SOAS University of London

Centre for Global Finance

Working Paper Series

No. 5 / 2022

Segmentation of the interbank money market in Zambia

By Jonathan M Chipili, Francis Z Mbao, Alick B Lungu, Shula M Sikaona, Anthony Bwalya, and Cosam S Chanda

The Centre for Global Finance (CGF) Working Paper Series features recent studies by resident members of CGF as well as visiting researchers, altogether demonstrating the depth and breadth of research being undertaken at CGF. The papers are published to facilitate preliminary dissemination of ongoing research, enhance quality of work and contribute to the advancement of knowledge. We acknowledge, without implication, financial support from the DEGRP Research Grant (ES/N013344/2) on "Delivering Inclusive Financial Development and Growth", funded by the ESRC and the former UK Department for International Development, which merged with the Foreign & Commonwealth Office on 2 September 2020 to become the Foreign, Commonwealth & Development Office (FCDO), the ESRC-NSFC (ES/P005241/1) Research Grant on "Developing financial systems to support sustainable growth in China – The role of innovation, diversity and financial regulation", and the AXA Research Fund.

List of previous Working Papers of CGF:

No.1/2018 *Capital, risk and profitability of WAEMU banks: Does cross-border banking matter?* By Désiré Kanga, Victor Murinde, and Issouf Soumaré

No.2/2018 *Capital flows and productivity in Africa: The angel is in the details.* By François A. B. Bationo, Stephany Griffith-Jones, Victor Murinde, Issouf Soumaré and Judith Tyson

No.3/2018 *The persistence of bank fragility in Africa: GMM dynamic panel data evidence.* By Abbi M. Kedir, Syed Faizan Iftikhar, Victor Murinde and Bernadette Kamgnia

No.4/2018 *Reflections on central banking*. By Victor Murinde and Patrick Njoroge

No.5/2018 *Let beholders behold: Can banks see beyond oil booms and mitigate the Dutch disease?* By Morakinyo O. Adetutu, John E. Ebireri, Victor Murinde and Kayode A. Odusanya

No.6/2018 *National culture, CEO power and risk-taking by global banks.* By Eilnaz Kashefi Pour and Victor Murinde

No.7/2018 *Corporate investment, financing and payout decisions under financial constraints and uncertainty: Evidence from UK firms*. By Qingwei Meng, Victor Murinde and Ping Wang

No.8/2018 *Bank opacity and risk-taking: Evidence from analysts' forecasts* By Samuel Fosu, Collins G. Ntim, William Coffie, and Victor Murinde

No.9/2018 *Does microcredit increase hope, aspirations and well-being? Evidence from Sierra Leone.* By Adriana Garcia, Robert Lensink, and Maarten Voors

No.10/2018 *Lessons from emerging economies for African low income countries on managing capital flows.* By Stephany Griffith-Jones and José Antonio Ocampo

No.11/2018 *Financial inclusion and economic growth: What do we know?* By Joshua Y. Abor, Haruna Issahaku, Mohammed Amidu, and Victor Murinde

No.12/2018 *Climate vulnerability and the cost of debt.* By Gerhard Kling, Yuen C Lo, Victor Murinde, and Ulrich Volz

No.13/2018 *Pan-African banks on the rise: Does cross-border banking increase firms' Access to finance in WAEMU?* By Désiré Kanga,Victor Murinde, Lemma Senbet, and Issouf Soumaré

No.14/2018 *The peer monitoring role of the interbank market and implications for bank regulation: Evidence from Kenya.* By Victor Murinde, Ye Bai, Christopher J. Green, Isaya Maana, Samuel Tiriongo, and Kethi Ngoka-Kisinguh

No.1/2019 *Central bank independence: What are the key issues*? By Désiré Kanga and Victor Murinde

No.2/2019 *Banking services and inclusive development in sub-Saharan Africa.* By Haruna Issahaku, Mohammed Amidu and Aisha Mohammed Sissy

No.3/2019 *A survey of literature on financial literacy and financial behaviour: Is there a gender gap*? By Maryam Sholevar and Laurence Harris

No.4/2019 *Capital adjustment over the cycle: Evidence from microfinance institutions*. By Issouf Soumaré, Hubert Tchakoute Tchuigoua, and Hélyoth T.S. Hessou

No.5/2019 *Provisioning and business cycle: Evidence from microfinance institutions*. By Hélyoth T.S. Hessou, Robert Lensink, Issouf Soumaré, and Hubert Tchakoute Tchuigoua

No.6/2019 *Lending and business cycle: evidence from microfinance institutions.* By Hubert Tchakoute Tchuigoua, Issouf Soumaré, and Hélyoth T.S. Hessou

No.7/2019 *Term structure of CDS spreads & risk-based capital of the protection seller: an extension of the dynamic Nelson-Siegel model with regime switching.* By Standley R. Baron and Issouf Soumaré

No.8/2019 *Confidence, financial inclusion and sustainable economic development.* By Ayse Demir, Reinhard Bachmann, Victor Murinde, Laurence Harris, Christine Oughton and Meng Xie

No.9/2019 *The network structure of the Malawi interbank market: implications for liquidity distribution and contagion around the banking system.* By Esmie Koriheya Kanyumbu

No.10/2019 *Aid and Exchange Rates in sub-Saharan Africa: No More Dutch Disease?* By Oliver Morrissey, Lionel Roger and Lars Spreng

No.11/2019 *Does credit deepening increase financial fragility*? By Peng Yiqing, Niels Hermes, and Robert Lensink

No.12/2019 *Does microcredit increase aspirational hope? Evidence from a group lending scheme in Sierra Leone.* By Adriana Garcia, Robert Lensink, and Maarten Voors

No.13/2019 *Do better formal institutions promote financial inclusion*? By Peng Yiqing, Niels Hermes, and Robert Lensink

No.14/2019 *Do interbank interest rates reflect the financial soundness of borrowing banks*? By Thomas Bwire, Martin Brownbridge, Doreen K. Rubatsimbira and Grace A. Tinyinondi

No.15/2019 *Institutional environment and the microstructure of the interbank market*. By Thomas Bwire, Martin Brownbridge, Doreen K. Rubatsimbira, and Grace A. Tinyinondi

No.16/2019 *Segmentation of the interbank money market in Zambia*. By Jonathan M Chipili, Francis Z Mbao, Alick B Lungu, Shula M Sikaona, Anthony Bwalya, and Cosam S Chanda

No.1/2020 *How has the rise of Pan-African banks impacted bank stability in WAEMU?* By Désiré Kanga, Victor Murinde, and Issouf Soumaré

No.2/2020 *Threshold effects of financial inclusion on income inequality*. By Ayse Demir, Vanesa Pesqué-Cela, and Victor Murinde

No.3/2020 *FinTech, financial inclusion and income inequality: A quantile regression approach.* By Ayse Demir, Vanesa Pesqué-Cela, Yener Altunbas, Victor Murinde

No.4/2020 *Director reputation and earnings management: evidence from the British honours system*. By Tolulola Lawal

No.5/2020 *Financial inclusion and the growth-inequality-poverty triangle: New evidence from Africa.* By Ayse Demir and Victor Murinde

No.6/2020 *Fellowship amongst peers: A systematic and selective survey of literature on the analysis of interbank lending networks*. By Anosi F. Ikimalo and Victor Murinde

No.7/2020 *Exploring the impact of COVID-19 pandemic on Africa's FinTech space*. By Joshua Yindenaba Abor

No.8/2020 *Financial market integration in sub-saharan Africa: How important is contagion*? By Robert Akunga, Ahmad Hassan Ahmad and Simeon Coleman

No.9/2020 *Finance and well-being in developing countries: Does access to mobile money improve household well-being*? By Fei Jiang, Christopher J. Green, Ahmad Hassan Ahmad and Carlos Sakyi-Nyarko

No.10/2020 *Mobile money, ICT, financial inclusion and inclusive growth: How different is Africa*? By By Fei Jiang, Christopher J. Green, Ahmad Hassan Ahmad and Victor Murinde

No.11/2020 *Financial inclusion and welfare improvement: Empirical evidence from A households survey data*. By Carlos Sakyi-Nyarko, Ahmad Hassan Ahmad and Christopher J. Green

No.12/2020 *The FinTech revolution: What are the opportunities and risks*? By Victor Murinde and Efthymios Rizopoulos

No.13/2020 *The COVID-19 pandemic and its impact on African economies and financial markets: A review*. By Elikplimi Komla Agbloyor and Joshua Yindenaba Abor

No.14/2020 *Online data collection for monitoring the impact of COVID-19*. By Victor Murinde, Athina Petropoulou and Meng Xie

No.15/2020 *Towards resolving the partner selection problem in venture capital syndication: new insights from a neural network based study*. By Qiong Ji, Xiaoming Ding and Victor Murinde

No.16/2020 *Government policy and financial inclusion: Analysing the impact of the Indian national mission for financial inclusion*. By Rachel Hadar and Ronny Manos

No.1/2021 *Forecasting the CBOE VIX with a hybrid LSTM-ARIMA model and sentiment analysis*. By Yossi Shvimer, Victor Murinde and Avi Herbon

