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Title: The impact of Basel III on bank balance sheet structure in South Africa

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Abstract

The global financial crisis cost the world economy an estimated 17 trillion dollars. (Wiese, 2012). This crisis was partly due to banks inability to have the required liquidity on hand to meet their necessary obligations. The Bank of International Settlements (BIS) released Basel III requirements in 2010 to mitigate the risk of the liquidity problems that banking sectors experienced during the 2007-2008 financial crisis, happening again. This research seeks to understand the impact of one aspect of the Basel III regulation, namely the Liquidity Coverage Ratio (LCR), on the South African (SA) banking sectors balance sheet structure.

This research aims to ascertain whether there has been a significant reduction in credit extension in the SA economy, whether there has been a significant increase in the maturity term structure of bank liabilities from asset managers and whether the type of depositor that banks seek to attract has significantly changed in line with previous research done in the US, UK and the EU.

The research follows a case study methodology which analyses the SA banking sector as a single case. Monthly, publically available data was sourced from the SA Reserve Bank and the testing of the hypotheses was carried out using an Autoregressive Integrated Moving Average Approach (ARIMA).

The results show that the implementation of the LCR has not had a significant impact on credit extension in the SA economy. The SA banking sectors reliance on funding from asset managers did reduce, however, not significantly as a result of the regulations. The proportion of medium and long term funding that bank receive from asset managers decreased contradicting the literature on the subject.

Keywords

Financial Crisis

Basel III

Liquidity Coverage Ratio

Credit Extension

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Shrinesan Pather

06-11-2017

Date

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Abbreviations

LCR	Liquidity Coverage Ratio
HQLA	High Quality Liquid Assets
SA	South Africa
US	United States
UK	United Kingdom
EU	European Union
BIS	Bank of International Settlements
SARB	South African Reserve Bank
BCBS	Basel Committee on Banking Supervision
SME	Small Medium Enterprise

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Chapter 1 – Introduction to research problem

1.1 The global financial crisis

De Haan and Van Den End (2013) in their research on deciphering the financial crisis in 2007-2008, explained that the global financial crisis brought to light the inability of banks' around the world, to raise liquidity during a systemic crisis, to fund their day-to-day operations. They state that banks ran short of funding as wholesale short term depositors such as financial corporates, money market funds and other asset managers withdrew their funds with banks. This was due to banks incurring massive losses in their mortgage lending business and these depositors feared that banks would be unable to repay the deposits that were placed with them.

The mortgage lending losses caused concern for asset managers as to whether the banks would be able to repay their funds when they became due. Huang and Ratnovski (2014) explained that the inability of banks to roll the depositors funding for a further period of time, led to banks runs on funding which led the banks to insolvency. It was the banks' initial inability to meet these short-term cash obligations that translated into insolvency and the closure of 500 banks in the US alone. The financial crisis is said to have cost the United States of America (US) alone, approximately $12.8 trillion dollars in direct and indirect costs (Wiese, 2012).

Cabral (2013) in his paper on the symptoms and causes of the financial crisis explained that the crisis was described as a credit risk event and the losses in mortgage loans, having a knock on effect, caused the liquidity risk event of depositors withdrawing funds from banks in fear.

Demirgüç-Kunt and Huizinga (2010) in their research on bank activity and funding strategies stated that the financial crisis brought to light the international banking system's inability to find liquidity to run its day-to-day business during a crisis. The crisis resulted in significant losses across the US, United Kingdom (UK) and the European Union (EU) in multiple industries as the banking crisis caused a contagion effect, which spread to other industries.

Walter (2010) explained that shortcomings in the global banking system has led to an uptick in the occurrence of financial system crises with the chance of occurrence of between 4% and 5%. Banks are seen as a pivotal cog in a country's economic system

and the failure of even a single bank has multiple repercussions and knock on effects throughout the economy.

Handorf (2012) in researching the cost of bank liquidity explained the contagion effect that a banking crisis can have on other sectors of the economy. The financial crisis saw banks come under liquidity pressures, as there were points at which they did not have enough cash on hand to fund client needs. The spill over effect saw businesses in other sectors unable to find cash to fund their production of goods or the purchase of further assets to grow their business.

Basel Committee on Banking Supervision (2010) explains that the financial crisis during 2007-2008 brought about doubts related to the global banking systems' risk management practices and resulted in the Basel Committee on Banking Supervision introducing the Basel III regulations that forced banks to address the shortcomings during the financial crisis and to have stronger liquidity risk management practices in place to be better prepared to avert a liquidity crisis in future.

1.2 Overview of the regulations

As a result of the global financial crisis, the Bank of International Settlements (BIS), who create regulatory risk frameworks for the global banking market, better known as the Basel regulatory standards, developed Basel III, a set of regulations that sought to correct the shortcomings in the banking system that caused the shortage of liquidity during the global financial crisis.

Basel Committee on Banking Supervision (2013) explains that the Basel III regulatory framework was first proposed in 2010 as part of a consultative process between the BIS, in country regulators and banks in order to create a more robust banking system that could withstand the systemic shocks seen during the financial crisis.

The regulatory document goes on to explain that major outcomes of what was proposed was the implementation of regulation that states that banks' should hold a portfolio of high quality liquid assets (HQLA) that could be easily sold off or transferred under a repurchase agreement, to raise liquidity for a bank during a systemic or idiosyncratic crisis. The value of this portfolio should equal a forecasted, expected outflow of cash over a period of 30 days.

The regulation would be implemented in the form of the Liquidity Coverage Ratio (LCR), which is a ratio of the value of the HQLA portfolio that banks were now required to hold and a bank's contractual, expected net cash outflows over a 30-day period. This regulation catered for what is considered as market liquidity risk (Basel Committee on Banking Supervision, 2010).

$$Liquidity\ Coverage\ Ratio = \frac{Value\ of\ Portfolio\ of\ High\ Quality\ Assets}{Cash\ Outflows - Cash\ Inflows}$$

Hong, Huang and Wu (2014) in their paper on the information content of Basel III liquidity risk measures, explain that the reasoning behind the ratio is for banks to have enough HQLA on hand that can easily be converted to cash to meet their cash outflow obligations over a 30 day period.

Cabral (2013) in his research on a perspective of the symptoms and causes of the financial crisis explained that the strong regulatory response from the Basel committee on banking supervision and in country regulators came as a result of two reasons. The first was an assessment into the risk-taking activities of the banks pre the financial crisis and the risk mitigating controls that they had in place to limit the loss to the system if the risk were to be realised. Leading up to the crisis, the controls of the amount of liquidity required was not quantified correctly and fell extremely short of what was required during the crisis.

The second reason was as a result of the contagion effect during the crisis. In country regulatory supervisors took heed of the fact that the bank failures did not just affect direct stakeholders of banks, but additionally had far-reaching consequences for the entire financial system of a country and society as a whole.

1.3 Possible implications of the regulations

Schmaltz, Pokutta, Heidorn and Andrae (2014) in their paper on how to make regulators and shareholders happy under Basel III explain that bank decisions on how to grow the balance sheet post the implementation of the regulation, would be driven by the impact on bank's earnings and the knock on effect that the implementation would have on credit extension in the economy.

