.73	0.017	0.1	1	0.5
1	6	0.618425	0.425554	0.09	3.20E+08	19.58508	9.97	0.019	0.1	0.4	0.5
1	7	0.548771	0.473817	0.09	3.80E+08	19.75065	17	0.21	0.1	-0.5	0.5
1	8	0.65932	0.388672	0.09	3.80E+08	19.75756	21.87	0.031	0.1	0.8	0.5
1	9	0.589274	0.454696	0.09	4.50E+08	19.93004	26.38	0.035	0.1	-0.1	0.5
1	10	0.696924	0.359461	0.09	5.40E+08	20.1126	27.35	0.04	0.1	0.5	0.5
1	11	0.745892	0.341367	0.09	5.80E+08	20.17595	27.95	0.065	0.05	0.7	0.75
1	12	0.71242	0.351143	0.09	6.20E+08	20.2401	29.47	0.059	0.05	1	0.75
1	13	0.776536	0.281668	0.09	6.20E+08	20.23845	28.85	0.06	0.05	1.1	0.75
1	14	0.689378	0.379341	0.09	6.40E+08	20.27041	27.95	0.09	0.05	0.1	0.75
1	15	0.796361	0.342152	0.09	6.40E+08	20.27955	26.87	0.12	0.05	0.3	0.75
1	16	0.723605	0.320998	0.09	6.50E+08	20.2899	27.85	0.17	0.05	-0.1	0.75
1	17	0.723605	0.320998	0.09	6.50E+08	20.2899	28.85	0.19	0.05	-0.1	0.75
1	18	0.723605	0.320998	0.09	6.50E+08	20.2899	28.15	0.03	0.05	-0.1	0.75
1	19	0.800855	0.303588	0.09	7.60E+08	20.44259	28.15	0.024	0	0.1	0.75
1	20	0.800855	0.303588	0.09	7.60E+08	20.44259	28.45	0.01	0	0.2	0.75
1	21	0.887395	0.234658	0.09	7.20E+08	20.39511	28.45	0.018	0	0.5	0.75
1	22	0.730394	0.237172	0.09	7.70E+08	20.45851	29.4	0.017	0	-0.4	0.75

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1	23	0.772551	0.28979	0.09	8.30E+08	20.53722	29.34	0.019	0	0.9	0.75
1	24	0.700607	0.323892	0.09	8.60E+08	20.56719	27.6	0.21	0	0.5	0.8
1	25	0.780894	0.246091	0.09	7.50E+08	20.44073	27.6	0.031	0	0.8	0.85
1	26	0.819711	0.210007	0.09	7.60E+08	20.45439	27.6	0.035	0	0.1	0.85
1	27	0.803568	0.217318	0.09	8.10E+08	20.51271	26.5	0.04	0	0.1	0.95
1	28	0.724315	0.259078	0.09	9.20E+08	20.64084	26.75	0.065	0	0.2	0.95
1	29	0.80628	0.195371	0.09	9.00E+08	20.62078	25.7	0.059	0	0.3	0.95
1	30	0.811	0.201356	0.09	9.30E+08	20.65203	26.5	0.06	0	0.1	0.95
1	31	0.857943	0.170985	0.09	9.30E+08	20.64794	26.15	0.09	0	0.9	0.95
1	32	0.840443	0.139725	0.09	9.40E+08	20.66357	27.2	0.12	0	0.1	0.95
2	1	0.038464	0	0.091	1.00E+08	18.44776	5.25	0.17	0.1	-2.1	0.5
2	2	0.035423	1.04879	0.091	1.10E+08	18.50755	5.15	0.19	0.1	-1.1	0.5
2	3	0.034043	0.996537	0.091	1.00E+08	18.43908	5.1	0.03	0.1	-1	0.5
2	4	0.037898	1.02676	0.091	1.30E+08	18.69236	9.7	0.024	0.1	0.6	0.5
2	5	0.080517	0.95	0.091	1.40E+08	18.75594	7.73	0.01	0.1	1	0.5
2	6	0.136927	0.911608	0.091	1.40E+08	18.77984	9.97	0.018	0.1	0.4	0.5
2	7	0.151522	0.888564	0.091	1.50E+08	18.84499	17	0.017	0.1	-0.5	0.5
2	8	0.138076	0.896606	0.091	1.60E+08	18.91298	21.87	0.019	0.1	0.8	0.5
2	9	0.176002	0.866685	0.091	1.50E+08	18.81397	26.38	0.21	0.1	-0.1	0.5
2	10	0.177946	0.888797	0.091	1.90E+08	19.04751	27.35	0.031	0.1	0.5	0.5
2	11	0.221921	0.838717	0.091	1.70E+08	18.97049	27.95	0.035	0.05	0.7	0.75
2	12	0.21935	0.832602	0.091	1.70E+08	18.95238	29.47	0.04	0.05	1	0.75
2	13	0.208192	0.826723	0.091	1.70E+08	18.96359	28.85	0.065	0.05	1.1	0.75
2	14	0.210752	0.829236	0.091	1.70E+08	18.96121	27.95	0.059	0.05	0.1	0.75
2	15	0.200943	0.833056	0.091	1.80E+08	18.98506	26.87	0.06	0.05	0.3	0.75
2	16	0.219744	0.821825	0.091	1.80E+08	19.02095	27.85	0.09	0.05	-0.1	0.75

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

2	17	0.219744	0.821825	0.091	1.80E+08	19.02095	28.85	0.12	0.05	-0.1	0.75
2	18	0.219744	0.821825	0.091	1.80E+08	19.02095	28.15	0.17	0.05	-0.1	0.75
2	19	0.263932	0.777705	0.091	2.20E+08	19.20871	28.15	0.19	0	0.1	0.75
2	20	0.263932	0.777705	0.091	2.20E+08	19.20871	28.45	0.03	0	0.2	0.75
2	21	0.275623	0.770028	0.091	2.20E+08	19.20931	28.45	0.024	0	0.5	0.75
2	22	0.253866	0.782653	0.091	2.30E+08	19.26076	29.4	0.01	0	-0.4	0.75
2	23	0.272908	0.764518	0.091	2.30E+08	19.23943	29.34	0.018	0	0.9	0.75
2	24	0.242747	0.804625	0.091	2.50E+08	19.33261	27.6	0.017	0	0.5	0.8
2	25	0.274685	0.762733	0.091	2.40E+08	19.30341	27.6	0.019	0	0.8	0.85
2	26	0.320439	0.721603	0.091	2.30E+08	19.25469	27.6	0.21	0	0.1	0.85
2	27	0.326929	0.71763	0.091	2.30E+08	19.27024	26.5	0.031	0	0.1	0.95
2	28	0.302512	0.781891	0.091	2.50E+08	19.33146	26.75	0.035	0	0.2	0.95
2	29	0.302539	0.76497	0.091	2.70E+08	19.41977	25.7	0.04	0	0.3	0.95
2	30	0.316402	0.748653	0.091	2.70E+08	19.40366	26.5	0.065	0	0.1	0.95
2	31	0.274516	0.777552	0.091	3.00E+08	19.50904	26.15	0.059	0	0.9	0.95
2	32	0.277813	0.76716	0.091	2.90E+08	19.48154	27.2	0.06	0	0.1	0.95
3	1	0.03241	0	0.11	1.10E+08	18.48793	5.25	0.09	0.1	-2.1	0.5
3	2	0.032053	1.05379	0.11	1.20E+08	18.6181	5.15	0.12	0.1	-1.1	0.5
3	3	0.109517	0.940418	0.11	1.30E+08	18.68766	5.1	0.17	0.1	-1	0.5
3	4	0.194779	0.780917	0.11	1.40E+08	18.77924	9.7	0.19	0.1	0.6	0.5
3	5	0.32279	0.823229	0.11	1.50E+08	18.82833	7.73	0.03	0.1	1	0.5
3	6	0.360739	0.697315	0.11	1.60E+08	18.92096	9.97	0.024	0.1	0.4	0.5
3	7	0.3856	0.6666	0.11	1.80E+08	18.99419	17	0.01	0.1	-0.5	0.5
3	8	0.413087	0.65693	0.11	1.80E+08	19.01809	21.87	0.018	0.1	0.8	0.5
3	9	0.233486	0.816656	0.11	2.80E+08	19.44908	26.38	0.017	0.1	-0.1	0.5
3	10	0.209643	0.856373	0.11	2.90E+08	19.49921	27.35	0.019	0.1	0.5	0.5

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

3	11	0.195736	0.87702	0.11	3.00E+08	19.51572	27.95	0.21	0.05	0.7	0.75
3	12	0.230656	0.840304	0.11	2.80E+08	19.46638	29.47	0.031	0.05	1	0.75
3	13	0.284355	0.751215	0.11	3.10E+08	19.53912	28.85	0.035	0.05	1.1	0.75
3	14	0.290941	0.782707	0.11	3.80E+08	19.76561	27.95	0.04	0.05	0.1	0.75
3	15	0.343771	0.728694	0.11	3.90E+08	19.77592	26.87	0.065	0.05	0.3	0.75
3	16	0.481065	0.629755	0.11	2.90E+08	19.47264	27.85	0.059	0.05	-0.1	0.75
3	17	0.481065	0.629755	0.11	2.90E+08	19.47264	28.85	0.06	0.05	-0.1	0.75
3	18	0.481065	0.629755	0.11	2.90E+08	19.47264	28.15	0.09	0.05	-0.1	0.75
3	19	0.516961	0.60284	0.11	3.70E+08	19.72899	28.15	0.12	0	0.1	0.75
3	20	0.516961	0.60284	0.11	3.70E+08	19.72899	28.45	0.17	0	0.2	0.75
3	21	0.446379	0.558623	0.11	4.00E+08	19.809	28.45	0.19	0	0.5	0.75
3	22	0.495339	0.60836	0.11	4.10E+08	19.83654	29.4	0.03	0	-0.4	0.75
3	23	0.475731	0.643418	0.11	4.20E+08	19.84663	29.34	0.024	0	0.9	0.75
3	24	0.500191	0.631418	0.11	3.30E+08	19.61925	27.6	0.01	0	0.5	0.8
3	25	0.52672	0.633625	0.11	4.10E+08	19.82931	27.6	0.018	0	0.8	0.85
3	26	0.526466	0.630219	0.11	3.40E+08	19.65083	27.6	0.017	0	0.1	0.85
3	27	0.547599	0.630468	0.11	3.50E+08	19.67833	26.5	0.019	0	0.1	0.95
3	28	0.699856	0.488257	0.11	3.60E+08	19.69813	26.75	0.21	0	0.2	0.95
3	29	0.668916	0.520842	0.11	3.70E+08	19.72907	25.7	0.031	0	0.3	0.95
3	30	0.519628	0.680358	0.11	3.70E+08	19.737	26.5	0.035	0	0.1	0.95
3	31	0.523275	0.642568	0.11	3.70E+08	19.73642	26.15	0.04	0	0.9	0.95
3	32	0.552149	0.645702	0.11	3.70E+08	19.74141	27.2	0.065	0	0.1	0.95
4	1	0.138242	0	0.15	1.30E+08	18.66743	5.25	0.059	0.1	-2.1	0.5
4	2	0.160287	0.858283	0.15	1.30E+08	18.71031	5.15	0.06	0.1	-1.1	0.5
4	3	0.160287	0.858283	0.15	1.30E+08	18.71031	5.1	0.09	0.1	-1	0.5
4	4	0.142295	0.866361	0.15	1.70E+08	18.96038	9.7	0.12	0.1	0.6	0.5

