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Bank Liquidity in Disstressed Macro-Economic Conditions: The Case of Zimbabwe

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Abstract

The bank liquidity phenomenon remains an unending theme of much debate among banking sector officials and the general banking public since it has the tenacity to derail economic activities in the event of chronic macro-economic fluctuations. Unstable macro economic environments are a formidable threat to bank liquidity positions as they play a significant role in deteriorating banks? assets value which often diminishes banks? liquidity.

Index terms— bank liquidity, liquidity ratios, macro-economic factors, distressed economic environment, regressors.

I. Introduction and Background of the Study raditionally banks function as financial intermediaries which pool and transform small short-term deposits from surplus units into bigger and longer-term loans for the deficit sectors. This bank intermediation role exposes the bank to various types of risk, namely; liquidity risk (due to the mismatch of deposit and loan maturities), interest rate risk (mismatch between fixed and floating interest rates charged on assets and liabilities), default risk, and operational risk. Since loans are illiquid and deposit withdrawals usually random, banks should hold adequate liquidity to meet daily depositors' demand and wholesale commitments (Sekoni, 2015).

Various techniques in banking like the matched book, repricing model and duration model have been developed to manage this core idiosyncratic liquidity risk (Choudhry, 2018). The repricing model, although it ignores the time value of money, overaggregates assets and liabilities into time buckets and ignores cash flows from off-balance-sheet assets, remains an important model in bank asset and liability management and is the bedrock upon which better models like duration and value at risk models are constructed (Saunders and Cornet 2011).

Modern-day banking is now complex and dynamic. Banks operate with a wide array of complex hybrid financial products across international markets and have evolved into one-stop-shop conglomerates. However, at the core of all capital and money market activities lies the original logic behind the raison deitre of all banks which is to bring together the suppliers of capital with the borrowers of capital (Choudhry, 2018). Sekoni (2015) argued that liquidity acts as the grease that facilitates the smooth functioning of a financial system. Indeed liquidity is the lifeblood of the banking sector, even though other fundamentals like capital adequacy are managed well, illiquidity can paralyze a bank and cause bank runs that can have repercussions on the bank's overall financial performance.

The global financial crisis of 2008 was a wakeup call for the world's financial sector and to regulators all over the world that financial sector liquidity regulations needed to be strengthened. Considering the shortcomings of the Basel II accord, the Basel Committee developed a new accord to create a more resilient financial sector that could absorb severe economic shocks. At the centrepiece of this regulation, Basel III consists of liquidity management regulations that changed how banks view, categorize and manage their assets and liabilities.

The new liquidity coverage ratio requires banks to hold high-quality liquid assets that can be easily converted into cash within a day and without a decrease in value. These assets should meet the expected net cash outflows for 30 calendar days (Bank for International Settlements 2013). The net stable funding ratio supplements the liquidity coverage ratio by promoting liquidity risk resilience over a longer time horizon of up to a year. Banks are required to fund their activities with more stable sources of funding on an ongoing process (Bank for International Settlements, 2013). However, the Centre of Global Development (2019) argues that this regulation requires a wellestablished financial market in terms of market depth and market breadth to be effective and suggested that there is a need for a differentiated approach to the implementation of bank regulations for emerging markets/developing economies and developed economies.

Zimbabwe' sfinancial sector performance has always been a function of the domestic macroeconomic fundamentals and developments in the global and regional economies (Reserve Bank of Zimbabwe, 2019). After the accelerated Land reform program embarked by the Zimbabwean government in 2000, the financial sector faced a myriad of challenges and financial crises like inflationary pressures and speculative activities in the foreign exchange and stock market, among other factors (RBZ 2008).

In the year 2009, Zimbabwe adopted the multicurrency regime and during this period, the economy stabilized for a while. Inflationary pressures were subdued to deflation, unemployment decreased, GDP growth rates improved. However, bank liquidity remained one of the most critical challenges during this period. The demand for foreign currency in the Zimbabwean economy, mainly the United States Dollar, continued to outweigh supply and bank liquidity deteriorated substantially. The Reserve Bank of Zimbabwe responded by introducing bond coins at a rate of 1:1 with the United States Dollar. This policy facilitated bank runs and severe bank illiquidity as the general public was afraid of the return of the Zimbabwean dollar and the exchange rate was not justifiable, thereby loss of confidence by the general public.