No.2/2021 *A political economy analysis (PEA) of capital account management (CAM) measures in Ghana*. By Peter O'Flynn, Stephany Griffith-Jones, and Stephen Spratt

No.3/2021 *Does energy efficiency matter for prices of tenant-owned apartments*? By David Stenvall, Pontus Cerin, Bo Sjö, and Gazi Salah Uddin

No.4/2021 *Finance and well-being in developing countries: Does access to mobile money improve household well-being*? By Ahmad Hassan Ahmad, Christopher J. Green, Fei Jiang, and Carlos Sakyi-Nyarko

No.5/2021 *Mobile money access and usage: Evidence from household surveys*. Carlos Sakyi-Nyarko, Ahmad Hassan Ahmad and Christopher J. Green

No.6/2021 *The Gender-Differential Effect of Financial Inclusion on Household Financial Resilience*. By Carlos Sakyi-Nyarko, Ahmad Hassan Ahmad, and Christopher J. Green

No.7/2021 *The impact of ICT and mobile money on inclusive growth and financial development. Is Africa different*? By Ahmad Hassan Ahmad, Christopher J. Green, Fei Jiang, and Victor Murinde

No.8/2021 *Fertility decline, women's empowerment and financial inclusion in Kenya: It may not be 'As You Like It'*? By Maren Duvendack

No.9/2021 *Credit information sharing, access to finance and bank risk: what do we know*? By Jeffrey Ighedosa

No.10/2021 *COVID-19 debt relief.* By Leonardo Becchetti and Pasquale Scaramozzino

No.11/2021 *Venture capital and corporate investment: Evidence from Chinese firms.* By Qiong Ji, Xiaoming Ding, and Victor Murinde

No. 12/ 2021 *Venture capital experience and portfolio firms' long-run performance in China*. By Qiong Ji, Xiaoming Ding, and Victor Murinde

No.1/2022 *Foreign direct investment and human capital development in Africa.* By Phyllis Papadavid, Sherillyn Raga, and Dirk Willem te Velde

No.2/2022 *Heterogeneity of assets, structure of interbank market and systemic risk: Evidence from East African banking sector*. By Peter Wamalwa, Cappitus Chironga, Anne Kamau and Samuel Tiriongo

No.3/2022 *Can national development banks help alleviate the shortage of patient investment capital in Africa? Evidence from bank-level panel data*. By Léonce Ndikumana, Karmen Naidoo and Francisco Perez

No.4/2022 *From bilateral trade to centralized markets: A search model for commodity exchanges in Africa*. By Yaw Nyarko and Heitor S. Pellegrina

Centre for Global Finance
SOAS University of London
10 Thornhaugh Street, Russell Square
London
WC1H 0XG

Email: cgf@soas.ac.uk
Website: https://www.soas.ac.uk/centreforglobalfinance/publications/

Segmentation of The Interbank Money Market in Zambia

Jonathan M Chipili[*], *Francis Z Mbao**, *Alick B Lungu**, *Shula M Sikaona**, *Anthony Bwalya**, *and Cosam S Chanda**

Abstract

This study builds on previous empirical work in assessing segmentation in the interbank money market in Zambia. It uses lending and borrowing preference indices as well as expanded measures of network framework analysis. The analysis also considers bank size and bank ownership, which are critical in credit risk assessment that underlies interbank interactions. Empirical results confirm the existence of segmentation in the interbank money market and further reveals that the market structure is incomplete, but not disconnected as trades occur both within and cross-bank categories. Most counterparties of a bank also have credit lines among themselves and tend to trade with banks they have previously interacted. In addition, large subsidiaries of global multinational banks play a pivotal role as intermediators of liquidity in the market. Further, large banks tend to borrow from and lend to medium sized banks and among themselves than they do with small sized banks. This is mainly attributed to existing strict credit risk compliance rules that broadly reflect ownership of counterparties, associated counterparty default risk and country risk. To underwrite credit risk, which is at the core of interbank trading and hence market segmentation, establishing a fund to guarantee interbank trades and developing regulations to deliberately promote interbank trading can be explored. Reforms and regulations to support the growth of a secure repo market could also help in dealing with counterparty risk.

Key Words: Interbank money market, segmentation, credit risk, network framework analysis
JEL classification: E44, E52, G21

[*] Bank of Zambia, P.O. Box 30080, Lusaka, 10101. Zambia. Corresponding author: Jonathan M Chipili, e-mail: jchipili@boz.zm Tel: +260 211 399 338. The views expressed in this paper do not in any way represent the official position of the Bank of Zambia. The authors remain fully responsible for all the errors and omissions.

Acknowledgement

We are indebted to our employer, Bank of Zambia, for allowing us to participate in the SOAS University of London research under the theme "*'Delivering Inclusive Financial Development and Growth*" on banking and finance in Africa. The research was supported by a grant from the United Kingdom Economic and Social Research Council (ESRC). The study benefited from incisive comments from participants at the DFID-ESRC workshop held at SOAS University of London in London during 6-7 September 2019 and Bank of Zambia Research Seminars. We are also grateful to Lilian Muchimba Sinyangwe (Bank of Zambia and PhD student at Portsmouth University) for insightful comments on the final draft.

1 Introduction

The interbank market in Zambia was in its nascent stage prior to 1990. The financial sector was dominated by subsidiaries of foreign banks mainly serving the needs of expatriate and foreign businesses (Brownbridge, 1996). excess liquidity characterized the interbank market and there was very little evidence of trading in the early post-colonial years. However, as the market started to develop from the 70s and more economic reforms undertaken in the early 90s, the number of commercial banks increased and the importance of the interbank money market became more pronounced. By 1994, there were signs of the financial system transitioning towards market-based structures as exchange controls were abolished, interest rates decontrolled, control on goods prices lifted, and the Banking and Financial Services Act enacted. In addition, secondary market trading in government securities, not only among commercial banks but also among non-bank financial institutions, emerged. During this period, a number of commercial banks started to rediscount government securities while repurchase agreements involving Treasury bills between commercial banks and their clients also increased. With these developments, interbank money market transactions rose and overnight loans reached K40 billion within weeks from virtually zero.

There are, however, no clearly defined and specific laws or regulations that govern the operations of the interbank money market, let alone a code of conduct for money market players. The code of conduct provides a framework for responsibilities, integrity, trust, honesty and faith for market participants in dealing with interbank transactions to strengthen market discipline. Nonetheless, the interbank market is indirectly regulated by some provisions of the Bank of Zambia Act and the Banking and Financial Services Act by virtue of this market being dominated by commercial banks. In addition, the interbank money market benefits, to a large extent, from spillover regulations governing the foreign exchange and government securities markets. Unlike the foreign exchange market where participants provide both bid and offer prices using a trading platform, participants in the interbank money market trade over-the-counter (OTC). Treasury bills are widely used and accepted as collateral for transactions in the interbank money market. Very few clean (unsecured) transactions are executed depending on the level of relationship between banks.

The majority of small banks tend to be net borrowers in the interbank money market while large banks are mostly net providers of liquidity (Muhanga, Mutoti and Zgambo, 2009). The dominant lending role of large banks is supported by the huge deposit base they possess and exploit. However, not all large banks are active in the interbank market mostly due to structural rigidities that include internal credit policies. Overnight transactions dominate trades in the interbank money market (Muhanga, Mutoti and Zgambo, 2009). Further, the distribution of liquidity is highly skewed towards large banks that do not necessarily trade with medium and small sized banks leading to the segmentation of the interbank market. Segmentation prevents the interbank money market from effectively performing its typical function of optimally distributing liquidity, facilitating the transmission of monetary policy, and stabilizing the financial system (Oduor *et al.*, 2014; Mayordomo *et al.*, 2015; and Osoro and Muriithi, 2017).

A segmented interbank money market may be characterized by product type offered, pricing, concentration of liquidity, and the operational structure in which banks trade with each other (Osoro and Muriithi, 2017). Typically, market segmentation should lead to high dispersion in market prices or interest rates quoted by participants which makes it hard for them to infer a fair

price (Mayordomo *et al.*, 2015). In the presence of distortions, the market is not able to precisely distinguish the intended effects of the monetary policy stance through changes in the target policy rate and changes induced by liquidity shocks. Commercial banks respond to liquidity shocks by borrowing in the interbank market or liquidating assets. However, borrowing tends to be limited by credit lines, and when it is possible, stringent borrowing constraints exist. Large banks are reluctant to create sufficient credit lines with small banks partly due to mistrust (Arukaevu, 1998). Commercial banks with higher levels of credit risk tend to suffer the most during episodes of severe market stress when banks are not willing to lend to each other.

Interest rates also vary across different lender-borrower categories or pairs. Underlying this difference is the cost of funds, default or credit risk, and strength of relationship among lender-borrower pair. The marginal cost of acquiring funds during periods of liquidity shortage increases with the size of the shortage and the marginal cost of offloading excess funds in an attempt to earn a return increases with the accumulated amount of excess liquidity (Kim, 2017). The liquidity cost for large banks is zero as parties are not willing to accept a lower return on excess liquidity as they are not willing to accept a higher borrowing cost (Kim, 2017)[1]. This results in little variation in interest rates as trading between large banks tends to be very close to the central bank target rate (policy rate).