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

4	5	0.165542	0.855067	0.15	1.70E+08	18.92783	7.73	0.17	0.1	1	0.5
4	6	0.194898	0.826346	0.16	1.60E+08	18.90692	9.97	0.19	0.1	0.4	0.5
4	7	0.234735	0.792432	0.17	1.70E+08	18.95122	17	0.03	0.1	-0.5	0.5
4	8	0.270193	0.758302	0.17	1.80E+08	18.98693	21.87	0.024	0.1	0.8	0.5
4	9	0.256543	0.776547	0.18	1.90E+08	19.06783	26.38	0.01	0.1	-0.1	0.5
4	10	0.309332	0.714221	0.18	2.00E+08	19.12828	27.35	0.018	0.1	0.5	0.5
4	11	0.325662	0.700862	0.15	2.10E+08	19.16295	27.95	0.017	0.05	0.7	0.75
4	12	0.372953	0.693719	0.15	1.60E+08	18.89015	29.47	0.019	0.05	1	0.75
4	13	0.421328	0.611929	0.15	2.10E+08	19.18185	28.85	0.21	0.05	1.1	0.75
4	14	0.444972	0.591612	0.15	2.20E+08	19.22225	27.95	0.031	0.05	0.1	0.75
4	15	0.401092	0.636481	0.15	2.50E+08	19.32883	26.87	0.035	0.05	0.3	0.75
4	16	0.376827	0.662328	0.15	2.70E+08	19.40573	27.85	0.04	0.05	-0.1	0.75
4	17	0.376827	0.662328	0.15	2.70E+08	19.40573	28.85	0.065	0.05	-0.1	0.75
4	18	0.376827	0.662328	0.15	2.70E+08	19.40573	28.15	0.059	0.05	-0.1	0.75
4	19	0.383599	0.669309	0.12	2.90E+08	19.5013	28.15	0.06	0	0.1	0.75
4	20	0.383599	0.669309	0.14	2.90E+08	19.5013	28.45	0.09	0	0.2	0.75
4	21	0.292733	0.748216	0.15	3.80E+08	19.74317	28.45	0.12	0	0.5	0.75
4	22	0.323636	0.722782	0.14	3.40E+08	19.65834	29.4	0.17	0	-0.4	0.75
4	23	0.332554	0.718632	0.15	3.30E+08	19.61049	29.34	0.19	0	0.9	0.75
4	24	0.374667	0.679258	0.15	3.20E+08	19.59614	27.6	0.03	0	0.5	0.8
4	25	0.333746	0.716023	0.15	3.50E+08	19.66552	27.6	0.024	0	0.8	0.85
4	26	0.35018	0.641557	0.15	3.50E+08	19.65999	27.6	0.01	0	0.1	0.85
4	27	0.358536	0.648561	0.15	3.50E+08	19.66177	26.5	0.018	0	0.1	0.95
4	28	0.369519	0.622436	0.15	3.50E+08	19.68515	26.75	0.017	0	0.2	0.95
4	29	0.386875	0.620892	0.15	3.40E+08	19.64717	25.7	0.019	0	0.3	0.95
4	30	0.430194	0.630368	0.15	3.50E+08	19.67311	26.5	0.21	0	0.1	0.95

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

4	31	0.4829	0.57189	0.15	3.40E+08	19.64905	26.15	0.031	0	0.9	0.95
4	32	0.505308	0.556543	0.15	3.40E+08	19.65566	27.2	0.035	0	0.1	0.95
5	1	1.30706	0	0.1	8.70E+07	18.28466	5.25	0.04	0.1	-2.1	0.5
5	2	1.12189	0.865585	0.1	9.30E+07	18.35334	5.15	0.065	0.1	-1.1	0.5
5	3	1.14965	0.596943	0.1	1.10E+08	18.51173	5.1	0.059	0.1	-1	0.5
5	4	0.630243	0.438771	0.1	1.10E+08	18.49784	9.7	0.06	0.1	0.6	0.5
5	5	0.707576	0.389579	0.1	1.00E+08	18.43786	7.73	0.09	0.1	1	0.5
5	6	0.707576	0.389579	0.1	1.00E+08	18.43786	9.97	0.12	0.1	0.4	0.5
5	7	0.665148	0.382367	0.1	1.10E+08	18.53054	17	0.17	0.1	-0.5	0.5
5	8	0.619314	0.446647	0.1	1.10E+08	18.48263	21.87	0.19	0.1	0.8	0.5
5	9	0.638241	0.467529	0.1	1.20E+08	18.60407	26.38	0.03	0.1	-0.1	0.5
5	10	0.726249	0.491685	0.1	9.80E+07	18.3965	27.35	0.024	0.1	0.5	0.5
5	11	0.718553	0.541194	0.1	9.90E+07	18.41444	27.95	0.01	0.05	0.7	0.75
5	12	0.638167	0.60899	0.1	1.00E+08	18.42452	29.47	0.018	0.05	1	0.75
5	13	0.617971	0.63842	0.1	1.10E+08	18.52708	28.85	0.017	0.05	1.1	0.75
5	14	0.580483	0.641469	0.1	1.30E+08	18.68271	27.95	0.019	0.05	0.1	0.75
5	15	0.518485	0.659146	0.1	1.70E+08	18.96765	26.87	0.21	0.05	0.3	0.75
5	16	0.646948	0.549135	0.1	1.40E+08	18.78762	27.85	0.031	0.05	-0.1	0.75
5	17	0.646948	0.549135	0.1	1.40E+08	18.78762	28.85	0.035	0.05	-0.1	0.75
5	18	0.646948	0.549135	0.1	1.40E+08	18.78762	28.15	0.04	0.05	-0.1	0.75
5	19	0.62943	0.458486	0.08	1.70E+08	18.97824	28.15	0.065	0	0.1	0.75
5	20	0.62943	0.458486	0.08	1.70E+08	18.97824	28.45	0.059	0	0.2	0.75
5	21	0.740107	0.331905	0.08	1.50E+08	18.82904	28.45	0.06	0	0.5	0.75
5	22	0.658552	0.477813	0.08	1.60E+08	18.91424	29.4	0.09	0	-0.4	0.75
5	23	0.645652	0.52027	0.08	1.80E+08	19.02688	29.34	0.12	0	0.9	0.75
5	24	0.60583	0.56077	0.08	1.60E+08	18.9173	27.6	0.17	0	0.5	0.8

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

5	25	0.623542	0.474132	0.08	1.70E+08	18.95121	27.6	0.19	0	0.8	0.85
5	26	0.573903	0.701382	0.08	1.10E+08	18.52081	27.6	0.03	0	0.1	0.85
5	27	0.476902	0.737487	0.08	1.40E+08	18.77903	26.5	0.024	0	0.1	0.95
5	28	0.537408	0.665769	0.08	1.50E+08	18.81104	26.75	0.01	0	0.2	0.95
5	29	0.511387	0.602989	0.08	1.60E+08	18.89271	25.7	0.018	0	0.3	0.95
5	30	0.689013	0.487207	0.08	1.30E+08	18.7174	26.5	0.017	0	0.1	0.95
5	31	0.653638	0.472986	0.08	1.40E+08	18.73512	26.15	0.019	0	0.9	0.95
5	32	0.596104	0.532778	0.08	1.60E+08	18.9167	27.2	0.21	0	0.1	0.95
6	1	0.473958	0	0.08	6.00E+07	17.9063	5.25	0.031	0.1	-2.1	0.5
6	2	0.291796	1.70618	0.1	6.20E+07	17.94474	5.15	0.035	0.1	-1.1	0.5
6	3	0.291796	1.70618	0.1	6.20E+07	17.94474	5.1	0.04	0.1	-1	0.5
6	4	0.53774	0.336743	0.1	8.30E+07	18.23182	9.7	0.065	0.1	0.6	0.5
6	5	0.539851	0.850072	0.1	8.50E+07	18.25387	7.73	0.059	0.1	1	0.5
6	6	0.442115	0.866684	0.1	8.90E+07	18.30927	9.97	0.06	0.1	0.4	0.5
6	7	0.344921	0.825583	0.1	8.70E+07	18.27798	17	0.09	0.1	-0.5	0.5
6	8	0.335712	0.775436	0.1	8.60E+07	18.26588	21.87	0.12	0.1	0.8	0.5
6	9	0.45993	0.748931	0.1	9.60E+07	18.37776	26.38	0.17	0.1	-0.1	0.5
6	10	0.26096	0.822367	0.1	1.40E+08	18.7908	27.35	0.19	0.1	0.5	0.5
6	11	0.394167	0.696003	0.1	1.50E+08	18.81813	27.95	0.03	0.05	0.7	0.75
6	12	0.174355	0.836519	0.1	2.30E+08	19.26978	29.47	0.024	0.05	1	0.75
6	13	0.369482	0.626229	0.1	1.80E+08	18.99003	28.85	0.01	0.05	1.1	0.75
6	14	0.530496	0.472292	0.1	1.40E+08	18.77865	27.95	0.018	0.05	0.1	0.75
6	15	0.463399	0.56245	0.1	1.50E+08	18.84812	26.87	0.017	0.05	0.3	0.75
6	16	0.626694	0.395889	0.1	1.40E+08	18.75309	27.85	0.019	0.05	-0.1	0.75
6	17	0.750882	0.414973	0.1	1.70E+08	18.97629	28.85	0.21	0.05	-0.1	0.75
6	18	0.750882	0.414973	0.1	1.70E+08	18.97629	28.15	0.031	0.05	-0.1	0.75