In October 2018, all-local USD denominated bank accounts opened during the multicurrency regime before the introduction of the local currency were converted into RTGS$ accounts at one as to one rate and new foreign currency accounts (FCA) were introduced specifically for foreign currency deposits. This transition disheartened depositors and investors, thereby losing confidence in the financial sector. The statutory instrument SI 33/2019 of 22 February liberalized the exchange rate, and finally SI 142/2019 of 24 June 2019 removed the multi-currency system and re-introduced the local currency ZWL as the sole legal tender in the country (RBZ, 2019). Figure 1 shows the composition of bank deposits as of 30 June 2019. Due to loss of confidence in the financial sector, the bulk of deposits in Zimbabwe are transitory, thus, account holders can withdraw the money at any time. Such deposits are difficult to manage and to transform/pool into profitable loans without compromising bank liquidity. Currently, the Zimbabwean foreign market is mainly characterized by multiple exchange rates, which aggravate opportunities for foreign exchange arbitrage opportunities. Discrepancies between the official interbank rate, which is usually lower than the Old Mutual implied rate, and the black market rate, which is usually higher than the official exchange rate cause depreciation of the local currency in the parallel market. Due to these discrepancies in the official and blackmarket rates, commodities are also charged based on the prevailing black market rates and not official bank rates. This causes inflationary pressures on commodity prices and poverty levels as only a few will afford them. Today, prices are still being denominated in both foreign currency and local currency and such differentiated pricing forces consumers to buy in foreign currency where prices are perceived lower, thereby increasing the demand for the scarce foreign currency.

1 Source: Reserve Bank of Zimbabwe

Zimbabwe has passed through various macroeconomic phases as explained in the background above; therefore the need for this research to econometrically analyse the impact of such macroeconomic changes on bank liquidity. There is no research that has analysed the impact of macroeconomic factors on bank liquidity in Zimbabwe. The Zimbabwe banking system architecture comprises of thirteen commercial banks, five-building societies, and one savings bank.

The primary objective of this research was therefore, to determine the effect of different macroeconomic conditions on bank liquidity. Specifically, the study analysed the effect of gross domestic product, inflation, unemployment, loan interest rate, and the real interest rate on bank liquidity.

2 II.

3 Literature Review

Liquidity is defined as the ability of a bank to fund increases in assets and meet obligations as they become due, without incurring unacceptable losses ??Vodova, 2014). This liquidity can be categorised into two, that is, market liquidity and funding liquidity (Yu Tian, 2009). Market liquidity is the ability of a market participant to execute a trade or liquidate a position with little or no cost, risk or inconvenience and funding liquidity is the ability of a bank to fund increases in assets and meet obligations as they become due, without incurring unacceptable losses (Yu Tian, 2009). Existing literature further postulates that from these two categories of liquidity, emanates two categories of liquidity risk, which are, market liquidity risk and funding liquidity risk. In the same vein, Vodova (2014) also categorized liquidity risk into two categories; the funding liquidity risk, where a bank will not be able to adequately fund its operations without affecting its daily operations or the financial position of the bank and market liquidity risk category, where a bank cannot easily offset a position at the market price because of inadequate market depth and market disruption.

Saunders and Cornnet (2014) however, categorised liquidity risk into liability side liquidity risk and asset size liquidity risk. Just as market liquidity risk established by Vodova (2014) these authors argue that when liability holders of a bank demand cash by withdrawing their deposits, the bank should meet this demand by cash, sale of bank liquid assets or by borrowing additional funds. If the bank funds this deposit drain by sale of bank assets at low fire-sale prices, this will threaten the liquidity position of the Bank. Asset side liquidity risks represent the ability of a Bank to fund loan requests and exercise off-balance sheet loan commitments and other credit lines. Saunders and Cornet (2014) established that when a borrower finally draws a loan on commitment, the bank should fund this loan immediately through additional borrowing, sale of liquid assets or sale of liquid assets. The ability to fund such commitments represents the level of asset-side liquidity risk.

There is no consensus in the literature on the way liquidity risk should be measured. Moorad (2018) postulated that liquidity risk could be measured by liquidity gap, the difference between bank assets and bank liabilities in different maturity buckets. Since it is fundamental for a bank to keep the value of assets equal to the value of its liabilities. Moorad (2018) argued that the bank's liquidity position should be squared on a daily basis, taking into consideration the value of its ratesensitive assets and rate-sensitive liabilities. Saunders and Cornet (2014) however, argued that liquidity should be measured by the use of peer group liquidity ratio comparisons, liquidity index and the level of the financing gap. The liquidity index measures the potential loss a bank could suffer as a result of immediate disposal of an asset, while ratios such as loans to deposit ratios and borrowed funds to total assets ratios are compared among banks of similar size and location. Liquidity risk could also be measured by the difference between the bid-ask spread of an asset (ask price is the price the seller is willing to accept for an asset and the bid, the price the buyer is willing to pay for an asset). Thus the difference between the lowest ask price and the highest bid price becomes the value of liquidity risk (Yu Tian, 2009). This spread measure can be incorporated into the traditional Markowitz portfolio theory or the convectional VaR model. The bank of International settlements however, implemented new liquidity measures, the liquid coverage ratio, the net stable funding ratios and other risk control measures to ensure financial system stability.