Their research went on to explain that the earning impacts are in the form of changes to the net interest margins. The portfolio of high quality HQLA comes at an opportunity cost of not being able to use funding for higher yielding loans. Therefore, it is in a bank's interest to reduce this portfolio by reducing the 30-day net cash outflow amount.

Fuhrer, Müller and Steiner (2017) in their paper on the liquidity coverage ratio and security prices, explain that the way to go about reducing the 30-day cash net outflow amount is by changing liability structure of deposits as the expected outflow is driven by the type of deposits a bank holds and the maturity structure of those deposits. The longer the term structure, the less the outflow, and the more deposits a bank has from retail, SME and non-financial corporates, the lower the outflow.

The decisions that a bank takes has payoff implications on the impact on the numerator and denominator of the LCR equation. In the case of a bank paying up to attract longer-term deposits, the bank incurs an increased funding cost. In extending the term of deposits, the bank has less deposits falling into the 30-day window of cash outflows. This would reduce the denominator of the LCR equation, which in turn would reduce the numerator, as a bank would need to purchase less low yielding HQLA to meet regulatory requirements and focus on growing higher yielding loan products.

Therefore, the above strategy would increase interest expense due to the extension of the maturity structure but at the same time, increase interest income due to spending of a greater proportion of funding on higher yielding loans as opposed to lower yielding HQLA. A bank will usually decide on strategy depending of which provides the greater net benefit.

King (2013) provides another strategy that would be to reduce the amount of funding a bank gets from asset managers and increase funding from other sources. The bank would need to increase deposit rates for deposit products to other counterparty types such as retail clients and non-financial corporates and as this increases, a bank would simultaneously reduce funding from asset managers by offering asset managers lower rates on their deposits.

The reasoning behind the strategy is that a bank should expect all deposits from financial corporates maturing in the next 30 days as an outflow of cash, whereas for retail and non-financial counterparties, only a small proportion of deposits are expected as an outflow as seen during the global financial crisis.

Therefore, by shifting the counterparties from which a bank receives its funding, a bank would increase its cost on retail and non-financial corporates deposits, decrease its cost on asset managers and by reducing the expected 30-day cash outflow number, a bank also reduces the amount of HQLA that it needs to hold. Again, a bank will usually decide on a strategy depending of which provides the greater net benefit.

From Banerjee and Mio (2017), Van den End and Kruidhof (2013) and Wei, Gong and Wu (2017) , it is blatant to see that the regulation and its effects on credit extension and the change in the structural nature of banks' balance sheets is extensively covered but most research states that in covering the impacts on a single country, there is plenty of room for further research on other jurisdictions due to different macro-financial environments and different balance sheet structural starting points at the outset of the implementation.

There have been many studies usually focusing on a single implication of Basel III regulations on banks operating in other countries and economies that function differently to SA, (Vazquez and Federico (2015), King (2013), Fuhrer, Müller and Steiner (2017), Bonner and Eijffinger (2016)), but none regarding the impacts on the SA banking sector.

1.4 The South African specific focus and need for this research

This research will focus on the impacts of the LCR on the SA banking sector's credit extension and the structural changes of the banking sectors balance sheet by the type of counterparty that the sector sources it's funding from as well as the term of funding from asset managers that it attracts.

The impacts of the regulations are two-fold. The primary effects on balance sheet structural changes and the secondary impacts on the economy of a country. The balance sheet impacts would be driven by how a banking sector decides to implement the regulations.

Banerjee and Mio (2017) in their research on the impact of liquidity regulations on banks explained that banks can respond the regulations in a number of ways which would lead to different implications in the societies in which they operate. One such strategy would be for banks to choose to adjust deposit structures by term or type of deposit to reduce the amount of low yielding HQLA that the bank would need to hold thereby freeing up funding used to grow credit extension in the economy.

The SA banking sector was faced with adopting Basel III regulatory standards for the LCR on 1 January 2015 and the requirement hurdle increasing on an annual basis. The banks will be required to have a minimum ratio of 60% by 1 January 2015, increasing by 10% annually, until they achieve 100% ratio by 1 January 2019.

Krug, Lengnick and Wohltmann (2015) in their paper on the impact of Basel III on financial stability explain that this the planned phase in is intended to allow banks to grow their portfolio of HQLA over time without downsizing the credit extension in the economy. At the same time it offer regulators and researchers the opportunity to understand and quantify the impact of the regulatory change.

The consequences of the regulations on the SA banking sectors' ability of banks to grow credit extension in the economy, the structural maturity changes to the balance sheet and the type of deposits that banks would seek to attract, is unknown.

There has been papers such as Duijm and Wierts (2014), Vazquez and Federico (2015) and Fuhrer, Müller and Steiner (2017), who cover various impacts of the regulation on banks around world but none on the impact on the SA banking sector. The impacts of the regulation on the SA banking sectors ability to grow credit extension and the structural impacts on the SA banking sectors' balance sheets would be different to existing research for the following reasons:

How banks would perform without having access to any form of quantitative easing programme as the influence of operational procedures relating to quantitative easing have a drastic implication on the cost of HQLA, which in turn affects banks decision on the structural balance sheet changes.

Banerjee and Mio (2017) speak to the fact that the impact of the regulations on UK, US and EU banks would be dependent on the specific macro-financial environment with specific attention paid to in the cost of acquiring and holding HQLA when the regulation came into effect. The rate provided to banks by the Bank of England for reserves created a perfectly elastic HQLA supply curve, which did not affect the cost of HQLA. This in turn would not have a drastic effect on bank decisions in relation to structural balance sheet changes.

They went on explain that the impact of the regulation on bank balance sheet structure is dependent on the macro environment as the driving factor of the price of HQLA informs a banks' decision on which approach to take. The SA banking sector did not have this

luxury of these rates provided by the SARB and the value of HQLA such as government bonds increased in price.

Fuhrer, Müller and Steiner (2017) in their research on the LCR and security prices covered the impact on LCR in Switzerland and found that the LCR caused an increase in the price of government securities or HQLA by at least 40 basis points on average. This argue that this HQLA premium is country dependent and depending on monetary policy within a country the impact would be different.

From Fuhrer, Müller and Steiner (2017) research above we take note that concentration in the banking sector is another factor that makes the SA banking sector different in comparison to other markets. A concentrated banking system does not offer vastly different rates between banks as a result of credit ratings of banks being the same. In other countries, banks with lower credit ratings have to offer greater deposit rates and hence their funding structure is more reliant on funding from asset managers. The effect of the LCR implementation would be different from the SA banking sector due the difference in cost of the implementation.

From Mckinsey (2014) and SARB Financial Stability Review (2016) a case is made for the third differential factor that makes the SA case incomparable. It is that international banking sectors are coming off a much lower base of retail and non-financial funding than the SA banking sector. The proportion of 30-day outflows is expected to be much higher than SA banks due to their funding structure.

The fourth factor that makes the SA impact different is due to the lack of deposit insurance in SA which affects the sectors ability to offer retail depositors greater assurances when compared to the US, UK and EU banking sectors.

1.5 What are the objectives of this research?

The research sets out to gain a greater understanding of the impact of this regulation on the SA banking sector since 1 January 2013, when the bank's began making structural changes to their balance sheets, in anticipation of the SA Reserve Banks (SARB) tiered implementation of regulation as of 1 January 2015.