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

6	19	0.750882	0.414973	0.12	1.70E+08	18.97629	28.15	0.035	0	0.1	0.75
6	20	0.750882	0.414973	0.12	1.70E+08	18.97629	28.45	0.04	0	0.2	0.75
6	21	0.871906	0.387075	0.12	1.80E+08	18.99384	28.45	0.065	0	0.5	0.75
6	22	0.627099	0.383757	0.12	1.90E+08	19.03961	29.4	0.059	0	-0.4	0.75
6	23	0.680485	0.318143	0.12	1.80E+08	19.00872	29.34	0.06	0	0.9	0.75
6	24	0.633734	0.301038	0.12	1.80E+08	19.00895	27.6	0.09	0	0.5	0.8
6	25	0.661295	0.308719	0.12	1.80E+08	19.03579	27.6	0.12	0	0.8	0.85
6	26	0.704587	0.321071	0.12	1.70E+08	18.93359	27.6	0.17	0	0.1	0.85
6	27	0.717075	0.320797	0.12	1.70E+08	18.92465	26.5	0.19	0	0.1	0.95
6	28	0.662278	0.36795	0.12	1.90E+08	19.04124	26.75	0.03	0	0.2	0.95
6	29	0.674311	0.349705	0.12	1.90E+08	19.06963	25.7	0.024	0	0.3	0.95
6	30	0.689041	0.33445	0.12	1.90E+08	19.08345	26.5	0.01	0	0.1	0.95
6	31	0.676573	0.354222	0.12	2.10E+08	19.16878	26.15	0.018	0	0.9	0.95
6	32	0.735712	0.305963	0.12	2.10E+08	19.16507	27.2	0.017	0	0.1	0.95
7	1	0.420832	0.337456	0.1	3.40E+06	15.05262	5.25	0.019	0.1	-2.1	0.5
7	2	0.420832	0.337456	0.1	3.40E+06	15.05262	5.15	0.21	0.1	-1.1	0.5
7	3	0.557783	0.430139	0.1	4.60E+06	15.34976	5.1	0.031	0.1	-1	0.5
7	4	0.557783	0.430139	0.1	4.60E+06	15.34976	9.7	0.035	0.1	0.6	0.5
7	5	0.948423	0.057482	0.1	1.60E+07	16.57947	7.73	0.04	0.1	1	0.5
7	6	0.864415	0.142802	0.1	1.90E+07	16.78248	9.97	0.065	0.1	0.4	0.5
7	7	0.864415	0.142802	0.1	1.90E+07	16.78248	17	0.059	0.1	-0.5	0.5
7	8	0.664111	0.011098	0.1	3.30E+07	17.31021	21.87	0.06	0.1	0.8	0.5
7	9	0.664111	0.011098	0.1	3.30E+07	17.31021	26.38	0.09	0.1	-0.1	0.5
7	10	0.599777	0.107814	0.1	4.10E+07	17.53308	27.35	0.12	0.1	0.5	0.5
7	11	0.388939	0.040521	0.1	4.50E+07	17.62152	27.95	0.17	0.05	0.7	0.75
7	12	0.484586	0.108863	0.1	5.00E+07	17.72	29.47	0.19	0.05	1	0.75

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

7	13	0.344129	0.127089	0.1	5.80E+07	17.87806	28.85	0.03	0.05	1.1	0.75
7	14	0.190213	0.192669	0.1	6.20E+07	17.95008	27.95	0.024	0.05	0.1	0.75
7	15	0.198443	0.097429	0.1	6.60E+07	17.99789	26.87	0.01	0.05	0.3	0.75
7	16	0.351252	0.195487	0.1	8.50E+07	18.25418	27.85	0.018	0.05	-0.1	0.75
7	17	0.351252	0.195487	0.1	8.50E+07	18.25418	28.85	0.017	0.05	-0.1	0.75
7	18	0.351252	0.195487	0.1	8.50E+07	18.25418	28.15	0.019	0.05	-0.1	0.75
7	19	0.724189	0.154025	0.15	1.70E+08	18.94168	28.15	0.21	0	0.1	0.75
7	20	0.724189	0.154025	0.15	1.70E+08	18.94168	28.45	0.031	0	0.2	0.75
7	21	0.781423	0.215515	0.15	1.50E+08	18.83326	28.45	0.035	0	0.5	0.75
7	22	0.823022	0.215271	0.15	1.80E+08	18.98073	29.4	0.04	0	-0.4	0.75
7	23	0.9245	0.124497	0.15	1.90E+08	19.06585	29.34	0.065	0	0.9	0.75
7	24	1.00269	0.040018	0.15	1.90E+08	19.03978	27.6	0.059	0	0.5	0.8
7	25	0.941129	0.10009	0.15	2.00E+08	19.13491	27.6	0.06	0	0.8	0.85
7	26	0.941129	0.10009	0.15	2.00E+08	19.13491	27.6	0.09	0	0.1	0.85
7	27	1.04374	0.041924	0.15	2.00E+08	19.12769	26.5	0.12	0	0.1	0.95
7	28	1.06726	0.028988	0.15	1.90E+08	19.03949	26.75	0.17	0	0.2	0.95
7	29	1.06413	0.038957	0.15	2.00E+08	19.09372	25.7	0.19	0	0.3	0.95
7	30	1.09493	0.03118	0.15	2.00E+08	19.11633	26.5	0.03	0	0.1	0.95
7	31	1.07454	0.038279	0.15	2.10E+08	19.17179	26.15	0.024	0	0.9	0.95
7	32	1.08119	0.025966	0.15	2.10E+08	19.15167	27.2	0.01	0	0.1	0.95
8	1	0.291779	0	0.1	4.40E+07	17.60021	5.25	0.018	0.1	-2.1	0.5
8	2	0.475509	1.21518	0.1	4.30E+07	17.57986	5.15	0.017	0.1	-1.1	0.5
8	3	0.476136	1.02244	0.1	5.00E+07	17.7343	5.1	0.019	0.1	-1	0.5
8	4	0.777714	1.11084	0.1	5.60E+07	17.83239	9.7	0.21	0.1	0.6	0.5
8	5	0.628592	1.03	0.1	6.00E+07	17.91444	7.73	0.031	0.1	1	0.5
8	6	0.590466	1.02662	0.1	7.30E+07	18.11123	9.97	0.035	0.1	0.4	0.5

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

8	7	0.815272	0.941379	0.1	6.80E+07	18.03519	17	0.04	0.1	-0.5	0.5
8	8	0.637229	0.718572	0.1	7.20E+07	18.08998	21.87	0.065	0.1	0.8	0.5
8	9	0.743972	0.544907	0.1	7.90E+07	18.1839	26.38	0.059	0.1	-0.1	0.5
8	10	0.685001	0.600772	0.1	8.90E+07	18.30406	27.35	0.06	0.1	0.5	0.5
8	11	0.766259	0.535937	0.1	8.30E+07	18.23418	27.95	0.09	0.05	0.7	0.75
8	12	0.858693	0.418502	0.1	8.90E+07	18.30385	29.47	0.12	0.05	1	0.75
8	13	0.708047	0.497578	0.1	9.60E+07	18.38022	28.85	0.17	0.05	1.1	0.75
8	14	0.74277	0.406911	0.1	9.40E+07	18.36248	27.95	0.19	0.05	0.1	0.75
8	15	0.672114	0.48161	0.1	1.10E+08	18.51605	26.87	0.07	0.05	0.3	0.75
8	16	0.677727	0.329311	0.1	1.00E+08	18.41763	27.85	0.03	0.05	-0.1	0.75
8	17	0.677727	0.329311	0.1	1.00E+08	18.41763	28.85	0.024	0.05	-0.1	0.75
8	18	0.677727	0.329311	0.1	1.00E+08	18.41763	28.15	0.01	0.05	-0.1	0.75
8	19	0.795963	0.153539	0.17	1.20E+08	18.63203	28.15	0.018	0	0.1	0.75
8	20	0.795963	0.153539	0.17	1.20E+08	18.63203	28.45	0.017	0	0.2	0.75
8	21	0.815178	0.160888	0.17	1.30E+08	18.7027	28.45	0.019	0	0.5	0.75
8	22	0.677023	0.273876	0.17	1.50E+08	18.83248	29.4	0.21	0	-0.4	0.75
8	23	0.747097	0.168444	0.2	1.50E+08	18.82978	29.34	0.031	0	0.9	0.75
8	24	0.728382	0.15513	0.2	1.60E+08	18.88365	27.6	0.035	0	0.5	0.8
8	25	0.76786	0.136239	0.2	1.70E+08	18.9402	27.6	0.04	0	0.8	0.85
8	26	0.782164	0.142954	0.2	1.60E+08	18.90842	27.6	0.065	0	0.1	0.85
8	27	0.787238	0.121408	0.2	1.60E+08	18.88221	26.5	0.059	0	0.1	0.95
8	28	0.786191	0.143404	0.2	1.70E+08	18.94265	26.75	0.06	0	0.2	0.95
8	29	0.793679	0.108312	0.2	1.60E+08	18.91885	25.7	0.09	0	0.3	0.95
8	30	0.767768	0.1177	0.2	1.70E+08	18.94401	26.5	0.12	0	0.1	0.95
8	31	0.776381	0.118119	0.2	1.50E+08	18.85783	26.15	0.17	0	0.9	0.95
8	32	0.776134	0.141375	0.2	1.50E+08	18.83014	27.2	0.19	0	0.1	0.95