Various authors concur that bank liquidity is a function of micro bank-specific factors under the control of bank management and macro-economic, external factors that the bank has no control over. Al-Homaidi et. al. (2019), analysed the determinants of bank liquidity of listed commercial banks in India. The authors established that macro-economic factors like interest and the exchange rates had a significant negative impact on bank liquidity, while bank-specific factors like bank size, capital adequacy ratio, operational efficiency ratio and return on assets ratio had a significant positive impact on liquidity. Asset quality ratio, asset management ratio, return on equity ratio and net interest margin also had a negative significant impact on bank liquidity. The general method of moments (GMM), pooled fixed effects and random-effects models were used to analyse data for 37 listed Indian commercial banks.

Madhi (2017) analysed the impact of macroeconomic factors on bank liquidity for a sample of 13 Albanian banks. The author argued that bank liquidity was difficult to measure and there was no universal standard to measure liquidity. Therefore they used various ratios to measure bank liquidity including; liquid assets to total assets ratio, loans to total assets ratio, loans to deposits and short term financing ratio, and liquid assets to deposits plus short term borrowing. Inflation, unemployment rate, GDP growth rate, public deficit, interbank interest rate, and interest rate were used as macroeconomic indicators. Fixed regression results proved a significant relationship between bank liquidity and unemployment rate, capital adequacy, interest rate, and non-performing loans. Surprisingly there was no significant relationship for bank liquidity, GDP, and inflation.

Trenca et. al (2015) analysed the impact of macroeconomic variables upon banking system liquidity of a group of European countries, namely; Greece, Portugal, Spain, Italy, Cyprus, and Croatia. Net loans to total deposits ratio was used as the dependant variable. In this case, the higher the ratio, the lower the liquidity as banks rely on borrowed funds. The authors established that inflation and liquidity rate in the previous period were the major determinants of liquidity in banks. However, the authors expected a negative relationship between liquidity and inflation as they argued that inflation lowered the purchasing power of people, thereby increasing bank lending as people need more money to buy the same products, thus lowering liquidity.

Zheng et. al. (2016) argue that a wellfunctioning and established interbank market, is crucial for channelling liquidity between a bank with surplus and shortages and minimizes bank holding of costly liquid assets. The author further established that the disruption of this crucial interbank market during the 2007-2008 global economic crisis was one of the major causes of bank failures as banks refrained from lending to each other and individually hoarding liquidity resulting in market illiquidity and bank failures. Zheng et. al. (2016) further posited that there were two main schools of thought that explain the impact of liquidity on a bank. The precautionary motive and the moral hazard motive. The precautionary motive posits that liquidity hoarding by individual banks causes overall market illiquidity and therefore, bank failure. Precautionary motive predicts that bank liquidity is positively related to bank failure risk. The moral hazard motive posits that government support of banks in distress incentivizes banks to engage in risky behaviour and discourages the holding of adequate liquidity and thereby causing failure risk. The authors further established that, the moral hazard effect is prone to larger banks due to the too big to fail effect. They tend to get more government support in times of distress while the precautionary motive is prone to small banks which have less access to external capital markets and therefore end up hoarding liquidity to curb financial constraints.

Calomiris (2003) analyzed Argentina and the Brazilian financial crisis as a case study. The authors argued that unlike in developed economies where an independent bank controls the monetary policy, in emerging countries, government controls the central bank and in times of distress, banks are forced to finance government debt and those who refuse are penalized. This, therefore, reduces bank liquidity and eventually leads to a countrywide financial crisis.

In the same vein, Ondiro (2018) analyzed the effect of macro-economic factors on commercial banks' liquidity in Kenya. The author analyzed panel data for a sample of 30 commercial banks through a randomeffects model. Ondiro (2018) established that the liquidity of a bank was positively related to loan loss provision, interest rates, and inflation rates while bank profitability and gross domestic product negatively influenced bank liquidity.

Madhi (2017) concurred with Zheng et. al. (2016) precautionary and moral hazard liquidity principles as they established a negative relationship between bank size and bank liquidity, affirming the too big to fail principle of big banks and small banks' liquidity hoarding. In the same vein. Vodova's (2012) study of Czech and Slovak's bank established that big banks relied on the inter-bank market and on the lender of last resort liquidity assistance in times of distress while small and medium-sized banks held a buffer of liquidity assets. There is no research that has empirically analyzed the effect of bank size on liquidity in Zimbabwe and hence, this research adds bank size as one of the independent variables affecting bank liquidity.