This study builds on previous empirical work in assessing segmentation in the interbank money market in Zambia. It extends Muhanga, Mutoti and Zgambo (2009) who established the existence of the interbank segmentation but did not ascertain the extent of its prevalence. In seeking to examine segmentation in the interbank market, this study covers a relatively longer sample period (2012m1-2020m6) and broadens the classification of banks by focusing on total assets, ownership, volumes, and prices using network framework analysis as well as lending and borrowing (trading) preference indices. Muhanga, Mutoti and Zgambo (2009) focused on a relatively smaller sample (2006-2009) and solely on ownership structure of banks (domestic or foreign) of small and large banks using price dynamics analysis. An appreciation of the extent of market segmentation provides a useful framework to the monetary authorities in Zambia to determine the likely success of monetary policy as the country transitions to inflation targeting. The interbank market serves as a cornerstone for the transmission mechanism of monetary policy under the inflation targeting regime.

The empirical results confirm the existence of segmentation in the interbank market and further reveals that the market structure is incomplete, but not disconnected as both within and cross-bank categories trades occur. Most counterparties of a bank also have credit lines among themselves and tend to trade with banks they have previously interacted. In addition, large subsidiaries of global multinational banks play a pivotal role as intermediators of liquidity in the market. Further, large banks tend to borrow from and lend to medium sized banks and among themselves than they do with small sized banks. This is mainly attributed to existing strict credit risk compliance rules

[1] Small banks tend to lend funds to large banks below the central bank target rate, but small banks borrow at interest rates above the central bank target rate from large banks. Nonetheless, favourable rates are applied when a small bank trades with a large bank for larger loans: receive a higher rate for large loans provided to large banks and get charged a lower rate when borrowing from a large bank for a large loan.

that broadly reflect ownership of counterparties, associated counterparty default risk and country risk.

The rest of the paper is organized as follows: Section 2 presents stylized facts about the interbank money market in Zambia. Section 3 provides a brief account of the relevant literature on interbank money market segmentation while section 4 outlines the methodology. Section 5 discusses data sources. Section 6 presents empirical findings. Section 7 concludes and offers policy recommendations.

2 Stylized Facts about the Interbank Market in Zambia

The banking system in Zambia has grown following the implementation of economic reforms in the early 90s. Subsidiaries of foreign banks[2] dominate the banking sector, accounting for about 70 percent of the market share in terms of assets, loans and deposits (Table 1). Out of the 18 operating commercial banks in 2020, nine were subsidiaries of foreign banks, five were locally owned private banks, and four were partially owned by Government. The banking industry is also concentrated despite the increase in the number of operating commercial banks to 18 in 2020 from four (4) in the 60s. Further, the industry has continued to exhibit a high degree of concentration with few large banks dominating the financial landscape (Simpasa, Kayizzi-Mugerwa and John, 2013).

Table 1:Distribution of Assets, Loans and Deposits by Ownership Type (Percent), 2017 – 2019

	2017				2018				2019			
	Assets	Loans	Deposits	PBT	Assets	Loans	Deposits	PBT	Assets	Loans	Deposits	PBT
Subsidiaries of foreign banks	73.4	69.2	73.6	82.3	73.0	67.9	72.2	68.3	74.9	71.1	74.0	74.4
Partially owned by Government	18.1	20.1	18.5	3.3	18.2	21.8	19.7	28.1	20.6	22.8	22.1	24.1
Local private banks	8.5	10.7	7.9	14.4	8.7	10.2	8.1	3.6	4.5	6.1	4.0	1.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Bank of Zambia and Author Computation
*PBT - Profit before tax

Foreign banks may pose a risk to the effectiveness of monetary policy transmission (Chileshe, 2017). They not only expose the financial sector to external shocks facing parent companies, but can use liquidity from parent banks to evade tight monetary policy in the host economy and hence render monetary policy ineffective. In addition, most foreign banks may possibly have policies regarding credit extension based on the policies in foreign countries (Simpasa, 2015). High levels of concentration in the banking sector could undermine the effectiveness of monetary policy through sluggishness in the adjustments of interest rates in response to changes in the monetary policy stance (Cottarelli and Kourelis, 1994 and Massarongo, 2012).

[2] One of the foreign owned banks operates more or less like a microfinance institution despite having a commercial bank license.

Similar to the trends in Uganda where lending and borrowing activities in the interbank money market are largely influenced by the asset share of banks (Bwire et al., 2019), large banks in Zambia generally lend and borrow the most relative to medium and small banks (Table 2). However, medium banks are generally net lenders while small banks are net borrowers.

Table 2: Interbank Trading by Bank Size: 2011 to 2019 (K'trillion)

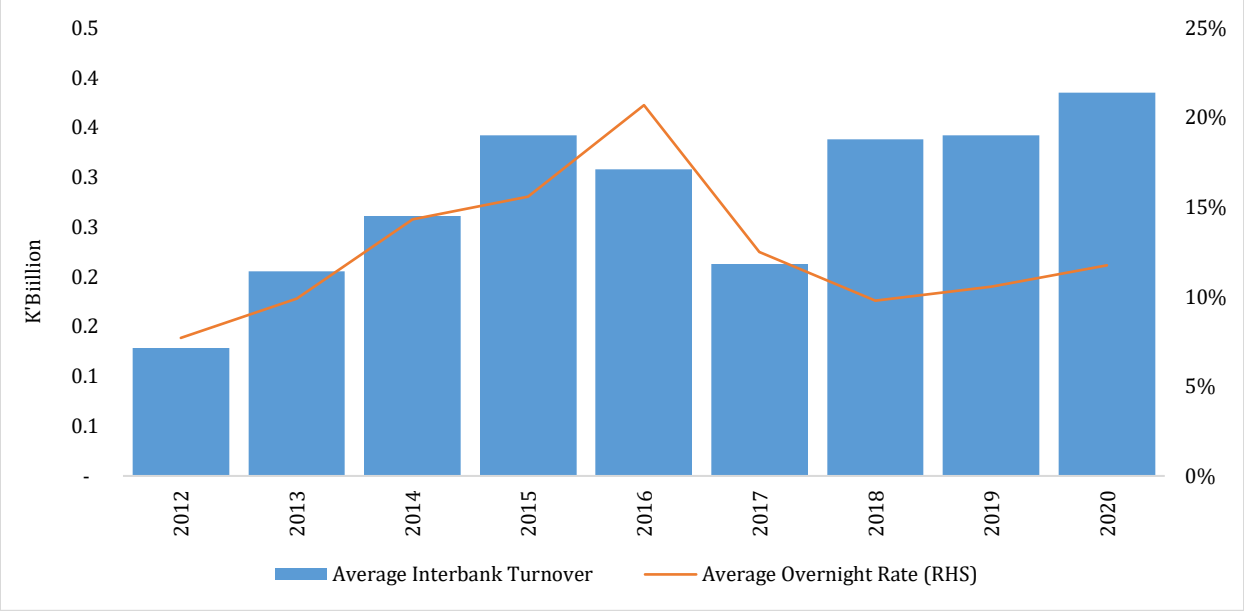
	Large Banks			Medium Banks		Small banks	
	Borrowing	Lending		Borrowing	Lending	Borrowing	Lending
2011	28.2	22.3		8.5	12.7	4.3	5.6
2012	13.8	16.6		10.1	11.5	9.3	3.9
2013	5.0	7.3		4.9	6.3	5.9	2.1
2014	32.5	17.5		18.3	38.6	15.9	9.5
2015	30.3	43.3		25.7	28.7	23.2	6.6
2016	39.6	21.2		20.0	49.9	19.4	3.4
2017	24.5	15.8		13.9	29.9	15.9	6.7
2018	48.3	20.1		18.0	52.4	17.3	8.8
2019	43.9	23.5		19.7	52.8	19.2	6.4

Source: Bank of Zambia and Author Computation

Commercial banks in Zambia are differentiated based on ownership and size. Ownership depends on the country of origin of the majority shareholder. Thus, banks can be regarded as local or foreign. Foreign banks are further divided into regional with a parent bank in Africa (Pan-African) and global with a parent bank outside Africa (Global Multinational). Commercial banks can further be disaggregated into three groups according to their size: large, medium or small. This is based on the identified methodology outlined in section 4.

Both local and foreign owned banks participate in the interbank market depending on liquidity pressures and availability of credit lines or relationship with the counterparty. Generally, the annual average turnover in the interbank, mostly on an overnight basis, grew almost three-fold between 2012 and 2020 (Chart 1). This was largely contingent on liquidity conditions and utilization of available credit lines.