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

9	1	0.051096	1.16054	0.2	1.90E+07	16.76298	5.25	0.008	0.1	-2.1	0.5
9	2	0.051096	1.16054	0.2	1.90E+07	16.76298	5.15	0.008	0.1	-1.1	0.5
9	3	0.040635	1.16371	0.2	2.00E+07	16.80634	5.1	0.0059	0.1	-1	0.5
9	4	0.153655	0.922246	0.1	2.40E+07	16.98702	9.7	0.03	0.1	0.6	0.5
9	5	0.108377	0.828832	0.1	2.70E+07	17.11034	7.73	0.024	0.1	1	0.5
9	6	0.203982	0.584638	0.1	2.70E+07	17.11681	9.97	0.01	0.1	0.4	0.5
9	7	0.332847	0.460402	0.1	2.70E+07	17.1264	17	0.018	0.1	-0.5	0.5
9	8	0.357572	0.405027	0.1	2.90E+07	17.17956	21.87	0.017	0.1	0.8	0.5
9	9	0.943051	0.441198	0.1	3.20E+07	17.28563	26.38	0.019	0.1	-0.1	0.5
9	10	0.959448	0.485492	0.1	3.70E+07	17.41494	27.35	0.21	0.1	0.5	0.5
9	11	0.903392	0.459539	0.1	3.90E+07	17.4673	27.95	0.031	0.05	0.7	0.75
9	12	0.959158	0.478807	0.1	4.10E+07	17.52286	29.47	0.035	0.05	1	0.75
9	13	0.844743	0.432275	0.1	4.40E+07	17.59128	28.85	0.04	0.05	1.1	0.75
9	14	0.960642	0.236124	0.1	4.40E+07	17.59506	27.95	0.065	0.05	0.1	0.75
9	15	0.89698	0.276445	0.1	4.60E+07	17.63443	26.87	0.059	0.05	0.3	0.75
9	16	0.95786	0.28208	0.1	4.70E+07	17.65576	27.85	0.06	0.05	-0.1	0.75
9	17	0.95786	0.28208	0.1	4.70E+07	17.65576	28.85	0.09	0.05	-0.1	0.75
9	18	0.95786	0.28208	0.1	4.70E+07	17.65576	28.15	0.12	0.05	-0.1	0.75
9	19	1.04666	0.115364	0.12	5.30E+07	17.7805	28.15	0.17	0	0.1	0.75
9	20	1.04666	0.115364	0.12	5.30E+07	17.7805	28.45	0.19	0	0.2	0.75
9	21	0.919571	0.220224	0.12	5.20E+07	17.77132	28.45	0.03	0	0.5	0.75
9	22	0.92307	0.216654	0.12	6.20E+07	17.94996	29.4	0.024	0	-0.4	0.75
9	23	0.959061	0.138201	0.12	6.80E+07	18.0293	29.34	0.01	0	0.9	0.75
9	24	1.13085	0.132677	0.12	6.70E+07	18.02112	27.6	0.018	0	0.5	0.8
9	25	1.26633	0.08807	0.12	6.50E+07	17.98751	27.6	0.017	0	0.8	0.85
9	26	1.19786	0.090062	0.12	6.50E+07	17.9823	27.6	0.019	0	0.1	0.85

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

9	27	1.22566	0.112132	0.12	8.60E+07	18.27225	26.5	0.21	0	0.1	0.95
9	28	0.963908	0.159152	0.12	1.10E+08	18.54718	26.75	0.031	0	0.2	0.95
9	29	1.07503	0.055761	0.12	1.10E+08	18.53588	25.7	0.035	0	0.3	0.95
9	30	1.05963	0.060333	0.12	1.20E+08	18.60254	26.5	0.04	0	0.1	0.95
9	31	1.08142	0.07614	0.12	1.10E+08	18.5453	26.15	0.065	0	0.9	0.95
9	32	1.02232	0.079957	0.12	1.10E+08	18.50731	27.2	0.059	0	0.1	0.95
10	1	0.013187	1.17847	0.1	4.00E+07	17.50908	5.25	0.06	0.1	-2.1	0.5
10	2	0.013187	1.17847	0.1	4.00E+07	17.50908	5.15	0.09	0.1	-1.1	0.5
10	3	0.116817	0.907747	0.1	2.90E+07	17.18788	5.1	0.12	0.1	-1	0.5
10	4	0.116817	0.907747	0.1	2.90E+07	17.18788	9.7	0.17	0.1	0.6	0.5
10	5	0.259385	0.778923	0.1	4.00E+07	17.50813	7.73	0.19	0.1	1	0.5
10	6	0.335249	0.695878	0.1	5.50E+07	17.82445	9.97	0.03	0.1	0.4	0.5
10	7	0.375063	0.631869	0.1	6.90E+07	18.05267	17	0.024	0.1	-0.5	0.5
10	8	0.415702	0.555954	0.1	7.10E+07	18.07124	21.87	0.01	0.1	0.8	0.5
10	9	0.430855	0.552259	0.1	7.80E+07	18.1728	26.38	0.018	0.1	-0.1	0.5
10	10	0.397746	0.556496	0.1	7.80E+07	18.16847	27.35	0.017	0.1	0.5	0.5
10	11	0.449208	0.50582	0.1	8.80E+07	18.29681	27.95	0.019	0.05	0.7	0.75
10	12	0.508825	0.462559	0.1	9.00E+07	18.31532	29.47	0.21	0.05	1	0.75
10	13	0.632123	0.36428	0.1	9.50E+07	18.37223	28.85	0.031	0.05	1.1	0.75
10	14	0.556056	0.450323	0.1	1.10E+08	18.489	27.95	0.035	0.05	0.1	0.75
10	15	0.551553	0.491544	0.1	1.20E+08	18.60794	26.87	0.04	0.05	0.3	0.75
10	16	0.512752	0.517988	0.1	1.30E+08	18.66039	27.85	0.065	0.05	-0.1	0.75
10	17	0.512752	0.517988	0.1	1.30E+08	18.66039	28.85	0.059	0.05	-0.1	0.75
10	18	0.512752	0.517988	0.1	1.30E+08	18.66039	28.15	0.06	0.05	-0.1	0.75
10	19	0.739678	0.367724	0.08	1.40E+08	18.75172	28.15	0.09	0	0.1	0.75
10	20	0.739678	0.367724	0.08	1.40E+08	18.75172	28.45	0.12	0	0.2	0.75

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

10	21	0.730306	0.37465	0.08	1.50E+08	18.80968	28.45	0.17	0	0.5	0.75
10	22	0.653251	0.390287	0.08	1.50E+08	18.85124	29.4	0.19	0	-0.4	0.75
10	23	0.679595	0.398012	0.08	1.60E+08	18.89754	29.34	0.03	0	0.9	0.75
10	24	0.727379	0.353568	0.08	1.60E+08	18.91205	27.6	0.024	0	0.5	0.8
10	25	0.777805	0.307564	0.08	1.70E+08	18.95353	27.6	0.01	0	0.8	0.85
10	26	0.719875	0.300691	0.08	2.00E+08	19.09113	27.6	0.018	0	0.1	0.85
10	27	0.701092	0.289015	0.08	2.00E+08	19.12138	26.5	0.017	0	0.1	0.95
10	28	0.757383	0.275542	0.08	1.90E+08	19.04881	26.75	0.019	0	0.2	0.95
10	29	0.65798	0.365704	0.08	2.00E+08	19.10573	25.7	0.21	0	0.3	0.95
10	30	0.624205	0.376573	0.08	2.10E+08	19.15668	26.5	0.031	0	0.1	0.95
10	31	0.668013	0.311253	0.08	2.20E+08	19.19914	26.15	0.035	0	0.9	0.95
10	32	0.663589	0.286425	0.08	2.20E+08	19.22811	27.2	0.04	0	0.1	0.95
11	1	0.336061	0	0.1	4.00E+06	15.20582	5.25	0.065	0.1	-2.1	0.5
11	2	0.576401	0.476856	0.1	4.60E+06	15.34793	5.15	0.059	0.1	-1.1	0.5
11	3	0.576401	0.476856	0.1	4.60E+06	15.34793	5.1	0.06	0.1	-1	0.5
11	4	0.576401	0.476856	0.1	4.60E+06	15.34793	9.7	0.09	0.1	0.6	0.5
11	5	0.431269	0.518564	0.1	2.70E+07	17.09915	7.73	0.12	0.1	1	0.5
11	6	0.431269	0.518564	0.1	2.70E+07	17.09915	9.97	0.17	0.1	0.4	0.5
11	7	0.569731	0.356384	0.1	2.60E+07	17.07331	17	0.19	0.1	-0.5	0.5
11	8	0.673064	0.33054	0.1	2.60E+07	17.06322	21.87	0.03	0.1	0.8	0.5
11	9	0.638147	0.336968	0.1	2.80E+07	17.13994	26.38	0.024	0.1	-0.1	0.5
11	10	0.608731	0.374606	0.1	3.20E+07	17.26818	27.35	0.01	0.1	0.5	0.5
11	11	0.762987	0.261079	0.1	3.00E+07	17.21822	27.95	0.018	0.05	0.7	0.75
11	12	0.705705	0.271201	0.1	3.30E+07	17.32404	29.47	0.017	0.05	1	0.75
11	13	0.567869	0.331213	0.1	4.00E+07	17.49487	28.85	0.019	0.05	1.1	0.75
11	14	0.684508	0.321061	0.1	4.50E+07	17.63083	27.95	0.21	0.05	0.1	0.75