4 Global Journal of Management and Business Research

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5 Research Methodology a) Data collection and sampling

Data was collected from Reserve Bank supervision and surveillance annual reports for all deposit-taking banks in Zimbabwean. A census of all banks in Zimbabwe was considered since there are only 19 banks in Zimbabwe. However, only fifteen banks were in operation for the selected period 2010-2018. Other banks were established during the selected period, and banks that failed during the same period were not considered for this research. The period 2010 to 2018 was considered to account for the multicurrency regime and the period after the introduction of the Zimbabwean dollar. Due to Base II and III accord pillar three of market discipline and market disclosure, banks are mandated to publish their audited financial statements. Therefore, bank financial data was readily available.

6 b) Econometric model specification

To analyse the impact of Zimbabwean macroeconomic factors on bank liquidity. The following panel regression model was estimated:Lit =? + X'it? + (ui + vit)

7 Where

Lit represents the dependent variable, one of the liquidity ratios for bank i at time t Xitis a vector of explanatory variables for bank i in time t, ? is a constant, ?' are coefficient which represents the slope of variables, ui represent the random effect specific to bank i and v it is the error term (Myoung, 2011).

8 c) Dependent variable

In literature, there is no consensus on how liquidity can be adequately measured. Although different authors recommend different liquidity ratios, there is no one standard ratio that can capture all liquidity risk of a bank (Ondiro 2018 **??** Vodova 2012, Madhi 2017). Therefore the need for this research to fill this gap in the literature and to use different liquidity ratios as dependent variables. This research will use four liquidity ratios as the dependent variable, namely; loans to deposits ratio, cash to total assets, loans to total assets and deposits to total assets ratio.

9 LTD =

10 ?????????? ?????????? ???????????????? ?? 100

This is a ratio of the most illiquid assets loans to the most liquid liabilities deposits. A lower ratio represents that the bank is using ordinary low-cost deposits to fund loans. The higher the ratio, the higher the illiquidity of a bank.

11 CTA =

???????????? ???????????? (?????? ?)

12 ?????????? ?????????? ?? ?? 100

The ratio of liquid assets to total assets represents the capacity of a bank to absorb liquidity shocks and unexpected demands for cash. This ratio is measured as the proportion of liquid assets (cash and money market instruments) to total assets. The higher the ratio the higher the liquidity of a bank. Zimbabwe has faced several liquidity challenges in the past two decades and these liquidity crunches have crippled the whole financial sector of the country every time they have occurred. Due to the trading of cash on the black market at a premium, financial markets have been disrupted and have lacked the adequate market depth to provide liquidity. Therefore the researcher considered cash as the major liquid asset to be considered for a bank in Zimbabwe.

13 LTA =

14 ?????????? ?????????? ???????????? ?? 100

This ratio represents the proportion of loans to total assets of a bank. Loans are categorised as one of the most illiquid assets of a bank. Therefore, this ratio indicates the percentage of bank assets tied up in illiquid loans. The higher the ratio, the higher the bank illiquidity (Vodova 2012).

15 DTA =

16 ???????????????? ?????????? ???????????? ?? 100

Bank deposits are categorised into transitory deposits which do not pay any interest to depositor and term deposits which are deposited for a stipulated period of time. Deposits should be one of the major sources of funding for banks and therefore increases bank liquidity. The higher the ratio, the higher the liquidity of a bank.

17 d) Explanatory/ independent variables

Explanatory variables were represented by gross domestic product, inflation, unemployment, bank size and return on equity. The variables and the expected signs are explained in table 1

18 Data Analysis

Panel data exploration in fig 2confirms a sharp decline in the proportion of cash to total assets during the period 2016 and 2018.This is the period when local currency bond notes and coins were introduced. A higher value of cash to total assets ratio represents higher liquidity. The graph also confirms a decrease of bank liquidity from years 2014 to 2018. Foreign-owned banks had the highest level of cash to total assets during the period 2010 -2014 which was the foreign currency regime, while the savings bank (6) maintained a steady proportion of cash to total assets during the entire period.

Source: author's processing To continue lending banks could easily change their risk appetite and lend to less risky sectors. However, there was a slight decline in the years 2017 and 2018. Banks continued to square off their net position of bank assets and liabilities. However, the proportion of loans to deposits increased in the years 2014 and 2015 for most banks. The ratio is a measure of illiquidity. The higher the ratio, the lower the liquidity. The trend in figure 4shows that bank liquidity declined during the period 2015 and 2018. The increase in the ratio was caused by a decline in bank deposits or an increase in loans. The Zimbabwean economy is agro-based, therefore the country's agricultural bank, funded by government had the highest proportion of loans to deposit ratio during the entire period.