Chart 1: Annual Average Interbank Turnover: 2012-2020



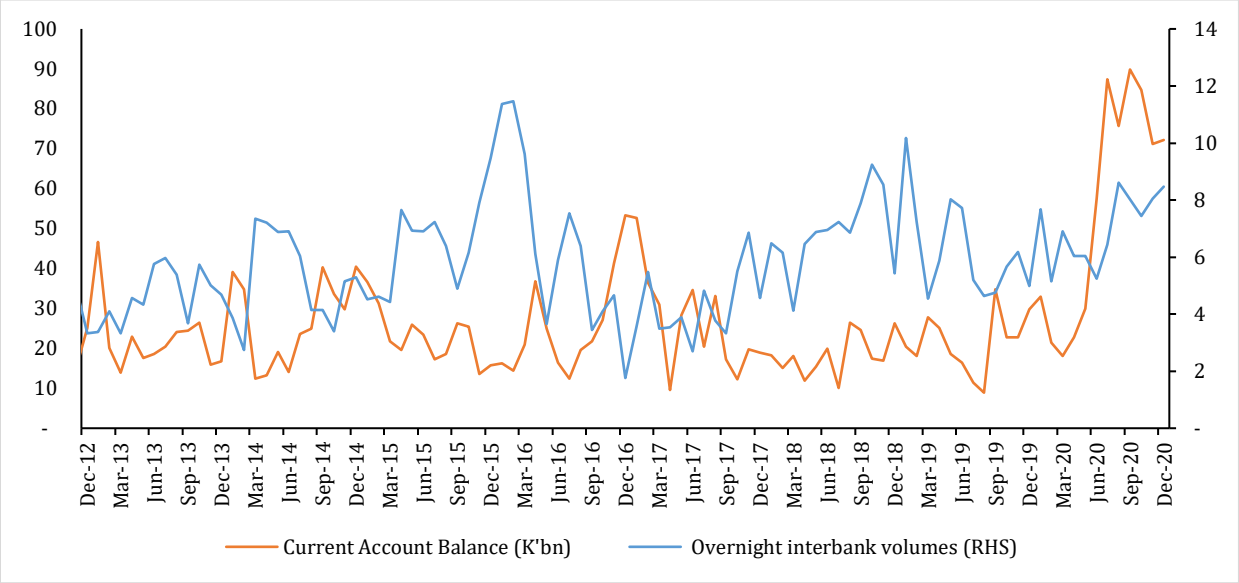
Source: Bank of Zambia and Author Computation

About 80% of interbank transactions are collateralized (secured) by Treasury bills while a few transactions are executed on clean lines (unsecured) basis depending on the existing relationship between counterparties. The overnight tenor dominates interbank trading, accounting for about 94% of the turnover. Other tenors include 7, 14, 21 and 90 days.

Between 2012 and 2015[3], it was observed that liquidity conditions and interbank turnover were inversely related although the relationship was very weak. The relationship, however, reversed after 2015[4] (Chart 2). This partly reflects the tight credit lines or business relationships which limit active trading across banks of different size. It is not evident from the data therefore that interbank turnover is directly related to the prevailing liquidity conditions in the money market. It appears that counterpart risk and liquidity concentration play a role in interbank relationships.

[3] The correlation coefficient for liquidity and interbank market turnover was -0.15
[4] The correlation coefficient for liquidity and interbank market turnover was 0.06

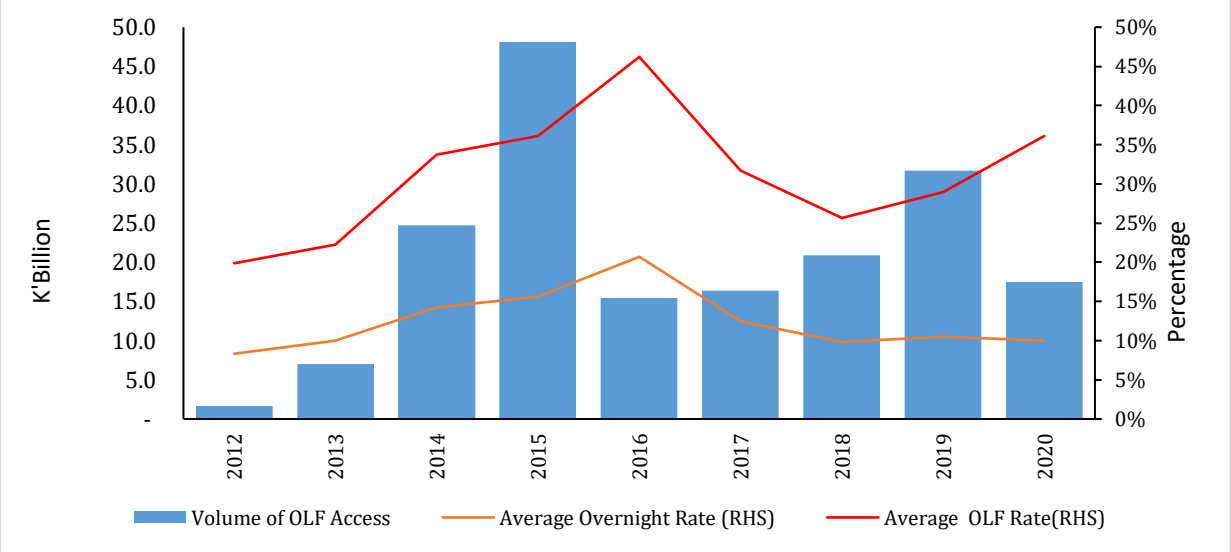
Chart 2: Correlation between Overnight Interbank Turnover and Commercial Banks' Aggregate Current Account Balance (K' billion)



Source: Bank of Zambia and Author Computation

The Bank of Zambia also provides liquidity support to the market through the Overnight Lending Facility (OLF). The OLF rate[5] is, however, highly punitive (Chart 3). The foregoing notwithstanding, banks' access to the OLF window has grown over the years, largely reflecting liquidity imbalances and concentration in few large banks with limited credit lines.

Chart 3: Access to OLF Facility



Source: Bank of Zambia and Author Computation

[5] The OLF rate is set as the discount rate computed as the BoZ Policy Rate plus a margin administratively determined by the central bank.

3 Literature Review

Despite the critical role interbank money markets play in allocating liquidity from banks with surplus funds to those facing liquidity shortages and in the transmission of monetary policy impulses to the real economy, studies on the interbank money market are generally rare across the globe. This is not surprising given the OTC nature and therefore confidentiality of interbank money market data. Studies on interbank money markets, in many Sub Saharan Africa (SSA) countries, Zambia inclusive, are even more scanty.

The ability of banks to trade in the interbank market is principally affected by liquidity shocks, operating costs and reputation as well as the operations of the central bank (Green et al., 2016). The interbank money market is mainly utilized as a source of funds for short-term liquidity obligations and not to expand liquidity. Anticipation of changes in policy and/or operating costs influence individual bank's trading decisions as well as decisions to supply or withhold liquidity in the interbank market. Shocks caused by liquidity stress may generate distortions and inefficiencies in the functioning of the interbank market, including the cost of funds, which may be transacted in a characteristically segmented market.

Segmentation has been established as one of the common features characterising interbank markets in a few available studies in SSA. For instance, Sichei, Kiplang and Shimba (2012) identified and demonstrated how market segmentation in Kenya can limit the ability of the interbank market in facilitating banks' liquidity management strategy. Using daily data for the period June 2003 - September 2012, and utilizing network framework and event studies, the Kenyan interbank market was found to be segmented. The market was highly segmented by size: small, medium and large banks. Large banks tended to discriminate against small banks in terms of credit extension and interest rates charged were usually higher for other categories than those charged on their peers. Although the results appear to suggest that segmentation impedes the effectiveness of monetary policy in the short-run, particularly during periods of liquidity volatility, monetary policy is somewhat transmitted in the long-run. To enhance the operation of the interbank market in Kenya, it was recommended that the term structure of interest rates should be extended by adding lending products with maturities exceeding overnight, number of currencies traded increased, benchmark interbank interest rate developed, and linkages with other money market segments increased.

In Malawi, the interbank market has also been found to be segmented. The interbank market is incomplete despite being highly connected (Kanyumbu, 2020)[6]. Muhanga, Mutoti and Zgambo (2009) established the existence segmentation of the interbank market in Zambia both in terms of the distribution of funds and pricing over the period 2006-2009. On average, about 43% of the settlement balance maintained at the central bank was held by major subsidiaries of foreign banks and 42% of the settlement balance was held by two major locally owned banks. Locally owned smaller banks tended to borrow at interest rates usually higher than the average market rate while subsidiaries of foreign banks tended to borrow below the market average interest rate. The study concluded that the concentration of funds in a few banks was the basis for market segmentation as dominant banks in the market used market power to influence the price.

[6] High connectivity implies that liquidity is able to flow in a fairly efficient manner within the network and banks are able to monitor each other's behavior.

Elsewhere, segmentation has been established with its attendant undesirable consequences. Colliard, Foucault and Hoffmann (2016) analyzed the core-periphery model of trading in the overnight interbank market during crisis period in the euro area. They concluded that segmentation between core and periphery banks poses significant challenges to central banks. It raises the market power of periphery banks connected to the core, increases dispersion of rates in the interbank market and promotes recourse to the central bank standing facilities. The dispersion in interest rates between core and periphery banks no longer reflected borrowing conditions of the interbank market. Further, Chiu and Monnet (2016) studied market segmentation arising from relationship lending in unsecured interbank market in the euro area using data for the period 2003-2013. The study concluded that a tiered lending network arises endogenously as banks choose to build relationships to insure against liquidity shocks and to economize on the cost to trade in the interbank market.