The focus of this research is purely on the impact of the regulation on changes in credit extension and balance sheet structural changes of the South African banking sector. The structural changes that this research seeks to observe is the shift in asset structure to

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increase the amount of low yielding HQLA on the balance sheet and the effect that this would have on a banks' ability to grow its higher yielding loan book and extend credit to the economy. The other objective is to test whether banks have changed liability maturity structure and the type of deposit client that they seek to attract in line with research done by Wei, Gong and Wu (2017), Handorf (2012) and López-Espinosa, Moreno, Rubia and Valderrama (2012).

1.6 The business and theoretical need for the research

From a theoretical stand point, this research contributes to the discussions around the impact of liquidity regulation on banks' balance sheets by explaining why the SA banking sector should be affected differently in comparison to banking sectors in the US, UK and the EU and lastly to investigate whether the impact of the implementation of the regulation has been similar other countries.

To the researcher's knowledge, this seems to be the first research that encompasses the testing of the 3 hypotheses proposed using actual data post the implementation of the LCR regulations.

The business need for the research would involve debt investors, equity investors and new entrants to the market who would be interested in understanding the impact of the regulations on SA banking sectors credit extension and balance sheet structure for the benefit of the reduced liquidity risk that banks receive.

A secondary reason for selecting this problem would be, for new entrants to the market such as Discovery, Postbank and Commonwealth bank, who are all in the process of applying for banking licenses, to gain an understanding of the impact of the regulations.

The rest of this research is organised as follows: Chapter 2 details the related literature on the topic. Chapter 3 outlines the hypothesis that will be tested. Chapter 4 explains the methodology that will be used to test the hypotheses and a defence of the approach taken. Chapter 5 contains the results of the statistical tests and chapter 6 provides a discussion of the results of the tests. The conclusion provides a summary of the findings.

Chapter 2: Literature Review

2.1 A banks balance sheet structure and the financial crisis

A banks balance sheet is usually comprised of loans and HQLA on the asset side and deposits from clients and other funding instruments on the liability side. This usually makes up 90% of assets and liabilities for any given bank (SARB, 2016).

López-Espinosa, Moreno, Rubia and Valderrama (2012) explain that banks run what commonly known as a maturity mismatch by taking in short term deposits and lending out long term loans. The mismatch in the liquidity of assets and liabilities gives rise to liquidity risk as depositors could easily withdraw their cash within a day and leave a bank exposed to liquidity risk, which leads to solvency risk. Solvency risk is the risk of assets being greater than the sum of liabilities and equity.

A number of researchers have done analysis on the liquidity events that caused the financial crisis and how it was based on the structural make up of banks' balance sheets. Vazquez and Federico (2015) in their research on the bank funding structures and risk explain that the idea behind a bank's ability to create liquidity in financial intermediation theory is closely related to the regulatory concept of structural liquidity mismatches in a banks' balance sheet.

The mismatch is reflected by long-term illiquid assets (loans) which constitute the structural position that is being financed by short term funding. The liquidity mismatch theory states that a bank with larger structural liquidity mismatch would create more liquidity. Historically banks generate earnings by being a maturity transformation organisation, by taking in short term deposits and lending out money for long term loans.

During the financial crisis, depositors became concerned of banks' ability to repay the deposit holders due to the losses that banks were taking on their mortgage business. This led to bank runs on deposits as asset managers and money market funds specifically, withdrew the short-term demand deposits that they had with the banks. This left banks exposed to liquidity risk.

Acharya and Mora (2015) in their research on a crisis of banks as liquidity providers explained that during the crisis, banks were only able to maintain credit lines to clients due to government led intervention efforts. They explain that at the outset of the crisis deposit inflows reduced and the gap between loans and deposits widened. Banks

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immediately increased deposit rates to attract funding but the results of this action was insufficient to cover shortfalls and reduce the need for new credit in society.

Ritz and Walther (2015) in their research on how banks respond to increased funding uncertainty showed that the financial crisis began with uncertainty over funding conditions from asset managers and showed that it was this uncertainty that led to reductions in lending volumes, balance sheets and profitability of banks during the crisis using a dataset of banks in the EU banking system.

Giordana and Schumacher (2013) in their research on bank liquidity risk, monetary policy and the impacts of Basel III, explain that liquidity risk should be interpreted as a bank having enough cash on hand to meet all the cash outflows over a specified duration. In order to stay solvent the bank needs to generate enough cash inflows during the specified period in order to meet its outflows.

They further go on to explain that the bank management need to monitor the asset-liability maturity mismatch as the greater the mismatch the greater the outflows. Bank management need to have a view on an accurate analysis of the term structure of the bank's assets and liabilities. The authors' further state that the other tool that a treasurer has in his arsenal is the use of HQLA that can easily be liquidated to meet cash outflow requirements.

Cabral (2013) in his research on a perspective on the symptoms and causes of the financial crisis found that banks' profits were extraordinary high in the run up to the financial crisis. The high profits were achieved through growing liquidity and term risk mismatches between assets and liabilities and as this leveraging increased, banks became less liquid, setting the scene for a financial crisis. It is this mismatch between short term liabilities funding long term assets that Basel III tries to regulate.

The shortcomings in liquidity risk management during the financial crisis gave rise to the Basel III regulations on the LCR. The idea behind the ratio is for banks to have a contingent pool of assets that can be converted to cash should banks ever experience a liquidity squeeze similar to the one felt during the financial crisis.

2.2 The liquidity coverage ratio regulations

The Basel Committee on Bank Supervision (BCBS) regulation paper's on LCR (BCBS, 2010, BCBS 2013) states that the LCR ratio was introduced in light of the financial crisis, to improve the banking sector ability to withstand shocks during a financial and economic stress. In doing so, banks would be able to reduce the probability of banking crisis creating a contagion knock on effect into other parts of the economy.

The LCR proposed by Basel III, states that banks should hold a portfolio of HQLA on hand so that in the event of a crisis, banks should be able to liquidate that portfolio in the financial markets to have cash on hand to meet all cash outflow obligations for the next 30 days. The ratio should equal 1 at all times.

The LCR is defined as follows:

$$Liquidity\ Coverage\ Ratio = \frac{Value\ of\ Portfolio\ of\ High\ Quality\ Assets}{Cash\ Outflows - Cash\ Inflows}$$

The LCR regulations state that the net cash outflow should be calculated as expected cash outflows from depositors withdrawing their deposits less the cash inflows from principal repayments on loans over a 30 day forecasted period. The two biggest factors contributing to the calculation on the outflow factor is the term of the deposit and the client type of the deposit.

The cash outflows are calculated as the amount of fixed term deposits that are maturing in the next 30 days plus a regulatory defined proportion of a bank's overnight chequing account deposits, savings deposits, call deposits, notice account deposits that could flow out of the bank over a 30 day period as one would not expect all deposits that are immediately available to deposit holder to leave the bank (BCBS, 2013).

The regulation also defines the proportion of bank's overnight chequing account deposits, savings deposits, call deposits, notice account deposits that would flow out based on the counterparty type that the deposit is received from. In this case retail depositors are assigned a 5% cash outflow factor and financial institutions such as asset managers are assigned a 100% outflow factor. These factors are based on experience during the financial crisis as sophisticated financial institutions were the first to withdraw funds whereas retail deposit are seen as sticky.