Generally, the proportion of deposits to total assets remained steady during the entire period. As reflected in figure 5; a higher value of this ratio represents a higher liquidity. It is evident that bank liquidity remained fairly low during the entire period. Through financial technology and innovations, banks can expand and grow their deposit base. The country's economy is highly in-formalised and the deposits that pass through the formal sector are transitory in nature. Therefore, an improved macroeconomic environment deemed temporary will not improve the deposit base of banks. Deposits are a function of customer confidence in the financial sector.

Source: author's processing

19 Regression Results

20 a) Cost to total assets ratio model

The explanatory power of this model was quite fair, with a probability chi-square of 0.0001. Gross domestic product, inflation and real interest rate had a negative significant relationship with bank liquidity. A positive relationship was expected for GDP. However, the negative relationship from regression results reflects the high demand for loans by borrowers during periods of economic expansion to fund investments and projects (Vodova, 2014). As expected, inflation had a significant negative relationship with bank liquidity, signalling that inflation deteriorates the overall economic environment and thereby lowering bank liquidity. Surprisingly, unemployment had a positive relationship with bank liquidity. In Zimbabwe, this could be a reflection of most banks issuing salary-based loans and shunning of SME loans. Therefore the lesser the formally employed people, the lesser the number of retail loans. Higher lending interest rates had a tendency to discourage unnecessary borrowing thereby a positive significant relationship between lending interest rates and bank liquidity. The effects on bank size was insignificant.

21 Table 4: Cash to total assets ratio model b) Deposit to total assets model

Liquidity was also measured by deposits to total assets ratio as reflected in table 5. The higher the ratio of deposit to total assets, the higher the liquidity of a bank. Bank size and lending interest rates had a positive significant relationship with bank liquidity while gross domestic product, unemployment and real interest rates had negative significant relationships as shown in table ??. Both models where liquidity was measured cash to total assets ratio and deposit to total assets ratio, established that gross domestic product hurt bank liquidity. During periods of economic expansion, banks tend to lend more, thereby holding less liquidity. There is no consensus in the literature concerning the relationship between bank size and liquidity, therefore, the positive relationship between bank size and bank liquidity in Zimbabwe is a reflection of the dominance of the big five banks in deposit market share and loan market share. Large banks therefore, held more liquidity than smaller banks.

The Zimbabwean economy is highly informalised, with most of the people employed in the informal sector, which rarely banks its money but promotes the circulation of hard currency outside the formal sector. This explains the significant negative relationship between unemployment and bank liquidity. A thriving black market for foreign currency has become a hide-out for most unemployed people. These black market dealers offer higher rates for foreign currency compared to formal market rate, thereby reducing bank foreign currency inflows and bank liquidity. The explanatory power for loans to total assets model and loans to deposit ratio model was quite low and most of the variables were insignificant. These two models had loans to total deposits and loans to total assets as measures of liquidity and are measures of illiquidity therefore, their regression signs are interpreted in reverse.

There is only one significant variable for the loan to total assets model. This lending interest rate had a negative significant relationship with bank liquidity. That is, the higher the lending interest rate, the lower the bank liquidity as the bank lends more for profit.

22 Table 6: Loan to total assets

Unemployment was significant at 90% confidence level. The higher the unemployment in the economy, the higher the illiquidity of banks since the pooling of depositors funds works effectively when there are more ordinary people with disposable income.