Although segmentations do exist in many markets, relationships and network dynamics increasingly influence interactions in the interbank money market (Green, et al, 2016). The position and direction of the credit relationship between banks affect the price a bank pays for liquidity in the interbank market (Craig, Fecht and Tümer-Alkan, 2015; Temizsoy, Iori and Montes-Rojas, 2015).

Colliard et al., (2016), Bräuning and Fecht (2017) as well as Chiu, Eisenschmidt and Monnet (2019) concluded that banks rely on repeated interactions with the same counterparties to access liquidity. Large banks prefer to lend to each other at interest rates close to the central bank target rate and limit their transactions with small banks as they view them as very risky due to the size of their assets (Allen and Gale, 1990; Allen and Saunders, 1992). Thus, small banks are left with the option of borrowing insufficient funds from their peers (Ho and Saunders, 1985). Small banks borrowing from large banks tend to pay higher rates than the central bank target rate. However, they charge lower interest rates than the central bank target rate when they lend to large banks.

Craig, Fecht and Tümer-Alkan (2015) assessed how the concentration of credit relationships and the position of a bank in the network topology of the system influence the bank's ability to meet liquidity demand. They concluded that banks with a more diversified borrowing structure in the interbank market bid significantly less aggressively and pay a lower price for liquidity in the ECB's main refinancing options.

From the empirical perspective, interbank trading relationships, including their outcomes on pricing under different liquidity conditions, have been brought to the fore with the use of network analysis procedures. For example, utilizing network analysis techniques, Wetherilt et al. (2010) established the existence of a core of highly connected banks in the UK alongside a periphery, which had consequences on interbank interest rates. The membership of the core appeared to have expanded during the financial crisis as a few intermediate banks became more connected. Bech and Atalay (2010) also found the US interbank market to have a core-periphery network structure (or tiered structure) where some banks in the periphery only trade with one bank while the latter might trade with many others.
Further, Kim (2017) draws on market segmentation of the form 'small-bank' – 'big-bank' dichotomy. Empirically, the odds point to outcomes against small banks partly attributed to

information asymmetry between a small borrowing financial institution and a prospective counterparty. Some banks tend to shy off from trading with banks that are less profitable and with lower market reputation.

In summary, literature confirms the existence of segmention in various markets. Its existence takes different forms ranging from relationship lending, core peri-phery setup, 'small-bank' – 'big-bank' dichotomy, repeated interactions and network dynamics. The implications that segmentation in the interbank market may have for market liquidity availability, liquidity transmission and liquidity cost gives impetus of confirming whether interbank market segmentation exists in Zambia. To this effect, this study takes advantage of the novel granular data from Bank of Zambia to assess the existence of market segmentation in Zambia. The study is expected to generate more information to assist policy makers in identifying areas requiring immediate intervention to improve liquidity management and the effectiveness of monetary policy.

4 Empirical Methodology

Network framework analysis as well as lending and borrowing (trading) preference indices are used to assess segmentation in the interbank money market in Zambia. The assessment also takes into account size and ownership of banks.

There are several approaches to classifying a bank as large, medium or small. For instance, Kim (2017) proposed the use of quantiles based on asset size distribution while Beck et al. (2011) used average bank size to the total industry to determine bank size. According to Beck et al. (2011), banks with total assets in excess of the US$220 million threshold are classified as large while medium sized banks have average assets between US$50 million and US$220 million. Banks with average assets below US$50 million are classified as small. In this study, banks are classified by:

a) Firstly, determining the ratio of individual bank assets to industry total assets using balance sheet data:

$$\beta_{it} = \left(\frac{\theta_{it}}{\Omega_t}\right) 100\%, i = 1, \dots\dots\dots\dots\dots\dots\dots\dots, n \quad (1)$$

where,

$t = 0,1,2 \dots\dots\dots\dots\dots\dots, T$

$\beta_{it} = size\ of\ individual\ bank\ (i) at\ time\ (t)$

$\theta_{it} = individual\ bank\ (i) total\ assets\ at\ time\ (t)$

$\Omega_t = sampled\ banks\ total\ assets$ at time (t)[7]

b) Secondly, computing the average bank size as:

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

where

[7] For the 14 banks making the sample in this study, combined assets account for 95% of the industry total assets.

$$\bar{\beta}_i = mean\ bank\ size\ for\ an\ individual\ bank$$
$$(T-t) = number\ of\ observations$$

c) Finally, using the following decision rule to classify a bank as small, medium or large:

$$\bar{\beta}_i = \begin{cases} \geq 0.10, \text{large bank} \\ 0.03\ but < 0.10\ , medium \\ < 0.03, \text{small bank} \end{cases} \quad (3)$$

A bank is classified large if the average market share is at least 10% (0.10). Otherwise, it is small if the market share is less than 3% (0.03) and medium if the market share is greater than 3%, but less than 10%. This rule is arbitrary but ensures that (a) large banks have a combined market share of at least 50% share of the industry; (b) small banks have a combined market share reflecting some number on the fringe; and (c) medium sized banks having a combined market share lying between 3% and 10%.

Applying the procedure above to the data for 14 commercial banks, five banks are classified as small with the average market share ranging from 1.6% to 2.0% (Table 3). The combined market share is only 8.8%. There are also five medium sized banks with the market share ranging from 3.6% to 9.8%, and combined market share of 34.0%. Four large banks have market share ranging from 12.7% to 17.0% and the total market share is 57.2%.

Banks are further classified according to ownership (Table 3). Ownership in this study is defined in terms of the origin of majority shareholding of a bank. Local ownership refers to banks owned by Zambian citizens with at least 51% shareholding while Pan-African refers to regional banks operating in Zambia with a parent bank in Africa. A global multinational is applicable to a subsidiary of a foreign bank with a parent bank outside Africa.

Table 3: Bank Classification by Asset Size and Ownership

Bank	Markets Share (%)	Bank Classification	Ownership
Bank SL1	2.0	Small	Local
Bank SL2	1.9	Small	Local
Bank SPA3	1.8	Small	Pan-African
Bank SPA4	1.7	Small	Pan-African
Bank SL5	1.6	Small	Local
Bank MGM1	9.8	Medium	Global Multinational
Bank ML2	8.8	Medium	Local
Bank MPA3	8.0	Medium	Pan-African
Bank MGM4	4.0	Medium	Global Multinational
Bank MPA5	3.6	Medium	Pan-African
Bank LGM1	17.0	Large	Global Multinational
Bank LGM2	14.2	Large	Global Multinational
Bank LL3	13.4	Large	Local
Bank LGM4	12.7	Large	Global Multinational

Source: Bank of Zambia and Author Computation

It is noted that ownership is one of the factors considered in setting credit lines in the interbank market[8]. In this regard, it is imperative to understand how ownership affects interbank trading

[8] Credit profiling of the banks tends to dictate exposure limits to counterparts (Odour *et al.*, 2014).

within and across different bank categories. The terms for credit lines are reviewed regularly as creditworthiness of banks changes in line with ownership status. Most banks consider bank ownership as a default risk measure when setting credit lines either at the group or board level.

Network framework proposed by Allen and Gale (2000) is used in this study to assess market segmentation in Zambia. In this framework, interbank trading relationships are assessed based on exposure matrices. According to this framework, three types of interbank structures exist: complete, incomplete as well as incomplete and disconnected.

A complete structure is where each bank is symmetrically connected to other banks in the market irrespective of size (Table 4). This means that each bank transacts (borrows and lends) with all the banks in the market (Sichei, Kiplang and Shimba, 2012). When an interbank market has a complete structure, the effect caused by unexpected shock in one bank can be absorbed by a large number of banks thereby reducing the intensity of the shock (Allen and Gale, 2000). This way, financial stability is likely to be sustained (Raga and Tyson, 2021) and help avert a breakdown in the transmission mechanism of monetary policy impulses.

Table 4: Complete Structure

			Borrowing								
			Small Banks			Medium Banks			Large Banks		
			Bank S1	Bank S2	Bank S3	Bank M1	Bank M2	Bank M3	Bank L1	Bank L2	Bank L3
Lending	Small Banks	Bank S1		√	√	√	√	√	√	√	√
		Bank S2	√		√	√	√	√	√	√	√
		Bank S3	√	√		√	√	√	√	√	√
	Medium Banks	Bank M1	√	√	√		√	√	√	√	√
		Bank M2	√	√	√	√		√	√	√	√
		Bank M3	√	√	√	√	√		√	√	√
	Large Banks	Bank L1	√	√	√	√	√	√		√	√
		Bank L2	√	√	√	√	√	√	√		√
		Bank L3	√	√	√	√	√	√	√	√	

Source: Bank of Zambia and Author Computation

Note: √ means existence of an active interbank credit line; S1-S3= small banks, M1-M3=medium banks, and L1-L3=large banks

In an incomplete interbank market segment, banks are only connected to their neighbours i.e. those in the same or neighbouring class. For instance, this may be the situation where small banks trade amongst themselves and medium banks, but not with large banks (Table 5). When the interbank market is incomplete, the initial shock in one bank is transmitted to its neighbours, but in a large magnitude with ripple effects.