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In calculating the LCR, banks consider all maturing deposits from assets managers within a 30 day forward looking time frame and the LCR regulation states the calculation of total expected cash outflow is a sum of actual outflows from each client type multiplied by a prescribed outflow factor.

Client type is defined as retail, small medium enterprises (SME), non-financial corporates, financial corporates and public sector. For example, retail deposits are assigned a 5% outflow factor due to the stickiness of deposits from retail clients whereas the regulation stipulates that financial corporates i.e. asset managers should be treated with 100% factor.

$$
\begin{aligned}
Cash\ &Outflows \\
&= (Funds\ from\ Retail\ maturing\ in\ the\ 30\ days * 5\%) \\
&+ (Funds\ from\ SME\ maturing\ in\ the\ 30\ day * 10\%) \\
&+ (Funds\ from\ non-Financial\ Corps\ maturing\ in\ the\ 30\ days * 50\%) \\
&+ (Funds\ from\ Financial\ Corps\ maturing\ in\ the\ next\ 30\ days * 100\%)
\end{aligned}
$$

Hence banks are incentivised to reduce funding from asset managers to reduce the total amount of outflows in the denominator of the ratio which in turn reduces the amount of HQLA a banks needs to hold at an opportunity cost.

Given that this is a ratio and that banks are required to meet the requirement based on a minimum ratio, banks can chose to either increase the value of HQLA or reduce the value of net cash outflows.

Banks would increase the value of the numerator by purchasing HQLA and decrease the value of the denominator in the multiple ways. Bonner and Eijffinger (2016), Giordana and Schumacher (2013) and Handorf (2012) showed that either banks tend to shift their deposit structure to a more stable source of funding from asset managers to try to attract more retail funding or banks can choose to increase the term structure of their funding from asset managers to attract medium to long term funding.

Operationally, banks would quantify what their expected net cash outflow, cash outflow minus cash inflow, would be for the next 30 days under stressed assumptions and make sure that they have enough HQLA on hand to match the value of the outflows. The forecasting is done on a daily basis and the size the HQLA portfolio will need to be adjusted according.

Fuhrer, Müller and Steiner (2017) explain that banks will incur opportunity costs in holding this portfolio of HQLA due to the low yield it will generate relative to a bank being able to use the funds to grow its loan book. Banks could also incur other costs in abiding by the regulation as the attraction of retail and non-financial corporate deposits could come at an increased cost, as banks will need to increase rates to attract sources of funding from these clients.

The other cost increase comes in the form of extending the maturity profile of the deposit book, as a bank would need to incentivise a client to shift funds from shorter durations to longer durations.

Banks can choose to restructure their balance sheets to reduce the net cash outflow amount, reduce the value of low yielding HQLA portfolio and still meet the regulatory requirement. Research done by Huang and Ratnovski (2011), Bologna (2013) and Acharya and Merrouche (2013) speak to the fact that most banks are trying to move away from short term asset managers funding as cash from this type of client is treated with 100% outflow factor.

The regulation in driven by the profit incentives that the regulation provides for banks to move away from unstable sources of funding and to hold an optimised level of HQLA to meet regulatory requirements. The additional costs incurred in abiding by the regulations needs to be offset in some way so as to grow earnings and maximise shareholder return.

From King (2013), we know that, banks are expected to have a reduced net interest margin due to the implementation of these regulations. This net interest margin makes up between 55%-65% of the revenue for the SA banking sector (PWC, 2016).

The implication of the regulations is that banks have needed to change the structure of their balance sheets over time to better manage liquidity and have had to be innovative about the business that it attracted in the lending (asset) and deposit (liability) side.

In changing the structural nature of the balance sheet, Van den End and Kruidhof (2013), Duijm and Wierts (2014) and Yan, Hall and Turner (2012) speak off the unintended possible consequence of reducing credit extension in the economy due to banks using a larger proportion of funding to fund to purchase of HQLA to meet the regulatory minimum for the ratio. This is one of the hypotheses that will be tested in this research for the SA banking sector given their high reliance on funding from asset managers and the concentration of banks in the sector.

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The other hypotheses that will be tested is whether the SA banking sector has been able to move away from asset manager funding and whether the SA banking sector has been able to move the term structure to increase the proportion of medium and long term funding.

The SARB has given the SA banking sector an opportunity to phase in the LCR requirements since the 1st January 2015 with banks only requiring a LCR ratio of 60%, increasing by 10% annually until the SA banks reach 100% by 1 January 2019 (SARB, 2016).

Vazquez and Federico (2015) in their research on bank funding structures pre the financial crisis carried out research to understand what effect the structural liquidity within banks' balance sheet had on a bank's ability to avoid failure. Their research covered a dataset of US and EU banks to measure structural liquidity in a way consistent with the formulation of the LCR. Their idea was to back test the LCR ratio with banks pre crisis to show which banks had good structural liquidity and which ones did not.

Their research illustrated that contrary to their initial expectations, the average structural liquidity measured by proxies for LCR was around the prescribed levels that regulators currently want banks to be at under LCR regulations. However they also find wide dispersion of results for the ratio amongst all the banks and those banks closer to the left tail end of the distribution (lower ratios) were more vulnerable to failure during the crisis and either did fail or required public sector bailouts.

Their research provides the basis of the importance of the regulations in creating a more robust and sustainable banking system as well as explaining the need to understand the implementation of regulations.

Beltratti and Stulz (2012) in their research on the global financial crisis and why some banks performed better than others confirmed the common theory around the fragility of banks financed through short term capital market funding. What was most interesting about their research was the argument against the fact that poor risk management practices were not a major cause of the crisis. They found that banks with boards that are more concerned with performance of the banks from an earnings perspective performed substantially worse during a crisis. This gives rise to questions as to whether further regulatory control improves the stability of the banking sector or not.

From a term structure perspective on the outflows, one needs to differentiate between term deposits which pay a predefined interest rate to a deposit holder to compensate him for the time that he will not have access to his money for and overnight deposits which are immediately available to deposit holders. The yield curve is derived in a manner that increasingly compensates deposit holders for the time for which that are willing to place money with the bank for. The longer a deposit is placed with a bank, the more a deposit holder will earn (Diamond and Dybvig, 1983).

The premise behind a longer dated source of funding is that during a crisis banks won't see an outflow of cash due to the bank being unable to convince clients to extend the maturity of their deposits. If a banks deposit maturity profile is spread over a longer term, it provides banks with time to eliminate or mitigate the primary impact that a risk event causes before secondary impacts arise. This again causes a reduction in net interest margins of the bank.

In meeting the LCR percentage requirements, a bank could opt to increase longer term deposits to shift depositors who currently have overnight deposits into term deposits greater than a 30 day period. This would reduce the amount of a banks' net cash outflows in the next 30 days and hence reduce the amount of low yielding HQLA that a bank would need to hold (BCBS, 2013).

The result would be an increase in cost to the bank, as the strategy of trying to make term deposits more attractive would occur by increasing the reward that a deposit holder would earn on term deposits. A bank would effectively be shifting clients who cost the bank very little for overnight deposits to higher costing term deposits.