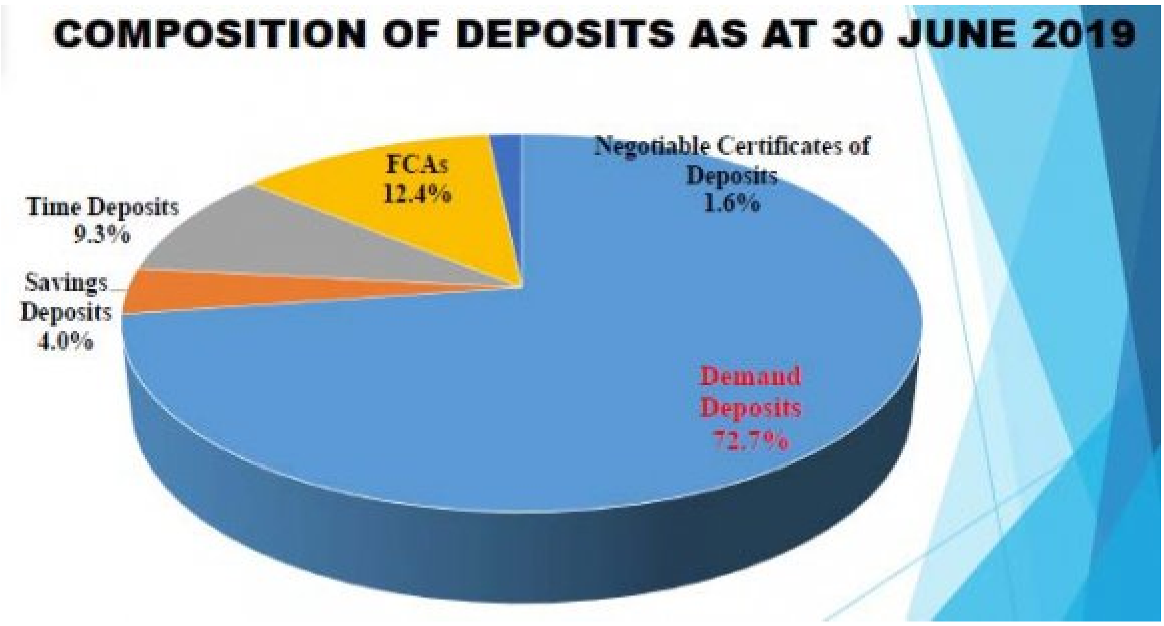
23 Global Journal of Management and Business Research

Volume XX Issue V Version I Year 2020 ( )

24 Conclusion

The aim of this study was to analyse the effect of macro-economic factors like inflation, gross domestic product, real interest rate, lending interest rate, unemployment on bank liquidity. The research established that gross domestic product, real interest rate and inflation had a negative significant relationship with bank liquidity in Zimbabwe while bank size; a bankspecific variable, had a positive relationship with liquidity. Banks therefore held low proportions of cash to their total assets. Policymakers should therefore improve the availability of cash in banks to improve financial system liquidity and stability during distressed economic environments.

ibliography and eferences [1]



1

Figure 1: Figure 1 :

R-sq: within = 0.5716
between = 0.0883
overall = 0.3877

Prob > chi2 = 0.0000

cta	Coef.	Robust Std. Err.	z	P>|z|
bsize	1.15312	.807228	1.43	0.153
gdp	-.1945458	.0748522	-2.60	0.009
inf	-.0788035	.0319764	-2.46	0.014
unemp	.7389438	.3645302	2.03	0.043
realint	-.1400158	.0535218	-2.62	0.009
lendint	1.971494	.4318708	4.57	0.000
_cons	-38.23019	18.94197	-2.02	0.044

2

Figure 2: Figure 2 :

R-sq: within = 0.2047
between = 0.5997
overall = 0.2780
Prob > chi2 = 0.0000

dta	Coef.	Robust Std. Err.	z	P>|z|
bsize	6.869611	3.015848	2.28	0.023
gdp	-1.149363	.2276696	-5.05	0.000
inf	.0225772	.1778906	0.13	0.899
unemp	-11.87631	2.725202	-4.36	0.000
realint	-.0767964	.3959855	-0.19	0.846
lendint	9.312248	1.808493	5.15	0.000
_cons	-82.38374	66.45098	-1.24	0.215

3

Figure 3: Figure 3 :

R-sq: within = 0.4644
between = 0.0002
overall = 0.2842

Prob > chi2 = 0.0000

lta	Coef.	Robust Std. Err.	z	P>|z|
bsize	-1.986706	2.565788	-0.77	0.439
gdp	-.6882942	.4509921	-1.53	0.127
inf	-.0397532	.2934422	-0.14	0.892
unemp	2.343802	3.075726	0.76	0.446
realint	.0967871	.5175608	0.19	0.852
lendint	5.044383	1.267794	3.98	0.000
_cons	28.91118	53.46368	0.54	0.589

4

Figure 4: Figure 4 :

```
R-sq:  within  = 0.3264
       between = 0.2062
       overall = 0.1834

Prob > chi2   =  0.0017
```

ltd	Coef.	Robust Std. Err.	z	P>|z|
bsize	-4.180885	2.62656	-1.59	0.111
gdp	-.4726743	.5843468	-0.81	0.419
inf	-.168063	.2510467	-0.67	0.503
unemp	18.74367	7.271476	2.58	0.010
realint	.277995	.380588	0.73	0.465
lendint	1.102237	2.179823	0.51	0.613
_cons	49.43021	53.14222	0.93	0.352

5

Figure 5: Figure 5 :