Table 5: Incomplete Structure

			Borrowing								
			Small Banks			Medium Banks			Large Banks		
			Bank S1	Bank S2	Bank S3	Bank M1	Bank M2	Bank M3	Bank L1	Bank L2	Bank L3
Lending	Small Banks	Bank S1		√	√	√	√	√	0	0	0
		Bank S2	√		√	√	√	√	0	0	0
		Bank S3	√	√		√	√	√	0	0	0
	Medium Banks	Bank M1	√	√	√		√	√	√	√	√
		Bank M2	√	√	√	√		√	√	√	√
		Bank M3	√	√	√	√	√		√	√	√
	Large Banks	Bank L1	0	0	0	√	√	√		√	√
		Bank L2	0	0	0	√	√	√	√		√
		Bank L3	0	0	0	√	√	√	√	√	

Source: Bank of Zambia and Author Computation

Note: √ means existence of an active interbank credit line while 0 implies no trade between corresponding banks; S1-S3= small banks, M1-M3=medium banks, and L1-L3=large banks

In an incomplete and disconnected interbank market structure, trades only occur within specific bank categories, that is, there are no cross category trades (Table 6).

Table 6: Incomplete and Disconnected Structure

			Borrowing								
			Small Banks			Medium Banks			Large Banks		
			Bank S1	Bank S2	Bank S3	Bank M1	Bank M2	Bank M3	Bank L1	Bank L2	Bank L3
Lending	Small Banks	Bank S1		√	√	0	0	0	0	0	0
		Bank S2	√		√	0	0	0	0	0	0
		Bank S3	√	√		0	0	0	0	0	0
	Medium Banks	Bank M1	0	0	0		√	√	0	0	0
		Bank M2	0	0	0	√		√	0	0	0
		Bank M3	0	0	0	√	√		0	0	0
	Large Banks	Bank L1	0	0	0	0	0	0		√	√
		Bank L2	0	0	0	0	0	0	√		√
		Bank L3	0	0	0	0	0	0	√	√	

Source: Bank of Zambia and Author Computation

Note: √ means existence of an active interbank credit line while 0 implies no trade between the corresponding banks; S1-S3= small banks, M1-M3=medium banks, and L1-L3=large banks

Further, centrality measures (i.e. betweenness centrality, closeness centrality, and cluster coefficient) are employed as part of network analysis. Centrality measures in network analysis give a deeper understanding of how interrelationships among banks work.

Centrality in a network is defined as a collection of points or "nodes" connected together by lines or "edges". The interpretation of nodes and edges depends on the context. In this study, nodes are commercial banks and edges are interbank loans extended to counterparties. Thus, a network is a representation of how elements are related in a system, which can be in matrix (exposure matrices highlighted above) or graphical form (Table 7).

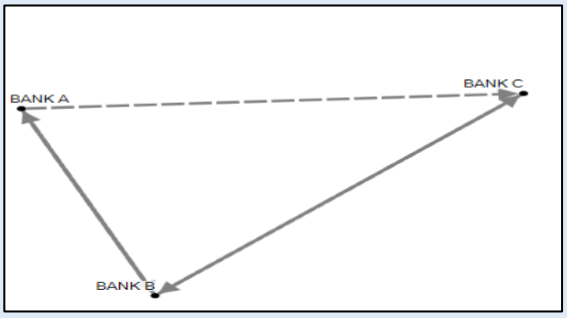
Table 7: Representation of a Network

Edge List

Lender	Borrower	Amount
BANK A	BANK B	20
BANK A	BANK C	5
BANK B	BANK A	15
BANK B	BANK C	22
BANK C	BANK B	60

Matrix

		BORROWER		
		BANK A	BANK B	BANK C
LENDER	BANK A	0	20	5
	BANK B	15	0	22
	BANK C	0	60	0



Source: Author Computation

Edges are lines that show relationships between vertices; financial networks assume different edges depending on what they depict; and vertices/nodes are number of items, pieces, banks, countries in a graph depicting relationships/linkages among various components.

For instance, Table 7 highlights that all the banks in the system are connected. Nonetheless, the nature of connection is that Bank A lends funds to both banks B and C but only borrows from bank B. Conversely, bank C only lends to bank B but borrows from both banks A and B. Only bank B borrows and lends to both counterparties.

Betweenness measures the importance of the bank by determining its role as a mid-agent between banks without credit lines in the network[9]. It is used to measure the intermediary role of banks in the network. Commercial banks may act as a mid-agent to facilitate the flow of liquidity between two of its counterparties that do not directly have credit lines despite both having credit lines with it. A higher metric on the betweenness centrality measure signifies the importance of a bank in acting as an intermediator in the network.

Closeness centrality illustrates the importance of a bank in the network by how close it is to the counterparties. In this study, closeness centrality in this study indicates how close a bank is to all the banks in the network in terms of interbank trades.

The clustering coefficient can be used to measure segmentation in the interbank market by establishing how connected vertices are to one another. More specifically, the coefficient is computed by dividing the number of edges connecting a vertex's neighbours by the total number of possible edges between the vertex's neighbours (COMESA Monetary Institute, 2019). If all the neighbours of a node are not connected to each other, the coefficient will be zero. Conversely, if

[9] https://www.sciencedirect.com/topics/computer-science/betweenness-centrality

all the neighbours are connected, the cluster coefficient will be 1. Thus, the clustering coefficient ranges from 0 to 1.

To assess the intensity of both lending and borrowing between bank categories, the lender preference index (LPI) and borrower preference index (BPI) are computed in line with Cocco, Gomes and Martins (2009). For every lender and borrower category, the LPI is computed as:

$$\text{LPI}_{\text{category X banks to category Y banks}} = \frac{\text{Total lending of funds by category X banks to category Y banks}}{\text{Total lending of funds by category X banks in the market}}$$

This ratio is more likely to be high if category X banks rely on fellow category X banks more than they do on category Y banks to lend funds in the market.

The BPI is computed in a similar way as:

$$\text{BPI}_{\text{category X banks to category Y banks}} = \frac{\text{Total borrowed funds by category X banks from category Y banks}}{\text{Total borrowed funds by category X banks in the market}}$$

5 Data Sources

The study used daily data for the period January 2012-June 2020 for which a reliable data set was available. All the data were sourced from the Bank of Zambia covering 14 commercial banks.

Lending data was utilised and included transacting bank, counterparty, loan amount, tenor, interest rate, collateral type, and value of transactions denominated in Kwacha. Further, lending transactions were split into intra and cross category trades. The transactions analyzed included small-to-small, small-to-medium, small-to-large, medium-to-small, medium-to-medium, medium-to-large, large-to-small, large-to-medium and large-to-large interbank lending.

6 Empirical Results and Analysis

The exposure matrix results in Table *8* show that the interbank market in Zambia is incomplete but not disconnected. This is similar to the findings by Odour et al. (2014) and Kanyumbu (2020) showing incomplete but highly connected interbank markets in Kenya and Malawi, respectively.

Table 8: Interbank Market Exposure Matrix (2012m1-2020m6)

		Lending													
		Small Banks					Medium Banks					Large Banks			
		Bank	Bank SL1	Bank SL2	Bank SPA3	Bank SPA4	Bank SL5	Bank MPA3	Bank MGM1	Bank MGM4	Bank MPA5	Bank ML2	Bank LGM2	Bank LGM4	Bank LGM1	Bank LL3
Borrowing	Small Banks	Bank SL1		√	√	√	√	√	0	0	√	√	0	√	0	√
		Bank SL2	√		√	√	√	√	0	0	√	√	0	√	√	√
		Bank SPA3	√	√		√	√	√	0	0	√	√	√	√	0	√
		Bank SPA4	0	√	√		√	√	0	0	√	√	√	√	√	√
		Bank SL5	√	√	√	√		√	0	0	√	√	0	√	0	√
	Medium Banks	Bank MPA3	√	√	√	√	√		0	0	√	√	√	√	√	√
		Bank MGM1	0	0	0	0	0	0		0	0	0	0	0	0	0
		Bank MGM4	0	√	√	√	0	√	0		0	√	√	√	√	√
		Bank MPA5	√	√	√	√	√	√	0	0		√	0	√	0	√
		Bank ML2	√	√	√	0	0	0	0	0	√		√	√	√	√
	Large Banks	Bank LGM2	√	√	√	√	0	√	√	√	0	√		√	√	√
		Bank LGM4	0	√	√	√	√	0	√	√	√	√	√		√	√
		Bank LGM1	0	√	√	√	√	√	0	√	√	√	√	√		√
		Bank LL3	0	√	√	0	√	√	0	√	√	√	√	√	√	

Source: Bank of Zambia and Author Computation

Note: √ means existence of an active interbank credit line while 0 implies no trade between the corresponding banks

Further, clustering coefficients of broadly 1 in Table 9 suggest that banks are not completely connected to each other[10]. This shows that counterparties of a bank are also highly connected but not fully. On average, most counterparties of a bank also have trading relationships among themselves signifying the strength of connectivity among banks in the interbank market. For instance, a bank may have credit lines with numerous counterparties, but this does not necessarily mean that all of these counterparties also have credit lines among themselves. Nonetheless, it is worth noting that medium sized subsidiaries of foreign banks (Bank MGM1and Bank MGM4) had clustering coefficients of 1, reflecting that all their counterparties were connected. These banks have the lowest number of credit lines in the market but are connected to dominant counterparties (mostly large banks i.e. Bank LGM1, Bank LGM2, Bank LGM4 and Bank LL3) and mainly those with less risk of default and with a substantial share of market liquidity.