This strategy would also result in a decrease in costs as a bank would reduce the value of the HQLA portfolio by the amount that the net cash outflow is reduce by thus, allowing a bank to use the funding to invest in higher yielding loans to clients rather than low yielding HQLA.

In some instances banks would either opt to incur the opportunity cost of the HQLA portfolio or incur the cost in growing its deposit franchise by offer higher rates to clients who place funding with the bank for a term of greater than 30 days.

2.3 The impact on credit extension in the economy

The premise on which most of the research discussed in this section is built, states that due to the LCR regulations, banks turn their focus towards using liabilities to fund the purchase of HQLA hence they will have less funding to spend to growing their loan book finally reducing credit extension in the economy. The research discussed in this section is divided on what the implication on the liquidity regulations on credit extension will be as research done on different jurisdictions provide varied conclusions.

The implications could possibly depend on tax systems, the regulatory implementations of different banks, monetary systems, the concentration on banks in a country, the reliance of the banking system on short term funding from asset managers and the availability of deposit insurance within a certain jurisdiction, how increased demand for government security increase its price and supply effects to name a few. The reasons for SA being different to other countries analysed under existing research are covered in greater depth in section 2.6.

Vousinas (2015) in his research on the transition from Basel I to Basel III and the supervision of financial institutions in his review of the regulation found that the regulation will bring new measures in favour of bank stability and to mitigate against financial shocks.

In his critical analysis of the regulation, he states that in some cases, the new regulations could result in a reduction in credit extension with negative effects on the real economy and growth. He states that the anticipated impact of the regulation has to be accurately quantified to understand the impact on lending.

His research leaned more towards the author's interpretation of what the expected impact of the regulations could be prior to banks starting the implementation phase. His analysis didn't cover any empirical data analysis to forecast impacts or draw any solid impact conclusions backed by data. This was merely a critical analysis.

Banerjee and Mio (2017) in their research on the impact of liquidity regulation on banks found that banks adjusted the structure of both assets and liabilities, increasing the proportion of HQLA and non-financial deposits while reducing short term funding from asset managers. They did not find evidence that the implementation of the LCR regulation shrunk balance sheets or reduced credit extension in any way. Their research

makes the statement that the results are jurisdiction dependent as the macro-financial environment has a big influence on the results.

Their research was based on the implementation of a regulation very similar to the LCR called the ILG, in terms of holding a portfolio of HQLA to cover net cash outflows over a 30 day period. Their analysis differs to the current analysis as in their analysis comparisons were made between a group of UK banks that the regulation was applied to and another controlled group that the regulations were not applied to.

Their empirical research covered balance sheet structural changes from the fourth quarter of 2009, the point at which UK banks started making structural changes to their balance sheets to first quarter of 2012. This time frame differs to the time frame on this particular research with runs from January 2013 to Dec 2016.

Van den End and Kruidhof (2013) in their research on modelling the LCR as a macro prudential instrument, show that LCR can become a binding constraint to an economy. Their approach involved a simulation of systemic implications of LCR using a model which takes account of secondary impacts of the implementation of the regulation. Using a Monte Carlo simulation, they found that LCR would have an undesired impact of a restriction of credit due to the additional HQLA that banks take on.

The research by Van den End and Kruidhof (2013) is based on simulated results compared to Banerjee and Mio (2017), and this research which uses empirical data. The simulated results are different to the empirical results of Banerjee and Mio (2017) in terms of the impact on credit extension. This could be due to the assumptions used in the Monte Carlo simulation or how bank behaviour was modelled in the simulation.

Bonner (2012) in his research on liquidity regulation, funding costs and corporate lending shows that due to banks inability to pass on increased liquidity regulation costs to clients, corporate credit extension will not be affected by the LCR regulation. He covered a group on 26 Dutch banks to understand the impact between the increased cost, its impact on lending rates and in turn the impact on the absolute amount of credit extension.

The above empirical research covered the impact of the Dutch quantitative liquidity rule, DLCR, which again is very similar to LCR. The research covers a comparison between banks that are slightly above or below the LCR threshold and compare them to banks who are further away from the threshold. Their research was based on ascertaining whether banks closer to the threshold of LCR charged higher interest rates on loans due

to the cost associated with LCR and whether this in turn reduced demand for loans due to the high cost. His research took a different approach relative to the current research and the other three studies mentioned above as it looked at cost implications of the regulations and its impact on credit extension.

De Haan and van den End (2013) in their research on bank liquidity, the maturity ladder and regulation found that most Dutch banks hold more HQLA against their stock liquid liabilities than strictly required by the regulation prior to the LCR implementation.

Their finding was that there hasn't been a significant increase in the HQLA portfolio post the implementation of LCR nor was there any impact on credit extension. Dutch banks already implemented liquidity regulation in 2003 pertaining to liquidity risk hence they had much more stringent regulation at the time of the financial crisis relative to other banks.

This empirical research also covered the LCR impacts by back testing bank data from 2004 to 2010, a time when banks were subject to very little liquidity regulation. This differs to the SA banking sector as seen in the proportion of assets that makes up HQLA over time. This number has increased from 5% to 15% since 2008 for the SA banking sector whereas the above research found that Dutch banks didn't have a simpler increase due to the fact that they already held a high proportion of HQLA to total assets. Hence there was no significant increase in HQLA that could have caused a reduction in credit extension.

Gambacorta (2011) in his research on whether bank capital and liquidity affect real economic activity in the long run analysed the long term economic costs of the new LCR regulations on banks. By looking at the effect on lending to the private sector as well as the amount of commercial and industrial loans to large and medium size firms, he found that a 25% increase in the ratio of US banks HQLA to total assets resulted in a 1.2% reduction in lending.

Similar to Bonner (2012) and De Haan and van den End (2013), the above research is back tested to the regulation over a period of 1994 to 2008 to understand what the impact would have been. Again, this removes the managerial decision making process in the implementation of set of regulations. The other problem with their results of the reduction in credit extension is that it is based on a simulation that excludes the financial crisis which would possibly change the result.

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Duijm and Wierts (2014) in their research on the effects of liquidity regulation on bank assets and liabilities argue that HQLA and liabilities should be co-integrated. They found a pro-cyclical pattern in HQLA and liabilities using regulation implemented by Dutch banks that mimics the LCR. By pro-cyclicality, they are referring to HQLA, loans and liabilities expanding in good times and contracting in bad times.

This contrasts previous findings that the credit extension impact of LCR is mainly driven by changes in HQLA and goes on to show that the value of HQLA and loans is cyclical. So this shows that Dutch banks' ability to grow credit extension is driven by economic cycles and not the LCR.

The research by Duijm and Wierts (2014) took a very different approach in explaining the impact of the implementation of LCR. They found that credit extension won't be affected by the LCR but rather the expansion and contraction of the economy. The found that the adjustments that banks make structurally is balanced towards the liability side rather than the asset side.

Yan, Hall and Turner (2012) in their research on cost benefit analysis of LCR regulations cover the long term economic impact of LCR regulations on bank output in terms of credit extension growth. The research speaks to the ability of UK banks to grow the asset side (loans) of the business given the funding restrictions that the LCR brings.

The main focus of their research was around the fact that the economic costs that banks incur in meeting LCR requirements, are passed on to clients in the form of higher lending rates that reduce the affordability of clients and reduce credit extension in the economy. Their research also was a back-testing exercise using data between 1997 and 2010.