CTA Hausman test

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	---- Coefficients ----			
bsize	1.17526	1.15312	.0221402	.2355061
gdp	-.1946402	-.1945458	-.0000944	.0079071
inf	-.0790745	-.0788035	-.000271	.0057199
unemp	.7405269	.7389438	.0015831	.0921714
realint	-.1400185	-.1400158	-2.69e-06	.0084785
lendint	1.975834	1.971494	.00434	.0547256

```
                     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)
                      =        0.01
            Prob>chi2 =      1.0000
```

5

Figure 6: Table 5 :

```
Random-effects GLS regression                   Number of obs      =       135
Group variable: bank                            Number of groups   =        15

R-sq:  within  = 0.5716                         Obs per group: min =         9
       between = 0.0883                                        avg =       9.0
       overall = 0.3877                                        max =         9

Random effects u_i ~ Gaussian                   Wald chi2(6)       =     77.69
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                                  (Std. Err. adjusted for 15 clusters in bank)
------------------------------------------------------------------------------
             |               Robust
         cta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       bsize |    1.15312    .807228     1.43   0.153    -.4290176    2.735258
         gdp |  -.1945458   .0748522    -2.60   0.009    -.3412535   -.0478382
         inf |  -.0788035   .0319764    -2.46   0.014    -.1414762   -.0161309
       unemp |   .7389438   .3645302     2.03   0.043     .0244776     1.45341
     realint |  -.1400158   .0535218    -2.62   0.009    -.2449165    -.035115
     lendint |   1.971494   .4318708     4.57   0.000     1.125043    2.817945
       _cons |  -38.23019   18.94197    -2.02   0.044    -75.35577   -1.104611
-------------+----------------------------------------------------------------
     sigma_u |  2.5774784
     sigma_e |  2.3923836
         rho |  .53719188   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Figure 7:

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
       bsize |   -2.705738    -1.986706       -.7190316        1.161674
         gdp |   -.6852283    -.6882942        .0030659        .0290649
         inf |   -.0309522    -.0397532        .0088011        .0229704
       unemp |    2.292389     2.343802        -.051413        .3411732
     realint |    .0968745     .0967871        .0000874        .0309603
     lendint |    4.903435     5.044383       -.1409479        .2517367
------------------------------------------------------------------------------
                           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)
                          =        0.38
                Prob>chi2 =      0.9990
```

Figure 8:

```
Random-effects GLS regression                   Number of obs      =       135
Group variable: bank                            Number of groups   =        15

R-sq:  within  = 0.4644                         Obs per group: min =         9
       between = 0.0002                                        avg =       9.0
       overall = 0.2842                                        max =         9

Random effects u_i ~ Gaussian                   Wald chi2(6)       =     64.82
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                                  (Std. Err. adjusted for 15 clusters in bank)
------------------------------------------------------------------------------
             |               Robust
         lta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       bsize |  -1.986706   2.565788    -0.77   0.439    -7.015559    3.042146
         gdp |  -.6882942   .4509921    -1.53   0.127    -1.572222     .195634
         inf |  -.0397532   .2934422    -0.14   0.892    -.6148893    .5353828
       unemp |   2.343802   3.075726     0.76   0.446     -3.68451    8.372114
     realint |   .0967871   .5175608     0.19   0.852    -.9176133    1.111188
     lendint |   5.044383   1.267794     3.98   0.000     2.559553    7.529214
       _cons |   28.91118   53.46368     0.54   0.589    -75.87571    133.6981
-------------+----------------------------------------------------------------
     sigma_u |  10.902948
     sigma_e |  11.122822
         rho |  .49001841   (fraction of variance due to u_i)
```

Figure 9:

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
       bsize |    1.061681     6.869611       -5.80793        2.827396
         gdp |   -1.124598    -1.149363        .0247648              .
         inf |    .0936672     .0225772        .0710901              .
       unemp |    -12.2916    -11.87631       -.4152848              .
     realint |   -.0760902    -.0767964        .0007062              .
     lendint |     8.17375     9.312248       -1.138497        .4289322
------------------------------------------------------------------------------
                           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)
                          =        4.22
                Prob>chi2 =      0.6470
                (V_b-V_B is not positive definite)
```

Figure 10:

```
Random-effects GLS regression                   Number of obs      =       135
Group variable: bank                            Number of groups   =        15

R-sq:  within  = 0.2047                         Obs per group: min =         9
       between = 0.5997                                        avg =       9.0
       overall = 0.2780                                        max =         9

Random effects u_i ~ Gaussian                   Wald chi2(6)       =     61.92
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