The closeness centrality measure reveals that banks did not alter trading partners over the sample period i.e. credit lines with previous counterparties were maintained (Table 9). Most banks tend to trade with banks they have previously traded on the back of confidence and trust established overtime. Relationships in this kind of network help banks to have counterparties they can fall back on in times of need. For example, based on the trust established, some interbank trades are executed without collateral (clean deals).

The betweenness centrality result shows that large subsidiaries of global multinational banks (Bank LGM2 and Bank LGM4) play a pivotal role as intermediators with the highest betweenness centrality value of about 6.4 apiece compared to medium subsidiaries of global multinational banks that never played this role over the sample period. This evidence reinforces the finding in the exposure matrix (Table *8*) that not all banks have credit lines with each other. Some banks resort to using other banks that have mutual credit lines to facilitate trades in times of liquidity shortages.

Table 9: Measures of Network Centrality

	Degree of Centrality	Betweenness Centrality	Closeness Centrality	Clustering Coefficient
Bank SPA4	13	0.40202	0.066667	0.948718
Bank SPA3	13	0.40202	0.066667	0.948718
Bank SL2	13	0.40202	0.066667	0.948718
Bank SL5	11	0.00000	0.058824	1.000000
Bank SL1	12	0.09091	0.062500	0.984848
Bank ML2	13	0.40202	0.066667	0.948718
Bank MPA5	12	0.09091	0.062500	0.984848
Bank MPA3	13	0.40202	0.066667	0.948718
Bank MGM4	10	0.00000	0.055556	1.000000
Bank MGM1	2	0.00000	0.038462	1.000000
Bank LL3	13	0.40202	0.066667	0.948718
Bank LGM1	13	0.40202	0.066667	0.948718
Bank LGM4	14	6.40202	0.071429	0.824176
Bank LGM2	14	6.40202	0.071429	0.824176

Source: Bank of Zambia and Author Computation

[10] Cluster coefficients close to 1 indicate that most counterparties of a bank also have credit lines among themselves.

A further analysis of the interaction of banks indicates that large banks are able to trade (interact) among themselves fully by utilizing all the available credit lines (Table 10). However, their interaction with small and medium banks is limited as they are able to utilize more of the available credit lines on the borrowing side (75% and 83%) than on the lending side (70% and 71%).

While interaction among small banks is relatively high, it is, however, limited among the medium-medium pair (Table 10). This implies that large and small banks interact amongst themselves more than medium sized banks do with the peers. Among the medium sized banks category, subsidiaries of global multinational banks have the most stringent credit line rules considerations as their risk tolerance is relatively lower than other banks. This tends to limit their involvement in interbank trading.

Table 10:Utilisation of Credit Lines by Bank Size Irrespective of Ownership (%)

		Lender		
		Small	Medium	Large
Borrower	Small	95	60	70
	Medium	67	50	71
	Large	75	83	100

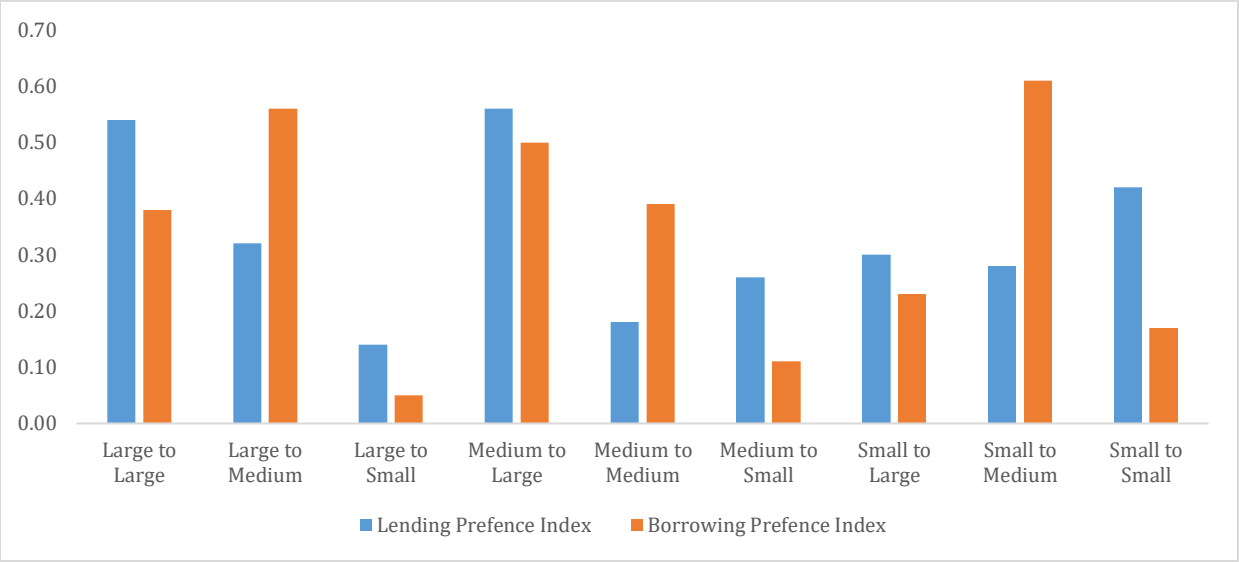
Source: Bank of Zambia and Author Computation

In terms of trading preference, large banks tend to borrow from and lend to medium sized banks and among themselves than they do with small sized banks (Chart 4). This finding is similar to Odour *et al.* (2014) who showed that large banks prefer to get funds from their counterpart large banks in the Kenyan interbank money market. This could be attributed to the strict credit risk compliance rules that large and medium sized banks follow in dealing with small banks. The consideration for credit lines ranges from ownership of the counterparty bank, associated counterparty default risk, and country risk since Treasury bills dominate as collateral.

Further, medium sized banks prefer to trade with large banks than they do with peers and small banks. This is also attributed to stringent default risk measures adopted by medium sized banks especially the dominant Bank MGM1 and Bank MGM4. The preference by small banks is to borrow from medium sized banks than large banks and the peers. Conversely, their lending preference is to the peers.

Risk considerations in the small banks category are more relaxed as peer trading relationships have been built overtime. This finding is consistent with interbank trading preference in Kenya established by Odour et al. (2014) who argued that medium-sized banks proritise their lending to large banks followed by their peers and lastly small-sized banks.

Chart 4: Lending and Borrowing Preference Indices



Source: Bank of Zambia and Author Computation
Note: Data used is based on traded volumes in billions of Kwacha

Ownership partially explains intense intra-trading within the small and large bank categories. The small bank category is dominated by locally owned banks while the medium and large bank categories are dominated by foreign ownership. The only locally owned banks in the medium and large categories are those in which the Government of Zambia holds shares. Most locally owned banks tend to have more trading linkages among peers. Global multinational banks also prefer to trade with fellow global multinational counterparties.

According to Table 11, there are no credit lines between medium sized subsidiaries of global multinational banks (generally with limited credit lines) and small sized Pan-African banks for both lending and borrowing. The medium sized global multinational banks do not also engage in any lending transactions with the small and medium banks regardless of their ownership. These banks (mostly global multinational) are highly sensitive to credit risk and their utilization of credit lines is generally the lowest as shown Table 10. This suggests that ownership (besides size) matters in the connectivity of banks in the interbank market. Bwire et al., (2019) corresponds with this finding and advances that market power or bank size as well as ownership provide a degree of insurance in the interbank against default, which might be independent of a bank's financial condition. In contrast, large banks utilize all available credit lines while small banks utilize 95% of the credit lines. Global multinationals prefer to trade mostly with banks in the large bank category unless Government has a stake in the counterparty.

Table 11:Utilisation of Credit Lines by Banks with respective to Size and Ownership (%)

		Lending						
		Bank SL	Bank SPA	Bank MPA	Bank MGM	Bank ML	Bank LGM	Bank LL
Borrowing	Bank SL	100	83	89	0	100	67	100
	Bank SPA	100	100	83	0	100	33	100
	Bank MPA	100	83	100	0	100	67	100
	Bank MGM	50	0	33	0	50	50	50
	Bank ML	67	50	67	0	100	100	100
	Bank LGM	100	50	78	83	100	100	100
	Bank LL	67	50	100	50	100	100	100

Source: Bank of Zambia and Author Computation

Note: Bank SL represents banks SL1, SL2 and SL5; Bank SPA represents banks SPA3 and SPA4; Bank MGM represents banks MGM1 and MGM4; Bank ML represents bank ML2; Bank MPA represents banks MPA3 and MPA5; Bank LGM represents banks LGM1, LGM2 and LGM4; and Bank LL represents bank LL3.