They've also proved that the ratio provides the banking system with greater resilience to prevent a banking crisis during economic downturns. Their research didn't directly look at balance sheet optimisation but did cover the idea that banks can rightfully pass the cost of the LCR directly onto clients as opposed to coming up with innovative ways to restructure their balance sheets.

The only problem with passing on the costs with higher lending rates is that your competitors have to do the same or a single bank will price itself out of the market. The research doesn't cover any innovative balance sheet structuring that could take place to avoid passing on the costs to clients.

Allen, Chan, Milne and Thomas (2012) in their research on Basel III: Is the cure worse than the disease, argue that the LCR regulation could possibly be a real danger to economies as the regulation threatens to limit the availability of credit and reduce economic activity.

They argue that it is not the actual regulations that will cause the reduction in loans but rather the structural adjustment and changes that the regulation brings to the entire sector that threatens to starve the economy of credit and they equate the implication to be worse than a disease. Their data analysis was confined to UK banks. They state that the implementation of LCR needs to be managed by central banks and governments, in close co-ordination with monetary policy to understand the impact that the regulation could have on different countries.

Gavalas (2015) in his research on the how banks perform under Basel III, argued that although the regulation is intended to provide greater stability to the financial sector, the implementation would cause an increase in lending rates to clients as well as lead to a reduction in credit extension.

He found that the higher marginal cost of funding brought on by the regulations would lead to higher lending rates due to banks passing on this cost to borrowers. The increased cost of borrowing would reduce volumes of loans by 4.97% in the long run. His analysis covered EU banks that were heavily affected by the financial crisis to understand how these banks which were the furthest away from achieving the regulatory minimums ratios, would perform.

The research papers discussed above seems to be divided on what the impact of the implementation of LCR will be on credit extension. Every research so far has drawn conclusions on whether the impact of the LCR will reduce credit extension or not based on simulation and back testing over periods where the regulation wasn't actually implemented and this contrast the approach taken in this particular research which is the understanding of the effects of the LCR on credit extension pre and post the implementation of the actual regulations.

Hence the hypothesis that is tested in this research is:
H1: The implementation of the Liquidity Coverage Ratio will not have an impact on credit extension by the SA banking sector.

2.4 The impact on bank funding from asset managers

The LCR regulations has been designed to deal with another shortcoming during the global financial crisis and that is to deal with banks overreliance on funding from asset managers. The regulation incentivise banks to reduce their reliance on funding from asset managers and to grow their deposit franchises.

During the financial crisis, the first funds that were withdrawn from banks were in the form of money market deposits from asset managers. A large portion of US banks funding during the crisis was from the money markets and it is this depositor type that was seen as the highest risk to liquidity and solvency.

Money market fund deposits from asset managers usually cost banks a lot more than other bank deposits due to the sophistication of teams working at the asset managers as well as the fact that the size of deposits are usually anything between R50 million and R2 billion rand at a time. It would take a retail deposit franchise of a bank a lot longer to raise that amount of funds from the general public.

Huang and Ratnovski (2011) in their research on the dark side of bank asset manager funding found that asset manager's decision making processes are key to the survival of most banks due to banks reliance on funding from such institutes. They found that funding from asset managers is beneficial when asset managers make informed decisions but may lead to inefficient liquidations when uninformed.

They found that asset managers enjoy an effective seniority in liquidation due to sequential service constraint, the relative sluggishness of retail depositors and the close monitoring of banks that asset manager's conduct on a daily basis. During the financial crisis, asset managers were able to get their funds out of banks without incurring significant losses earlier due to their constant monitoring, leaving retail depositors to bear the brunt of losses.

When asset manager's act based on noisy information in the market as opposed to monitoring banks more closely, the incentive to withdraw funds is too high relative to socially optimal levels. They act in their best interests and not in the public's interest and retail depositors bear the brunt of the losses.

The above research is one of many that deal with the fact that banks overreliance on funding from asset managers led to the liquidity shortages during the financial crisis. It is

for this reason that the LCR ratio incentivises banks to move away from asset manager funding and towards growing their own deposit franchises with retail, SME and non-financial corporate deposits although banks have multiple decisions to make in terms of how to go about doing this.

Bologna (2013) in his research on structural funding and bank failures explained that a key aspect of bank failure during the financial crisis was banks over reliance on funding from asset managers. He found that banks with a lower loan to deposit gap that was filled by asset manager funding resulted in greater resilience from that bank.

His theory was that a bank with less stable funding components were more likely to face financial distress as seen with banks during the crisis not being able to convince clients to extend the funding for a further period of time when they came up to maturity. He conducted his analysis on defaulted commercial banks in the US during the financial crisis. He concluded that the structural make up of a banks deposit clients plays a significant role in explaining why banks defaulted.

Acharya and Merrouche (2013) in their research on the precautionary hoarding of liquidity and interbank markets showed that before and during the global financial crisis large banks experienced a 30% increase in liquidity demand the day after asset managers money markets froze, fuelling the crisis. Their research provides evidence for the reasoning behind the LCR regulation and why banks are incentivised to increase the funding from the deposit franchises and reduce funding from money markets. Their sample covered UK banks.

Ritz and Walther (2015) in their research on how banks respond to funding uncertainty showed that this funding uncertainty leads to increase competition for retail deposits as short term deposits from asset managers become scarce using a dataset of banks in the EU banking system.

Their research looked at the financial crisis to understand how funding uncertainty from asset managers explains the increase competition for retail funding. They showed how banks were willing to offer 200 basis point more on retail deposits during the crisis when funds from asset managers were being withdrawn. This again shows how the regulation is in line with regulator trying to avert another crisis and incentivise banks to move away from asset manager funding.

Demirgüç-Kunt and Huizinga (2010) in their research on banking activity and funding strategies examined the implications of short term funding strategies that banks used in the lead up to the 2007-2008 financial crisis on risk and return. They showed how bank deposits from money markets lowers the rate of return on assets due to their high cost as well as how banks attracted most of their short term funding from money markets which increase bank fragility leading up to the crisis.

They raise concern over the riskiness of a bank's over reliance on money market deposits from a liquidity perspective as due to their sophistication and incentives, asset managers are purely incentivised on return and would have no problem withdrawing large sums of deposits from a single bank if they had any signal of distress on the quality of bank assets thereby causing a completely solvent bank to fail.

They also found that a sizable proportion of banks attract most of their short-term funding in the form of funding from asset managers at the cost of enhanced bank fragility. Hence many of the banks are unable to get away from funding from asset managers which begs the questions as to whether the LCR Regulation can get banks to move away from asset manager funding improve the fragility of the banking sector?

Banerjee and Mio (2017) in their research on the impact of liquidity regulation on banks found that banks adjusted the structure of both assets and liabilities, increasing the proportion of HQLA and non-financial deposits while reducing short term funding from asset managers. Their analysis was run on UK banks.

Bonner and Eijffinger (2016) in their research on the impact of liquidity regulations on bank intermediation show that the liquidity requirement will cause demand for interbank funding to increase due to banks reducing funding from asset managers. Banks will be unable to pass on additional costs of the regulation to private sector clients and hence will decrease banks interest margins. Their sample covered Dutch Banks. Their research provided an argument as to whether it was possible for banks to move away from asset manager funding due to the monetary system within Holland.