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

11	15	0.709158	0.313908	0.1	5.30E+07	17.79498	26.87	0.031	0.05	0.3	0.75
11	16	0.638542	0.362071	0.1	5.70E+07	17.8612	27.85	0.035	0.05	-0.1	0.75
11	17	0.638542	0.362071	0.1	5.70E+07	17.8612	28.85	0.04	0.05	-0.1	0.75
11	18	0.638542	0.362071	0.1	5.70E+07	17.8612	28.15	0.065	0.05	-0.1	0.75
11	19	0.781604	0.299144	0.06	6.20E+07	17.94212	28.15	0.059	0	0.1	0.75
11	20	0.781604	0.299144	0.06	6.20E+07	17.94212	28.45	0.06	0	0.2	0.75
11	21	0.712219	0.343419	0.06	6.40E+07	17.96795	28.45	0.09	0	0.5	0.75
11	22	0.719706	0.321755	0.06	6.60E+07	17.99759	29.4	0.12	0	-0.4	0.75
11	23	0.678724	0.387197	0.06	7.10E+07	18.07194	29.34	0.17	0	0.9	0.75
11	24	0.751269	0.309682	0.06	7.10E+07	18.08162	27.6	0.19	0	0.5	0.8
11	25	0.769904	0.290167	0.06	7.50E+07	18.13347	27.6	0.03	0	0.8	0.85
11	26	0.837009	0.222605	0.06	7.40E+07	18.12614	27.6	0.024	0	0.1	0.85
11	27	0.829588	0.241001	0.06	7.20E+07	18.08803	26.5	0.01	0	0.1	0.95
11	28	0.799243	0.296603	0.06	7.10E+07	18.07777	26.75	0.018	0	0.2	0.95
11	29	0.823593	0.259469	0.06	7.10E+07	18.07117	25.7	0.017	0	0.3	0.95
11	30	0.842124	0.24476	0.06	7.40E+07	18.11332	26.5	0.019	0	0.1	0.95
11	31	0.792344	0.278628	0.06	8.00E+07	18.199	26.15	0.21	0	0.9	0.95
11	32	0.757051	0.287951	0.06	8.70E+07	18.27677	27.2	0.031	0	0.1	0.95
12	1	0.552	0.29	0.1	3.90E+06	15.16535	5.25	0.035	0.1	-2.1	0.5
12	2	1.14082	0.367554	0.1	3.40E+06	15.04766	5.15	0.04	0.1	-1.1	0.5
12	3	1.08676	0.264298	0.1	5.70E+06	15.56066	5.1	0.065	0.1	-1	0.5
12	4	1.1468	0.119121	0.1	5.90E+06	15.58892	9.7	0.059	0.1	0.6	0.5
12	5	1.00188	0.147708	0.1	7.80E+06	15.86573	7.73	0.06	0.1	1	0.5
12	6	1.17959	0.333336	0.1	1.10E+07	16.17703	9.97	0.09	0.1	0.4	0.5
12	7	0.793425	0.454358	0.1	2.20E+07	16.91021	17	0.12	0.1	-0.5	0.5
12	8	0.793425	0.454358	0.1	2.20E+07	16.91021	21.87	0.17	0.1	0.8	0.5

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

12	9	0.730177	0.485024	0.1	2.20E+07	16.89539	26.38	0.19	0.1	-0.1	0.5
12	10	0.663611	0.382052	0.1	2.20E+07	16.91252	27.35	0.03	0.1	0.5	0.5
12	11	0.538147	0.459695	0.1	2.10E+07	16.85041	27.95	0.024	0.05	0.7	0.75
12	12	0.637109	0.257248	0.1	1.80E+07	16.72526	29.47	0.01	0.05	1	0.75
12	13	0.615731	0.311014	0.1	2.10E+07	16.86158	28.85	0.018	0.05	1.1	0.75
12	14	1.09727	0.170996	0.1	3.10E+07	17.24016	27.95	0.017	0.05	0.1	0.75
12	15	0.758383	0.545521	0.1	4.40E+07	17.59029	26.87	0.019	0.05	0.3	0.75
12	16	1.19081	0.106397	0.1	3.60E+07	17.40234	27.85	0.21	0.05	-0.1	0.75
12	17	1.19081	0.106397	0.1	3.60E+07	17.40234	28.85	0.031	0.05	-0.1	0.75
12	18	1.19081	0.106397	0.1	3.60E+07	17.40234	28.15	0.035	0.05	-0.1	0.75
12	19	1.09071	0.105781	0.117	4.40E+07	17.60091	28.15	0.04	0	0.1	0.75
12	20	1.09071	0.105781	0.117	4.40E+07	17.60091	28.45	0.065	0	0.2	0.75
12	21	0.693667	0.369876	0.117	5.30E+07	17.78008	28.45	0.059	0	0.5	0.75
12	22	0.693667	0.369876	0.117	5.30E+07	17.78008	29.4	0.06	0	-0.4	0.75
12	23	0.984688	0.067716	0.117	6.60E+07	17.99894	29.34	0.09	0	0.9	0.75
12	24	0.81076	0.104987	0.117	6.90E+07	18.05018	27.6	0.12	0	0.5	0.8
12	25	0.847934	0.106769	0.117	7.30E+07	18.10308	27.6	0.17	0	0.8	0.85
12	26	0.886104	0.098358	0.117	6.60E+07	18.0013	27.6	0.19	0	0.1	0.85
12	27	0.886104	0.098358	0.17	6.60E+07	18.0013	26.5	0.03	0	0.1	0.95
12	28	1.0162	0.086521	0.117	7.10E+07	18.07488	26.75	0.024	0	0.2	0.95
12	29	1.0162	0.086521	0.117	7.10E+07	18.07488	25.7	0.01	0	0.3	0.95
12	30	0.91267	0.10727	0.117	9.30E+07	18.3534	26.5	0.018	0	0.1	0.95
12	31	0.815682	0.148098	0.117	9.50E+07	18.36468	26.15	0.017	0	0.9	0.95
12	32	0.85293	0.075668	0.117	9.90E+07	18.40848	27.2	0.019	0	0.1	0.95
13	1	0.758551	0.219036	0.1	4.00E+07	17.50375	5.25	0.21	0.1	-2.1	0.5
13	2	0.758551	0.219036	0.1	4.00E+07	17.50375	5.15	0.031	0.1	-1.1	0.5

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

13	3	0.934833	0.239331	0.1	4.30E+07	17.56708	5.1	0.035	0.1	-1	0.5
13	4	0.934833	0.239331	0.1	4.30E+07	17.56708	9.7	0.04	0.1	0.6	0.5
13	5	0.934833	0.239331	0.1	4.30E+07	17.56708	7.73	0.065	0.1	1	0.5
13	6	0.741715	0.184382	0.1	4.40E+07	17.60438	9.97	0.059	0.1	0.4	0.5
13	7	0.651366	0.310679	0.1	5.00E+07	17.72868	17	0.06	0.1	-0.5	0.5
13	8	0.669096	0.266939	0.1	5.30E+07	17.78152	21.87	0.09	0.1	0.8	0.5
13	9	0.625592	0.29714	0.1	5.90E+07	17.88931	26.38	0.12	0.1	-0.1	0.5
13	10	0.544157	0.273409	0.1	6.00E+07	17.90499	27.35	0.17	0.1	0.5	0.5
13	11	0.746862	0.120777	0.1	5.00E+07	17.73582	27.95	0.19	0.05	0.7	0.75
13	12	0.746862	0.120777	0.1	5.00E+07	17.73582	29.47	0.03	0.05	1	0.75
13	13	0.659945	0.191326	0.1	6.80E+07	18.03622	28.85	0.024	0.05	1.1	0.75
13	14	0.607581	0.248504	0.1	7.70E+07	18.15784	27.95	0.01	0.05	0.1	0.75
13	15	0.600049	0.198123	0.1	8.80E+07	18.29619	26.87	0.018	0.05	0.3	0.75
13	16	0.683331	0.204775	0.1	1.30E+08	18.67923	27.85	0.017	0.05	-0.1	0.75
13	17	0.683331	0.204775	0.1	1.30E+08	18.67923	28.85	0.019	0.05	-0.1	0.75
13	18	0.819243	0.213274	0.1	1.90E+08	19.05498	28.15	0.21	0.5	-0.1	0.75
13	19	0.819243	0.213274	0.14	1.90E+08	19.05498	28.15	0.031	0	0.1	0.75
13	20	0.819243	0.213274	0.14	1.90E+08	19.05498	28.45	0.035	0	0.2	0.75
13	21	0.80762	0.203381	0.14	2.00E+08	19.09467	28.45	0.04	0	0.5	0.75
13	22	0.67015	0.204803	0.14	2.50E+08	19.33599	29.4	0.065	0	-0.4	0.75
13	23	0.677508	0.268815	0.14	2.50E+08	19.3458	29.34	0.059	0	0.9	0.75
13	24	0.819633	0.18272	0.14	2.60E+08	19.37087	27.6	0.06	0	0.5	0.8
13	25	0.599939	0.273064	0.14	3.20E+08	19.59553	27.6	0.09	0	0.8	0.85
13	26	0.677817	0.304971	0.14	3.20E+08	19.58599	27.6	0.12	0	0.1	0.85
13	27	0.762765	0.18625	0.14	3.30E+08	19.60327	26.5	0.17	0	0.1	0.95
13	28	0.681857	0.285325	0.14	3.80E+08	19.75783	26.75	0.19	0	0.2	0.95