                                  (Std. Err. adjusted for 15 clusters in bank)
------------------------------------------------------------------------------
             |               Robust
         dta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       bsize |   6.869611   3.015848     2.28   0.023      .958657    12.78057
         gdp |  -1.149363   .2276696    -5.05   0.000    -1.595587   -.7031387
         inf |   .0225772   .1778906     0.13   0.899    -.3260821    .3712364
       unemp |  -11.87631   2.725202    -4.36   0.000    -17.21761   -6.535012
     realint |  -.0767964   .3959855    -0.19   0.846    -.8529138     .699321
     lendint |   9.312248   1.808493     5.15   0.000     5.767666    12.85683
       _cons |  -82.38374   66.45098    -1.24   0.215    -212.6253    47.85779
-------------+----------------------------------------------------------------
     sigma_u |  2.3363789
     sigma_e |  15.950561
         rho |  .02100464   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Figure 11:

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
       bsize |   -2.105296    -4.180885         2.07559        1.373566
         gdp |   -.4815245    -.4726743       -.0088502               .
         inf |   -.1934686     -.168063       -.0254056               .
       unemp |    18.89208     18.74367         .148411               .
     realint |    .2777426      .277995       -.0002524               .
     lendint |    1.509104     1.102237        .4068667        .1361363
------------------------------------------------------------------------------
                           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)
                          =        2.28
                Prob>chi2 =      0.8919
                (V_b-V_B is not positive definite)
```

Figure 12:

```
Random-effects GLS regression                   Number of obs      =       135
Group variable: bank                            Number of groups   =        15

R-sq:  within  = 0.3264                         Obs per group: min =         9
       between = 0.2062                                        avg =       9.0
       overall = 0.1834                                        max =         9

Random effects u_i ~ Gaussian                   Wald chi2(6)       =     21.25
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0017

                                  (Std. Err. adjusted for 15 clusters in bank)
------------------------------------------------------------------------------
             |               Robust
         ltd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       bsize |  -4.180885    2.62656    -1.59   0.111    -9.328849    .9670786
         gdp |  -.4726743   .5843468    -0.81   0.419    -1.617973    .6726244
         inf |   -.168063   .2510467    -0.67   0.503    -.6601054    .3239795
       unemp |   18.74367   7.271476     2.58   0.010     4.491842     32.9955
     realint |    .277995    .380588     0.73   0.465    -.4679438    1.023934
     lendint |   1.102237   2.179823     0.51   0.613    -3.170137    5.374612
       _cons |   49.43021   53.14222     0.93   0.352    -54.72662     153.587
-------------+----------------------------------------------------------------
     sigma_u |  23.878778
     sigma_e |  17.439517
         rho |  .65214989   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Figure 13:

1

Variable	Explanation	Source	Expected signs (CTA & DTA)	LTD Expected signs (LTA &	Year 2020 Volume XX Issue V Version I ( ) C Global Journal of Management and Business Research
BSIZE	Bank size, calculated as the natural logarithm of bank total assets.	RBZ reports	+/-	+/-	
GDP	Growth rate of gross domestic product	World Bank	+	-\	
INF	Inflation measures the volatility in consolidated consumer price index	World Bank	-	+	

Figure 14: Table 1 :

7

Figure 15: Table 7 :

V.

.1 Regression Results

Panel data is a dataset in which the behaviour of entities in this case banks„ are observed over time and this data is usually analysed by fixed effects or random-effects model depending on whether the unobserved individual effect, embodies elements that are correlated with the regressors in the model. A correlation matrix represented in table 2 established that independent variables were not correlated with the majority of variables having less than 0.5 correlation index. A Hausman test was used to test for multicollinearity among the independent variables and to decide the appropriate model between fixed or randomeffects model. The null hypothesis for the Hausman test is that the preferred model is random-effects vs. the alternative the fixed effects. Hausman tests whether the unique errors (ui) are correlated with the regressors. The null hypothesis was that the unique errors were not correlated. Hausmantest p-value for all models were above 0.05.Therefore, the author failed to reject the null hypothesis hence the random-effects model was the most appropriate model (see appendices).

The Breusch-Pagan Lagrange multiplier test was conducted to decide between a random-effects model and a simple ordinary least squares regression. The null hypothesis for the Breusch-Pagan Lagrange multiplier test is that variances across entities are zero. This means no significant difference across units, hence no panel effect (Torres Oscar, 2007). The chi2 results for all models expect for DTA (0.044) model was 0.0001, thus less than 0.05. Therefore, the null hypothesis was rejected since there was a significant difference across units that represented the panel effect of data. The author chose random effects regression over the ordinary least squares regression model for all models. **??**———+——————————- **??**———+——————————-

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