The impacts of the implementation seen in this research differs from the analysis of Banerjee and Mio (2017) possibly due to the size of the banking sector jurisdictions that both the analyses was carried out in as the ability of a bank to move away from asset manager funding depends on the amount of retail and non-financial available in the market.

Giordana and Schumacher (2013) in their research on bank liquidity risk and monetary policy found that when testing Luxemburg banks on the impacts of LCR found that smaller banks ran much larger maturity mismatches than larger banks who seem to be cash flush and suppliers of funding to other EU markets.

The impact of the regulation on smaller banks is that these banks will need to find other ways to fund themselves as they would need to reduce asset manager funding which will in turn affect the lending businesses of the smaller banks. Their analysis was different to other in that it split the impacts between big and small banks and showed that the smaller banks will be affected a lot more than bigger banks. This analysis was again back tested on data from 2003 to 2010 which removes management decision on what strategies to use when implementing the regulations.

This research also goes on to explain that in some instances banks won't be able to replace asset manager funding with other sources and will be faced with reducing lending business.

Wei, Gong and Wu (2017) in their research on the impacts of Basel III requirements on banks choice of debt maturity focus on the incentive of the banks managers in their obligation to the shareholders as well as society. On the one hand they need to create a deposit structure that is social responsible in moving away from asset manager funding dependency and on the other they need to grow their business and use asset manager funding to do so, if need be. They find that bank managers bonus incentives from a bonus perspective has to be aligned to creating a more robust banking system in the long run rather than short term monetary incentives.

Giordana and Schumacher (2013) and Wei, Gong and Wu (2017) provide arguments for not reducing asset manager funding especially in the face of trying to grow credit extension. It is for this reason that the result of the first hypothesis will allow us to interpret the finding of this hypothesis better.

Based on the literature in this section, the 2nd hypothesis that will be tested is:

H2: The SA banking sector will not reduce funding from assets managers as a result of the implementation of the Liquidity Coverage Ratio.

2.5 The impact on term structure of funding from asset managers

The implementation on Basel III will cause banks to have a longer average maturity profile on their liabilities from asset managers which comes at a greater cost. Traditionally a bank makes money as a central maturity management function by paying low interest rates on deposits and changing higher rates for loans. The cost implications of LCR is that banks will need to pay higher average interest rates on deposits due to the fact that their maturity profile of the liabilities book will be extended in the form of more stable longer maturity deposits.

López-Espinosa, Moreno, Rubia and Valderrama (2012) in their research on short-term funding from asset managers and systemic risk analysed the factors within an individual institution that leads to a contagion effect from the institution to the international financial system and found that short term funding from asset managers is a key aspect in setting off systemic risk events. Their research covered a large sample of global banks characterised by large capitalisation and global activity.

King (2013) in his research on Basel III and net interest margins found that during the 2007–2008 financial crisis banks in many countries suffered liquidity shortages due to asset managers withdrawing funds from banks in fear of the losses that they were making on their mortgage loans portfolios. The banks worse effected by the crisis funded long term assets with short-term debt from asset managers and were unable to extend this funding from asset managers for further periods. This led to banks becoming insolvent due to asset managers exit from the funding market.

Hardorf (2012) explained that banks will incur reduced revenues in adhering to a higher LCR requirements by regulators due to the liquidity premium in the risk-free government yield curve. The yield curve is built on the premise that an investors needs to be compensated for the time in which give up access to his cash.

This will also force banks to restructure its funding profile to reduce overnight funding and attract funding greater than 30 days so that this funding is not constantly seen as a cash outflow in the next 30 days. Attracting longer maturity profiles will again lead to reduced net interest margins.

The above research explains that the regulations will cause banks to invest in short-term, low risk, highly marketable and liquid tradable securities. Banks will also be forced to come up with strategies to attract longer term funding which would be considered as

stable relative to short term, overnight cheque deposits. The change in costs that banks will incur in extending their funding profiles is dependent on the term structure of interest rates.

His research dealt with the notion that although banks will be incentivised to reduce short term funding to reduce the amount of cash outflows in the 30 day bucket, this reduction in short term funding will come at an incremental cost to increase medium to long term funding. Banks will be forced to quantify the cost benefit of holding less HQLA vs the cost increment of extending the term structure of deposits from asset managers.

Banerjee and Mio (2017) in their research on the impact of liquidity regulation on banks found that banks adjusted the composition of both assets and liabilities, increasing the share of HQLA and non-financial deposits while reducing short term funding from asset managers.

Bonner and Eijffinger (2016) in their research on the impact of liquidity regulation on bank intermediation showed that the regulations caused long term borrowing rates to increase due to banks demands for long term deposits and that banks aren't able to pass on the increased funding costs on to clients by increasing lending rates.

They conclude that the implementation of the LCR decrease bank interest margins. Their research looks at the portion of funding that banks raise in the asset manager funding and shows that the LCR requirement makes long term asset manager funding relatively more valuable, incentivising banks to borrow more albeit at a higher cost.

Wei, Gong and Wu (2017) in their research on the impacts of Basel III requirements on banks choice of debt maturity, focus on the incentives of bank managers vs the incentives of shareholders to explain that although Basel III intends to make banks more stable by increasing the term structure of deposits, it is not always in the best interest of the bank managers to do so. Although their research focused on the net stable funding ratio, the impacts directly affect the LCR as well due to it dealing with term structure as well.

They argue that extending the term structure comes at an additional cost that eats into the profits of banks and that although the shareholder would want the banks' balance sheet to be more resilient in the face of stress scenarios, bank managers are concerned with their bonuses which are based on profits. The research states that bank managers would still issue short and long term debt although due to their incentives the bank

manager's decision will lead to a higher proportion of short term debt than what the social optimum would entail.

Handorf (2012) focused this research on the cost of bank liquidity on the impact of the LCR on bank margins. His argument was based on the fact that although the benefits of LCR from the perspective of increasing the resilience of the banking system during a stress period were evident to see, the increased cost that accompanies the regulation is a disincentive to bank managers to adjust balance sheet structure to socially optimal levels.

His research found that in increasing the level of short and medium term funding from asset managers, banks will reduce the net interest spread that they make between deposits and loans. His research on US banks showed that if banks were to attract new medium and long term funding then the impact would come at a cost of 1.5% reduction in net interest margin. This additional cost needs to be factored in making decisions on how to attract more medium and long term funding.

Ramlall and Mamode (2017) in their research on a critical assessment of Basel III and its implications on the Mauritian banking sector found that the implementation of Basel III will reduce credit extension, result in higher cost of credit and cause restrictions on SME lending. They state that the liquidity reforms will shift reliance on short term funding to longer term funding. Consequently the cost of funding is likely to increase which will be passed onto the borrower at higher borrowing cost which would in turn reduce credit extension due to affordability constraints.

They believe that in order for the regulation to fulfil its full potential, it needs to be tailored to the Mauritian economy to offset the adverse effects on credit extension and bring down the cost of implementation. They used an opinion survey sent to banks and the local regulators to gather opinions and views on what the implications of the new regulations will be. The Mauritian banking sector is driven by a duopolistic banking structure with two banks covering 90% of the market. This was the only research available that dealt with the implementation of the LCR within Africa.