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

13	29	0.786111	0.201506	0.14	3.50E+08	19.67217	25.7	0.0533	0	0.3	0.95
13	30	0.813957	0.204084	0.14	3.80E+08	19.7473	26.5	0.1139	0	0.1	0.95
13	31	0.795287	0.215639	0.14	3.80E+08	19.76777	26.15	0.1109	0	0.9	0.95
13	32	0.785737	0.208564	0.14	5.10E+08	20.058	27.2	0.1758	0	0.1	0.95
14	1	0.611812	0.323471	0.1	2.10E+07	16.84038	5.25	0.1237	0.1	-2.1	0.5
14	2	0.611812	0.323471	0.1	2.10E+07	16.84038	5.15	0.0648	0.1	-1.1	0.5
14	3	0.668301	0.151371	0.1	2.10E+07	16.86164	5.1	0.0487	0.1	-1	0.5
14	4	0.772932	0.2089	0.1	2.40E+07	16.98821	9.7	0.0681	0.1	0.6	0.5
14	5	0.751651	0.183981	0.1	2.60E+07	17.05482	7.73	0.0991	0.1	1	0.5
14	6	0.751651	0.183981	0.1	2.60E+07	17.05482	9.97	0.0533	0.1	0.4	0.5
14	7	0.730177	0.485024	0.1	2.20E+07	16.89539	17	0.0301	0.1	-0.5	0.5
14	8	0.887233	0.219964	0.1	3.30E+07	17.2979	21.87	0.02	0.1	0.8	0.5
14	9	0.881329	0.221847	0.1	4.10E+07	17.52809	26.38	0.0195	0.1	-0.1	0.5
14	10	0.98243	0.281943	0.1	4.10E+07	17.52809	27.35	0.0598	0.1	0.5	0.5
14	11	1.04854	0.346114	0.1	3.90E+07	17.47952	27.95	0.0485	0.05	0.7	0.75
14	12	0.913338	0.35864	0.1	4.30E+07	17.57653	29.47	0.0452	0.05	1	0.75
14	13	0.977264	0.300557	0.1	4.80E+07	17.67642	28.85	0.2241	0.05	1.1	0.75
14	14	0.878361	0.330697	0.1	5.40E+07	17.79555	27.95	0.2599	0.05	0.1	0.75
14	15	0.709158	0.313908	0.1	5.30E+07	17.79498	26.87	0.2721	0.05	0.3	0.75
14	16	1.17863	0.31569	0.1	7.10E+07	18.08164	27.85	0.2628	0.05	-0.1	0.75
14	17	1.17863	0.31569	0.16	7.10E+07	18.08164	28.85	0.1529	0.05	-0.1	0.75
14	18	1.17863	0.31569	0.16	7.10E+07	18.08164	28.15	0.2097	0.05	-0.1	0.75
14	19	1.62976	0.258082	0.16	7.60E+07	18.14548	28.15	0.0997	0	0.1	0.75
14	20	1.62976	0.258082	0.16	7.60E+07	18.14548	28.45	0.0734	0	0.2	0.75
14	21	1.67393	0.146791	0.16	7.30E+07	18.10725	28.45	0.0324	0	0.5	0.75
14	22	0.765132	0.267738	0.16	1.10E+08	18.47286	29.4	0.0155	0	-0.4	0.75

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

14	23	0.899111	0.175261	0.16	1.00E+08	18.43358	29.34	0.0147	0	0.9	0.75
14	24	0.876868	0.182554	0.16	1.20E+08	18.58434	27.6	0.0185	0	0.5	0.8
14	25	0.835594	0.200134	0.16	1.30E+08	18.67997	27.6	0.0047	0	0.8	0.85
14	26	0.985319	0.15016	0.16	1.30E+08	18.64696	27.6	0.0056	0	0.1	0.85
14	27	0.932352	0.196665	0.16	1.30E+08	18.70589	26.5	0.2152	0	0.1	0.95
14	28	0.91349	0.221508	0.16	1.30E+08	18.68258	26.75	0.3071	0	0.2	0.95
14	29	0.917058	0.164019	0.16	1.40E+08	18.72463	25.7	0.2708	0	0.3	0.95
14	30	0.888961	0.176838	0.16	1.50E+08	18.80766	26.5	0.0011	0	0.1	0.95
14	31	0.89791	0.160939	0.16	1.60E+08	18.85916	26.15	0.0006	0	0.9	0.95
14	32	0.952741	0.144313	0.16	1.60E+08	18.85901	27.2	0.0006	0	0.1	0.95
15	1	0.588554	0	0.1	1.20E+07	16.32431	5.25	0.0038	0.1	-2.1	0.5
15	2	0.401346	0.530858	0.1	1.40E+07	16.42052	5.15	0.0025	0.1	-1.1	0.5
15	3	0.344984	0.634999	0.1	1.50E+07	16.54675	5.1	0.0025	0.1	-1	0.5
15	4	0.496482	0.418577	0.1	2.00E+07	16.81235	9.7	0.0031	0.1	0.6	0.5
15	5	0.362393	0.357257	0.1	1.90E+07	16.75714	7.73	0.0038	0.1	1	0.5
15	6	0.287898	0.452241	0.1	2.00E+07	16.80807	9.97	0.0033	0.1	0.4	0.5
15	7	0.287898	0.452241	0.1	2.00E+07	16.80807	17	0.003	0.1	-0.5	0.5
15	8	0.372864	0.331585	0.1	2.10E+07	16.85794	21.87	0.0015	0.1	0.8	0.5
15	9	0.372864	0.331585	0.1	2.10E+07	16.85794	26.38	0.0011	0.1	-0.1	0.5
15	10	0.566117	0.319651	0.1	3.60E+07	17.40972	27.35	0.0006	0.1	0.5	0.5
15	11	0.563129	0.254864	0.1	3.30E+07	17.30928	27.95	0.0006	0.05	0.7	0.75
15	12	0.558727	0.266665	0.1	3.00E+07	17.22106	29.47	0.0005	0.05	1	0.75
15	13	0.547777	0.210054	0.1	3.60E+07	17.38985	28.85	0.0009	0.05	1.1	0.75
15	14	0.48547	0.372229	0.1	4.20E+07	17.54225	27.95	0.0008	0.05	0.1	0.75
15	15	0.617597	0.274773	0.1	4.90E+07	17.71426	26.87	0.0008	0.05	0.3	0.75
15	16	0.649397	0.230969	0.1	4.40E+07	17.6028	27.85	0.0004	0.05	-0.1	0.75

LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS

15	17	0.649397	0.230969	0.1	4.40E+07	17.6028	28.85	0.0013	0.05	-0.1	0.75
15	18	0.649397	0.230969	0.1	4.40E+07	17.6028	28.15	0.0195	0.05	-0.1	0.75
15	19	0.601466	0.226198	0.1	4.50E+07	17.62606	28.15	0.0262	0	0.1	0.75
15	20	0.601466	0.226198	0.1	4.50E+07	17.62606	28.45	0.0025	0	0.2	0.75
15	21	0.640872	0.165073	0.1	4.30E+07	17.57427	28.45	0.0025	0	0.5	0.75
15	22	0.581187	0.451193	0.1	5.70E+07	17.8553	29.4	0.0031	0	-0.4	0.75
15	23	0.685436	0.329418	0.1	5.00E+07	17.73039	29.34	0.0038	0	0.9	0.75
15	24	0.652002	0.271576	0.1	4.90E+07	17.70475	27.6	0.0033	0	0.5	0.8
15	25	0.68784	0.169383	0.1	4.90E+07	17.70196	27.6	0.003	0	0.8	0.85
15	26	0.646289	0.201946	0.1	5.50E+07	17.82079	27.6	0.0025	0	0.1	0.85
15	27	0.702139	0.20376	0.1	5.40E+07	17.80063	26.5	0.0025	0	0.1	0.95
15	28	0.807313	0.103394	0.1	6.10E+07	17.91961	26.75	0.0031	0	0.2	0.95
15	29	0.885673	0.107515	0.1	6.00E+07	17.90549	25.7	0.0038	0	0.3	0.95
15	30	0.809487	0.195509	0.1	6.40E+07	17.98059	26.5	0.0033	0	0.1	0.95
15	31	0.775894	0.225755	0.1	6.30E+07	17.95262	26.15	0.003	0	0.9	0.95
15	32	0.804063	0.135609	0.1	6.70E+07	18.01727	27.2	0.0038	0	0.1	0.95

APPENDIX 6 : MULTIPLE CURRENCY ERA PANEL REGRESSIONS RESULTS

```

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    / _ / _ _ / / _ _ /
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```
. sum lqr lq cad size spreads npl rrr infl
```

Variable	Obs	Mean	Std. Dev.	Min	Max
-----+-----					
lqr	480	.6305669	.278013	.0131869	1.673926

Asymptotics: $N \rightarrow \text{Infinity}$

T Fixed

Time trend: Not included

	Statistic	z	p-value
rho	- 0.0868	-19.7753	0.0000

```
. xtunitroot ht size
```

Harris-Tzavalis unit-root test for size

Ho: Panels contain unit roots	Number of panels =	15
Ha: Panels are stationary	Number of periods =	32

Asymptotics: $N \rightarrow \text{Infinity}$

T Fixed

Time trend: Not included

Statistic	z	p-value
-----------	---	---------

rho	-0.0795	-38.9583	0.0000
-----	---------	----------	--------

. xtunitroot ht spreads

Harris-Tzavalis unit-root test for dspreads

Ho: Panels contain unit roots	Number of panels =	15
Ha: Panels are stationary	Number of periods =	32

AR parameter: Common	Asymptotics: N -> Infinity
----------------------	----------------------------

Panel means: Included	T Fixed
--------------------------	---------

Time trend: Not included

	Statistic	z	p-value
rho	0.3740	-21.0367	0.0000

. xtunitroot ht npl

Harris-Tzavalis unit-root test for npl

Ho: Panels contain unit roots	Number of panels =	15
-------------------------------	--------------------	----

Ha: Panels are stationary Number of periods = 32

AR parameter: Common Asymptotics: N -> Infinity

Panel means: Included T Fixed

Time trend: Not included

	Statistic	z	p-value
rho	0.3296	-23.6066	0.0000

. xtunitroot ht rrr

Harris-Tzavalis unit-root test for rrr

Ho: Panels contain unit roots Number of panels = 15

Ha: Panels are stationary Number of periods = 32

AR parameter: Common Asymptotics: N -> Infinity

Panel means: Included T Fixed

Time trend: Not included

	Statistic	z	p-value
--	-----------	---	---------

```

-----
rho                0.7449      -6.6866      0.0000
-----

```

```

. xtunitroot ht infl

```

```

Harris-Tzavalis unit-root test for infl

```

```

-----

```

```

Ho: Panels contain unit roots      Number of panels =      15
Ha: Panels are stationary          Number of periods =      32

```

```

AR parameter: Common              Asymptotics: N -> Infinity
Panel means:   Included              T Fixed
Time trend:    Not included

```

```

-----
Statistic          z          p-value
-----
rho                0.3301      -23.5867      0.0000
-----