7 Conclusion

The segmentation of the interbank money market in Zambia was analysed using network framework analysis as well as lending and borrowing (trading) preference indices over the period January 2012-June 2020. The assessment of market segmentation also took into account bank size and ownership.

The study has revealed the existence of segmentation in the interbank market. The market structure is incomplete, but not disconnected as both within and cross-bank categories trades occur. Most counterparties of a bank also have credit lines among themselves and tend to trade with banks they have previously interacted. In addition, large subsidiaries of global multinational banks play a pivotal role as intermediators of liquidity in the market. This reinforces the feature of the market that not all banks have credit lines with each other. Further, large banks are able to trade among themselves fully, but their interaction with small and medium banks is limited. Medium sized banks, dominated by subsidiaries of global multinational banks, have the most stringent credit line rules considerations that limits their involvement in interbank trading.

In terms of trading preference, large banks tend to borrow from and lend to medium sized banks and among themselves than they do with small sized banks, attributed to existing strict credit risk compliance rules. Ownership partially explains intense intra-trading within the small and large bank categories. Generally, global multinational banks have limited, and in some cases, no credit lines with most locally owned banks unless Government has a stake. The consideration for credit lines ranges from ownership of the counterparty bank, associated counterparty default risk and country risk as Treasury bills dominate as collateral.

Credit risk stands out as a key factor underlying interbank transactions and the segmentation of the market. A segmented market constrains effective liquidity management and monetary transmission. Some of the possible options to mitigate segmentation include the establishment of a fund to guarantee interbank trades and developing regulations to deliberately promote interbank

trading. These measures can contribute to the reduction in credit risk in the interbank market and also support the growth of a secure repo market.

References

Allen, F. and Gale, D. (1990) 'Incomplete Markets and Incentives to Set up an Options Exchange', *The Geneva Papers on Risk and Insurance Theory*, 15(1), pp. 17–46. doi: 10.1007/BF01498458.

Allen, F. and Gale, D. (2000) 'Financial Contagion', *Journal of Political Economy*, 108(1), pp. 1–33.

Allen, L. and Saunders, A. (1992) 'Bank Window Dressing: Theory and Evidence', *Journal of Banking and Finance*, 16(3), pp. 585–623. doi: 10.1016/0378-4266(92)90046-3.

Arukaevu, R. (1998) 'The Estonian Money Market', *Russian & East European Finance and Trade*, 34(5), pp. 71–96.

Bai, Y.. Green, C.J., Murinde, V., Ngoka, K.,Maana, I., Tiriongo, S. (2016) 'Overnight Interbank Markets and the Determination of the Interbank Rate : A Selective Survey', *International Review of Financial Analysis*, 44, pp. 149–161.

Bech, M. L. and Atalay, E. (2010) 'The Topology of the Federal Funds Market', *Physica A: Statistical Mechanics and its Applications*. Elsevier B.V., 389(22), pp. 5223–5246. doi: 10.1016/j.physa.2010.05.058.

Beck, T., Maimbo, S. M., Faye, I., Triki, T.(2011) *Financing Africa Through the Crisis and Beyond.* Washington DC: African Development Bank, German Federal Ministry for Economic Cooperation and Development; The World Bank.

Bräuning, F. and Fecht, F. (2017) 'Relationship Lending in the Interbank Market and the Price of Liquidity', *Review of Finance*, 21(1), pp. 33–75. doi: 10.1093/rof/rfw042.

Brownbridge, M. (1996) 'Financial Policies and the Banking System in Zambia.', *IDS Working Paper*. Geneva.

Bwire, T., Brownbridge, M., Rubatsimbira, D.K., Tinyinondi, G.A. (2019) 'Do Interbank Interest Rates Reflect The Financial Soundness Of Borrowing Banks?', in *Delivering Inclusive Financial Development and Growth, SOAS University of London*, pp. 1–19.

Chileshes, M. P. (2017) 'Banking Structure and the Bank Lending Channel of Monetary Policy Transmission : Evidence from Panel Data Methods', *Munich Personal RePEc Archive*, (82757).

Chiu, J., Eisenschmidt, J. and Monnet, C. (2019) 'Relationships in the interbank market', *Review of Economic Dynamics*. doi: 10.1016/j.red.2019.06.003.

Chiu, J. and Monnet, C. (2016) 'Relationships in the Interbank Market', *Bank of Canada Staff Working Paper*, (33).

Cocco, J. F., Gomes, F. J. and Martins, N. C. (2009) 'Lending Relationships in the Interbank Market', *Journal of Financial Intermediation*. Elsevier Inc., 18(1), pp. 24–48. doi: 10.1016/j.jfi.2008.06.003.

Colliard, J.-E. *et al.* (2016) 'Overnight Interbank Markets and the Determination of the Interbank Rate: A Selective Survey', *International Review of Financial Analysis*. Elsevier Inc., 44(14), pp. 149–161. doi: 10.1016/j.irfa.2016.01.014.

Colliard, J.-E., Foucault, T. and Hoffmann, P. (2016) 'Trading Frictions in the Interbank Market, and the Central Bank'. Available at: http://www.eief.it/files/2016/06/colliard.pdf.

COMESA Monetary Institute (2019) *Guidelines for Analysisng Banking Syetem Interconnectedness and Systemic Risk: Basic Network Analysis*.

Cottarelli, C. and Kourelis, A. (1994) 'Mechanism of Monetary Policy', *IMF Staff Papers*, 41(4).

Craig, B. R., Fecht, F. and Tümer-Alkan, G. (2015) 'The Role of Interbank Relationships and Liquidity Needs', *Journal of Banking and Finance*. Elsevier B.V., 53, pp. 99–111. doi: 10.1016/j.jbankfin.2014.12.022.

Ho, T. S. . Y. . and Saunders, A. (1985) 'A Micro Model of the Federal Funds Market', *The Journal of Finance*, 40(3), pp. 977–988.

Kanyumbu, E. K. (2020) 'The Network Structure of the Malawi Interbank Market : Implications for Liquidity Distribution and Contagion around the Banking System', *Open Journal of Business and Management*, 8, pp. 2740–2760. doi: 10.4236/ojbm.2020.86170.

Kim, K. (2017) 'A Price-Differentiation Model of the Interbank Market and Its Application to a Financial Crisis', *Finance and Economics Discussion Series*, 2017(065). doi: 10.17016/feds.2017.065.

Massarongo, F. (2012) *Analysis of the Effectiveness of Monetary Policy in sub-Saharan Africa Developing Countries : The Case of Mozambique*. University of London.

Mayordomo, S. Abasca, M., Alonso, T., Rodriguez-Moreno, M.. (2015) 'Fragmentation in the European Interbank Market: Measures, Determinants, and Policy Solutions', *Journal of Financial Stability*. Elsevier B.V., 16, pp. 1–12. doi: 10.1016/j.jfs.2014.11.001.

Muhanga, I., Mutoti, N. and Zgambo, P. (2009) 'Interbank Money Market Segmentation in Zambia'. Available at: (unpublished).

Odour, J., Sichei, M. M., Tiriongo, S., Shimba, C. (2014) 'Segmentation and Efficiency of the Interbank Market and their Implication for the Conduct of Monetary Policy', *African Development Bank Group Working Paper Series*, (202).

Osoro, J. and Muriithi, D. (2017) 'The Interbank Market in Kenya: An Event-Based Stress Analysis Based on Treasury Bill Market', *European Scientific Journal, ESJ*, 13(16), p. 127. doi: 10.19044/esj.2017.v13n16p127.

Raga, S. and Tyson, J. (2021) 'Sub-Saharan Africa's Interbank Markets: Progress, Barriers and Policy Implications', *The Development and Economic Growth Research Programme*, (February), p. 36. Available at: https://degrp.odi.org/wp-content/uploads/2021/02/Sub-Saharan-Africas-interbank-markets-DEGRP-2021-Synthesis-Report.pdf.

Sichei, M. M., Kiplang, S. and Shimba, C. (2012) 'Segmentation and Efficiency of the Interbank Market in Kenya', *Kenya Bankers Association, Centre for Research on Financial Markets and Policy, Working Papers Series*. (Working Papers Series), (01).

Simpasa, A. (2015) 'Bank Lending Channel in Zambia : Empirical Evidence from Bank Level

Data', *Journal of Economic Studies*, 42(6), pp. 1159–1174. doi: 10.1108/JES-10-2014-0172.

Simpasa, A. M., Kayizzi-mugerwa, S. and John, C. (2013) 'Competition and Market Structure in the Zambian Banking Sector', *African Development Bank Group Working Paper Series*, (168).

Temizsoy, A., Iori, G. and Montes-Rojas, G. (2015) 'The Role of Bank Rlationships in the Interbank Market', *Journal of Economic Dynamics and Control*, 59(14), pp. 118–141. doi: 10.1016/j.jedc.2015.07.008.

Wetherilt, A. Zimmerman, P., Soramäki, K., (2010) 'The Sterling Unsecured Loan Market During 2006 – 08 : Insights from Network Theory', *Bank of England Working Paper*, (398).