```

```

. corr lqr cad size spreads npl rrr infl

(obs=480)

```

	lqr	cad	size	spreads	npl	rrr	infl
-----+-----							
lqr	1.0000						
cad	-0.0957	1.0000					
size	-0.0440	0.0204	1.0000				
spreads	0.2889	0.0743	0.2820	1.0000			
npl	0.0690	0.0439	0.0524	0.0155	1.0000		
rrr	-0.3077	-0.1830	-0.3189	-0.6184	0.0323	1.0000	
infl	0.1440	-0.0027	0.1314	0.4844	-0.0172	-0.2631	1.0000

```
. reg lqr cad size1 spreads npl rrr infl
```

Source	SS	df	MS	Number of obs =	480
-----+-----					
Model	9.60139655	6	1.60023276	F(6, 473) =	27.60
Residual	27.421104	473	.057972736	Prob > F =	0.0000
-----+-----					
				R-squared =	0.2593
				Adj R-squared =	0.2499
Total	37.0225006	479	.077291233	Root MSE =	.24078

lqr	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----+-----						
cad	-.1412527	.4100542	-0.34	0.731	-.947006	.6645005

size1	-8.30e-10	9.33e-11	-8.90	0.000	-1.01e-09	-6.47e-10
spreads	-.0020028	.0021149	-0.95	0.344	-.0061585	.0021529
npl	.1219455	.0139485	8.74	0.000	.0945368	.1493541
rrr	-.8806257	.3102502	-2.84	0.005	-1.490265	-.2709866
infl	-.0160012	.0190792	-0.84	0.402	-.0534917	.0214894
_cons	-1.24511	.2179634	-5.71	0.000	-1.673407	-.816814

. ovtest

Ramsey RESET test using powers of the fitted values of liquid

Ho: model has no omitted variables

F(3, 458) = 1.96

Prob > F = 0.1189

. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of liquid

chi2(1) = 0.96

Prob > chi2 = 0.3268

```
. xtreg lqr cad size1 spreads npl rrr infl, fe
```

```
Fixed-effects (within) regression           Number of obs   =       480

Group variable: bank                       Number of groups =       15

R-sq:  within = 0.6186                     Obs per group:  min =       32
        between = 0.6103                               avg =      32.0
        overall = 0.5991                               max =       32

                                           F(6,459)         =    124.09

Prob > F                =    0.0000
```

```
-----+-----
      lqr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----+-----
      cad |   -.263565   .0212054   -12.43   0.000   -.3052367   -.2218933
     size1 |   .8413066   .3150968     2.67   0.008    .2220954    1.460518
   spreads |  -.004783   .0011726    -4.08   0.000   -.0070872   -.0024787
      npl |   .2577466   .0121629    21.19   0.000    .2338447    .2816485
      rrr |  -.3519638   .1750229    -2.01   0.045   -.6959093   -.0080183
     infl |  -.0308059   .0098275    -3.13   0.002   -.0501184   -.0114933
    _cons |   1.059978   .26567      3.99   0.000    .5378974    1.582058
-----+-----
```

```

sigma_u | .13515812

sigma_e | .12313236

rho | .54645836 (fraction of variance due to u_i)

-----

F test that all u_i=0:      F(14, 459) =    26.77          Prob > F = 0.0000

. est store fe

. xtreg lqr cad size1 spreads npl rrr infl, re

Random-effects GLS regression              Number of obs      =        480
Group variable: bank                      Number of groups   =         15

R-sq:  within  = 0.6181                   Obs per group: min =         32
        between = 0.6477                                avg =        32.0
        overall = 0.6180                                max =         32

Random effects u_i ~ Gaussian              Wald chi2(6)        =       763.80
corr(u_i, X)      = 0 (assumed)           Prob > chi2         =       0.0000

-----

lqr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
cad |   -0.2797871   .0199414   -14.03   0.000   -0.3188715   -0.2407026

```

```

      size1 |   .8943225   .3076445    2.91   0.004   .2913505   1.497295
spread1 |  -.0044882   .0011634   -3.86   0.000  -.0067685  -.0022079
      npl |   .2618687   .0119554   21.90   0.000   .2384366   .2853008
      rrr |  -.3995048   .1737742   -2.30   0.022  -.7400959  -.0589137
      infl | -.0308698   .0098467   -3.14   0.002  -.050169   -.0115706
      _cons |   1.276925   .2498876    5.11   0.000   .7871543   1.766696
-----+-----
      sigma_u |   .1208089
      sigma_e |   .12313236
      rho |   .4904762   (fraction of variance due to u_i)
-----+-----

. est store re

. hausman fe re

      ---- Coefficients ----
      |      (b)      (B)      (b-B)      sqrt(diag(V_b-V_B))
      |      fe      re      Difference      S.E.
-----+-----

      cad |   -.263565   -.2797871    .0162221    .0072117
      size1 |   .8413066   .8943225   -.0530159    .0681241
spread1 |   -.004783   -.0044882   -.0002948    .000146
      npl |   .2577466   .2618687   -.0041221    .0022374
      rrr |  -.3519638   -.3995048    .047541    .0208699
      infl |  -.0308059   -.0308698    .0000639      .

```

```
-----  
b = consistent under Ho and Ha; obtained from xtreg  
  
B = inconsistent under Ha, efficient under Ho; obtained from xtreg  
  
Test: Ho: difference in coefficients not systematic  
  
chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)  
= 6.74  
  
Prob>chi2 = 0.3460  
  
(V_b-V_B is not positive definite)
```

**ALTERNATIVE MEASURE OF LIQUIDITY RISK RESULTS IN THE
MULTIPLE CURRENCY ERA (LQ)**

```
xtreg lq cad size1 spreads pvtloans1 rrr infl, fe  
  
Fixed-effects (within) regression      Number of obs      =      480  
  
Group variable: bank                  Number of groups    =      15  
  
R-sq:  within  = 0.4161                Obs per group: min =      32  
      between  = 0.6245                                avg  =      32.0  
      overall  = 0.4935                                max  =      32  
  
                                         F(6,459)           =      54.51  
                                         Prob > F           =      0.0000
```

```
-----  
lq |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]  
-----+-----  
cad |   .2307688   .0269965     8.55   0.000   .1777167   .283821
```

```

      size1 |   -1.319932    .401149   -3.29   0.001   -2.108248   -.5316158
    spreads |   -.0010459    .0014928   -0.70   0.484   -.0039794    .0018877
      npl   |   -.1920738    .0154846  -12.40   0.000   -.2225033   -.1616443
      rrr   |    .5889407    .2228212    2.64   0.008    .1510645    1.026817
      infl  |    .0637333    .0125114    5.09   0.000    .0391465    .0883201
      _cons |    -.36928    .3382238   -1.09   0.275   -1.033939    .2953791
-----+-----

. xtreg lq cad size1 spreads pvtloans1 rrr infl, re

Random-effects GLS regression              Number of obs   =       480
Group variable: bank                      Number of groups  =       15

R-sq:  within  = 0.4152                   Obs per group: min =       32
      between = 0.6494                               avg   =      32.0
      overall  = 0.5095                               max   =       32

Random effects u_i ~ Gaussian              Wald chi2(6)      =      347.96
corr(u_i, X)      = 0 (assumed)           Prob > chi2       =      0.0000
-----+-----

      lq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      cad |   .2523839   .024307    10.38   0.000    .204743    .3000247

```

size1	-1.334969	.3846829	-3.47	0.001	-2.088933	-.5810042
spreads	-.0013457	.0014728	-0.91	0.361	-.0042324	.001541
npl	-.1989111	.015024	-13.24	0.000	-.2283577	-.1694645
rrr	.6427531	.220046	2.92	0.003	.2114709	1.074035
infl	.0641829	.0125459	5.12	0.000	.0395933	.0887725
_cons	-.6429712	.301849	-2.13	0.033	-1.234584	-.051358

-----+-----

APPENDIX 7: INTERVIEW GUIDE



LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS DURING THE ZIMBABWEAN DOLLAR ERA

INTERVIEW SCHEDULE

--	--	--	--	--

Introductions

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES
101.	When was the bank established in Zimbabwe?	☐ ☐ ☐ ☐
102.	Is the bank locally owned or internationally owned?	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES
103.	Who was responsible for liquidity risk management in your bank?	
104.	How was liquidity managed in your bank?	
105.	How would you characterise the liquidity position of your bank then?	
106.	Issues on Liability Management	
107.	What were the major sources of funds from 2000-2008?	
108.	What products were offered during this period?	
109.	With regard to money market investments (yes/no) the bank would; (a) charge a penalty to depositors for withdrawal where no notice was given or early redemption of investment? (b) show rate of return considering the amount of money being invested? (c) show rate considering the tenor of the investment? (d) show rate considering if the investment was being rolled over? (e) show rate considering the client relationship?	
110.	What were the considerations when setting money market investment rates?	
111.	Issues on Asset Management	
112.	What were the major applications of the bank's funds?	
113.	What were the sources of funds used for lending from 2000-2008?	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES
114.	What were the main considerations when lending to individuals?	
115.	What were the main considerations when lending to corporate clients?	
116.	When a client defaulted, what would the bank do?	
117.	In order of preference, what would the bank do if the bank position was down?	
118.	Please summarise the effects of inflation on the following: (i) Demand deposit tenors (ii) Fixed term products (iii) Deposit mobilisation from individuals (iv) Deposit mobilisation from public service (v) Cost of funds (v) Investment portfolio	
119.	Briefly comment on the effect of the following instruments introduced by the RBZ to fight inflation on your asset and liability management: (i) Accommodation Rate (ii) Statutory Reserve Ratio (iii) Open market Operations (iv) Financial Sector Stabilisation Bonds (FSSBs)	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES
	(v) Interest rate policy	
120.	What guided the banks' liquidity management during the 2000-2008 period?	
121.	What role did the Reserve Bank play in liquidity management?	
122.	What were the potential liquidity problems that the bank would predict in the Zimbabwean dollar era?	
123.	What did you do as a bank, in the face of the increasing challenging operating environment in the Zimbabwean dollar era?	

Thank you for your cooperation!

APPENDIX 8: QUESTIONNAIRE EXHIBIT



LIQUIDITY RISK MANAGEMENT BY ZIMBABWEAN COMMERCIAL BANKS IN THE MULTIPLE CURRENCY REGIME

Please answer **all** the questions by either writing your response in the space provided or circling the number that corresponds to your response.

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES			
124.	When was the bank registered	Year			
125.	Is it locally or internationally owned?	Locally owned.....	1		
		Internationally.....	2		
126.	How many branches does the bank have?				
127.	Who is responsible for the management of liquidity risk?	Treasury.....	1		
		Risk Division.....	2		
		Corporate Banking.....	3		
		Other, specify_____	4		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES			
128.	Are funds management and liquidity decisions centralised at the head office?	Yes	1		
		No	2		
129.	How is bank liquidity managed in your bank?	Daily.....	1		
		Weekly	2		
		Monthly.....	3		
		Other, specify.....	4		
130.	How would you characterise the liquidity position of your bank?	Very satisfactory.....	1		
		Satisfactory	2		
		Less satisfactory	3		
		Other, specify.....	4		
131.	Liability Management				
132.	What are your major sources of funds?	Increasing liabilities.....	1		
		Securitising.....	2		
		Selling assets.....	3		
		Other, specify.....	4		
133.	What products are offered by your bank? <i>(Tick all applicable)</i>	Fixed deposit accounts	1		
		Savings accounts	2		
		Current accounts	3		
		Foreign Current Accounts.....	4		
		Other, specify.....	5		

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES			
134.	Please rate the following statements by indicating agreement or disagreement with each.		Yes	No	
	(a) Do you charge a penalty to depositors for withdrawal/redemption of investments where no notice is given?		1	2	
	(b) Do you consider rates being offered by other banks to decide on your own investment rates?		1	2	
	(c) Do you consider amounts being invested when showing rates to clients?		1	2	
	(d) Do you consider tenor when offering rates?		1	2	
	(e) Do you make considerations when a client rolls over the investment?		1	2	
	(f) Do you consider client relationships in showing investment rates?		1	2	
112	Summarise the main considerations when setting money market rates.				
	Please rank with 1 st choice, 2 nd choice or 3 rd choice	1st choice	2nd choice	3rd choice	
	To manage demand for liquidity from depositors, your bank:				
	(i) Relies on cash reserves to fulfill daily liquidity withdrawals.	1	2	3	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES					
	(ii) Communicates with depositors who have big amounts of deposits regarding their withdrawal time schedule. (iii) Regularly calculates and analyses pattern of liquidity withdrawal for anticipation.	1 1	2 2	3 3			
	Asset Management						
135.	What are the major applications of funds?						
136.	What are the sources of funds for lending?						
137.	What considerations does your bank make when lending to corporate clients?						
138.	What considerations does your bank make when lending to individuals?						

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES				
139.	Please rank with most preferable, preferable, less preferable, not preferable When lending, your bank: (a) Prefers proposals of high net worth clients financed before (b) Lends based on financial statements (c) Lends based on security (d) Lends to clients with accounts with the bank (e) Lends short term (f) Lends for long term	Most Prefe rable 1 1 1 1 1 1 1	Prefer able 2 2 2 2 2 2	Less preferab le 3 3 3 3 3 3	Not prefer able 4 4 4 4 4 4	
140.	What does the bank do when a client defaults?					
141.	What have been the major causes of non-performing loans in the multiple currency regime?					
142.	Asset and Liability Management					

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES						
143.	Please rank with 1st choice, 2nd choice,3rd choice, 4th, 5th, 6th,or 7th choice If your bank position is due (by depositors withdrawals exceeding liquidity reserves), your bank will: (i) Borrow funds from the holding company (ii) Borrow funds from the interbank market (iii) Sell securities owned in the secondary market (iv) Withdraw private placement from other banks (v) Use bank’s capital to cover liquidity demanded (vi) Ask depositors to wait for extra days (vii) Borrow from the Reserve bank of Zimbabwe	1 st	2 nd	3 rd	4 th	5 rd	6 th	7 th
		1	2	3	4	5	6	7
		1	2	3	4	5	6	7
		1	2	3	4	5	6	7
		1	2	3	4	5	6	7
		1	2	3	4	5	6	7
		1	2	3	4	5	6	7
		1	2	3	4	5	6	7
144.	Does your bank have access to offshore lines of credit?	Yes				1		
		No.....				2		
145.	Please summarise the challenges posed by the							

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES				
	multiple currency regime in liquidity management.					
146.	Why has it been that banks are living on the short end of the market?					
	Please rate the following statements by indicating your level of agreement or disagreement to each.	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
147.	There has been increased emphasis on liquidity management in the multiple currency environment than before?	1	2	3	4	5
148.	Money markets in Zimbabwe are active.	1	2	3	4	5
149.	Capital markets in Zimbabwe are active.	1	2	3	4	5
150.	Derivatives markets in Zimbabwe are now active.	1	2	3	4	5
151.	Capital adequacy is affecting liquidity management by banks.	1	2	3	4	5
152.	What role did the Reserve Bank of Zimbabwe play in liquidity management during this period?					
153.	Bank Liquidity Risk Management and the Reserve Bank of Zimbabwe Guidelines					
154.	Does your bank have Board and Senior Management oversight?	Yes..... No.....			1 2	If yes go to 131
155.	What does it entail?					

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES		
156.	Does your bank have liquidity risk policies and procedures manuals?	Yes..... No.....	1 2	If yes go to 133
157.	Do you always follow the policies and procedures?	Yes..... No.....	1 2	
158.	Do you have liquidity risk limits in place?	Yes..... No.....	1 2	If yes go to 135
159.	Please complete the following table showing the liquidity risk Benchmark:	Limit		
160.	Does the bank always adhere to set limits?	Yes..... No.....	1 2	
161.	Do you conduct stress tests of liquidity positions?	Yes..... No.....	1 2	If yes go to 131
162.	How often?			
163.	Do you have contingency liquidity plans?	Yes..... No.....	1 2	If yes go to 140
164.	Do you test them?	Yes..... No.....	1 2	
165.	What system do you use for information systems?			
166.	What are the potential liquidity problems that the bank would predict in the multiple currency era?			
167.	What is the bank doing in the face of the increasing challenging operating environment in the multiple currency			

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES			
	era?				

Thank you for your cooperation!

APPENDIX 9: SUMMARY OF QUESTIONNAIRE RESPONSES

Variable	Frequency	Percentage
Ownership		
Locally-owned	12	80.0
Internationally-owned	3	20.0
Number of branches		
1-5	1	6.7
6-12	5	33.3
13-20	5	33.3
Above 20	4	26.7
Liquidity Risk Responsibility		
Treasury and risk division	15	100
Liquidity Risk Decisions		
Centralised	15	100
Liquidity Risk Management		
Daily	15	100
Liquidity Position		
Very satisfactory	3	20.0
Satisfactory	1	6.7
Less satisfactory	11	73.3
Liability Management		
Major Sources of Funds		
Increasing liabilities	6	40.0
Selling assets	4	26.7
Securitisation	5	33.3
Charge of Penalty on Early Redemption		
Yes	12	80
No	3	20
Considering Amount Being Invested when giving rates		
Yes	15	100
Considering Tenor		
Yes	15	100
Considerations of investment rollovers		

Yes	8	53.0
No	7	47.0
Considering client relationships		
Yes	15	100
Reliance on Cash Reserve		
1 st choice	10	66.7
2 nd choice	3	20.0
3 rd choice	2	13.3
Communication with clients		
1 st choice	4	26.7
2 nd choice	4	26.7
3 rd choice	7	46.7
Pattern of withdrawal		
1 st choice	1	6.7
2 nd choice	9	60.0
3 rd choice	5	33.3
Asset Management		
Prefer Proposals of high net worth clients		
Most Preferable	3	20.0
Preferable	2	13.3
Less preferable	-	-
Not preferable	10	66.7
Lend based on financial statements		
Most Preferable	-	-
Preferable	12	80.0
Less preferable	-	-
Not preferable	3	20.0
Lend based on security		
Preferable	11	73.4
Less preferable	2	13.3
Not preferable	2	13.3

Lend to clients with account with the bank		
Most Preferable	8	53.4
Preferable	5	33.3
Less preferable	-	-
Not preferable	2	13.3
Lend short term		
Most Preferable	15	100
Lend long term		
Not preferable	15	100
Borrowing from Holding Company		
4 th choice	2	13.3
5 th choice	4	26.7
6 th choice	7	46.7
7 th choice	2	13.3
Borrowing funds from interbank		
1 st choice	3	20.0
2 nd choice	4	26.7
3 rd choice	4	26.7
4 th choice	3	20.0
5 th choice	1	6.7
1 st choice	2	13.3
2 nd choice	5	33.3
3 rd choice	3	20.0
4 th choice	3	20.0
5 th choice	2	13.3
Withdrawing investments from other banks		
1 st choice	2	13.3
2 nd choice	2	13.3
3 rd choice	5	33.3
4 th choice	5	33.3

5 th choice	1	6.7
Borrow from the Reserve Bank		
Resort to Lender of the last Resort	0	0
Offshore lines of credit		
Yes	11	73.3
No	4	26.7
Keen to Lend		
Agree	8	13.3
Neutral	2	53.3
Disagree	5	33.3
Money market activities		
Neutral	5	33.3
Disagree	10	66.7
Capital markets		
Agree	3	20.0
Disagree	12	80.0
Derivatives markets		
Strongly disagree	15	100
Capital adequacy		
Strongly agree	2	13.3
Agree	7	46.7
Neutral	6	40.0
Benchmark Analysis		
Board and Senior Management Oversight		
Yes	15	100
Liquidity Policies and Procedures		
Yes	15	100
Adherence to set limits		
Yes	4	26.7
No	11	73.3
Conduct stress tests regularly		

Yes	6	40.0
No	9	60.0
Contingency liquidity plans in place		
Yes	15	100
Testing contingency liquidity plans		
No	15	100

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