Dietrich, Hess and Wanzenried (2014) in their research on the good and bad news about Basel III set out to understand the impact of the regulation on banks in Western Europe by back solving the impacts of the regulation on banks from 1996 to 2010. This research didn't look at what the impacts would be during the implementation phase and therefore disregarded any management actions that could happen to adjust balance sheet

structure to meet regulatory minimum requirements. If their analysis had been done during the implementation phase of Basel III it would have provided a much better view of how bank purposefully adjust balance sheet term structure to align to regulations.

Based on the literature in this section, the 3rd hypothesis that will be tested is:

H3: The SA banking sector will increase medium and long funding from asset managers because of the implementation of the Liquidity Coverage Ratio.

2.6 What differentiates the impact on South African banking sector?

List of the difference in the SA banking sector that results in possible different impacts:

- The treatment of HQLA by specific in country regulators has had different behavioural influences on how banks implement the LCR regulation.
- Concentration of banking sector.
- International banking sectors coming off a much lower base of retail and non-financial funding than the SA banking sector. The proportion of 30-day outflows is expected to be much higher than SA banks due to their funding structure.
- The effects of deposit insurance on the implementation of LCR. The impact differences of the implementation of LCR between the US, UK, EU and SA due to the lack of deposit insurance in SA.
- Savings rate of South Africans
- Banks historically offering low rates

Banerjee and Mio (2017) in their research on the impact of liquidity regulation on banks speak to the fact that the impact of the regulations on UK, US and EU banks would be dependent on the specific macro-financial environment and monetary policy environment, note notably in the cost of acquiring HQLA when the regulation came into effect. UK banks chose to place additional funds with the Bank of England and receive a bank rate. This facility provided a perfectly elastic supply curve of HQLA. If the Bank of England did not offer this facility then the cost of the regulation would be far greater than as bank would to go to the market to buy HQLA thereby increasing demand for government securities and pushing up the price.

In the case of SA, banks did not have the luxury of the rates that the Bank of England were offering and needed to go to the market to purchase government securities thereby increasing the cost to them. This would imply that SA banks had a greater incentive to find ways to reduce net cash outflows and HQLA duo the cost involved.

Fuhrer, Müller and Steiner (2017) in their research on the LCR looked at the decrease in yield(increase in price) spread of securities in the Swiss market that are eligible to be considered as HQLA post the banks implementation of LCR. The notion is that the market would perceive that there will be an additional demand for the high quality securities once the implementation of LCR is complete as all banks will look at acquiring these for their HQLA portfolios.

The increased demand would drop yields (increase in price) and result in further margin squeezes. Their analysis is done by analysing the change in the market price between HQLA and non-HQLA securities triggered by LCR and they conclude that the price increase is dependent on the elasticity of HQLA supply, the degree to which banks can reduce their net cash outflows and the additional demand for HQLA.

The resultant margin squeeze and its effect of overall profitability again demonstrates the need for understanding how the SA banking sector has dealt with the implementation of LCR and the effect on profitability.

They further emphasised in their research that the LCR and security prices further explained the impact of the liquid coverage ratio depends on the monetary policy environment. They state that in an environment where interbank lending rates are paid on reserves are the same as those paid on HQLA then banks have no cost incentive to increase HQLA and reduce loans on their balance sheets.

The second reason for the impact of the regulation being different for the SA banking sector is that the SA banking sector is structurally different to the US and EU banking systems is due to multiple factors. SA has a much more concentrated banking sector with four major players controlling a 85% market share (SARB, 2016) in terms of balance sheet size compared to the US where their top five only cover 46% market share (WalletHub, 2016).

Beau, Hussain and Nixon (2014) in their paper on banking funding costs explained that a bank's funding cost is comprised of the risk free rate, a credit risk premium that the depositor is taking on for placing his fund with a certain bank and a liquidity risk premium that banks pay the depositor based on the term for which funds are placed for. The credit risk premium is bank dependent upon the credit rating of that bank. It is this credit risk premium that differentiates US banks from SA banks.

These four SA banks don't offer vastly different compensation or return on deposits due to their identical credit rating compared to the US where each banks compensates depositors differently depending on the credit rating of the bank. Hence during a crisis the SA banking sector won't be faced with deposit runs as the flight to safety doesn't really exist due to the banks having the same credit risk.

Hence the behavioural effect on banks liquidity is very different for SA and the US hence the balance structure is vastly different. In competing for longer term asset manager

funding and trying to move away from asset manager funding to retail deposits, each of the big four banks will not reward clients based on the riskiness of bank defaulting with them as the risk is assumed to be the same across the big four banks.

Whereas in the US clients place deposits based on a risk/reward due the different credit ratings of banks hence a US banks' ability to attract retail and non-financial funding or to move to extend the maturity profile will come at a greater cost the lower the credit rating of the bank.

The manner in which a bank funds its assets is very important to risk during a stress. Retail and commercial deposits are seen as less risky and stickier hence they are less likely to flee during a stress situation. During the 2007–2008 financial crisis, banks in many countries suffered liquidity shortages due to the asset managers withdrawing their funds from the funding markets (King, 2013).

Hence, the third reason that the SA banking sector differ to US and EU banks is that the nature of structural funding is vastly different. The SARB Financial Stability review (2016) showed that the SA banking sectors main source of funding is in the form of deposits from retail and non-financial corporates at 70% of total labilities where 40% originated from corporates and 25% from retail clients. These ratios have been constant over the last 20 years.

Mckinsey (2014) in their research on the future of bank liquidity and funding in the US showed that during the financial crisis US banks only had deposit funding which covered 37% of liabilities although banks have made a concerted effort since then to increase this to 49%. The impact of the implementation of LCR would differ between banks in SA and the US due to the lower base that the US would be starting with. Structural changes to US banks' balance sheets could be much larger than SA, who already have a high base of retail and non-financial corporate funding.

The difference in the funding structures mentioned above means that the structural changes in the balance sheet and in turn; the increased cost that US banks will incur in the implementation of LCR should be vastly different to SA banks. The manner in which US banks will need to be a lot more aggressive with changing the balance sheet structure leads to very different impacts between SA and US banks from a balance sheet structuring and a net interest margin perspective.

The forth reason why the impact of the regulation would be different for the SA banking sector is the lack of deposit insurance in the SA market. Deposit insurance refers to individuals having insurance against losing their deposits that are placed with banks in the event of a bank becoming insolvent or going through financial distress.

Deposit insurance in available across the US and most of the EU. Deposit insurance in the US is controlled by the Federal Deposit Insurance Corporation (FDIC) who are an independent agency of the US government that protect individuals against losses up to deposited amounts of $250 000 (JP Morgan, 2014).

SA banks have historically offered very low rates on deposit products. As a result, individuals have placed cash with asset manager's money market funds in search of a better return than with a bank deposit. The risk associated with placing funds with an asset manager is almost the same as placing the funds with a bank as assets managers use the funds from individuals invest in banks deposits.

The only risk mitigation is in the form of a hedge that the money market fund offers by spreading funds across investments in multiple banks whereas if the individual deposited funds with a single bank then he is exposed to that single bank. It should be noted that this hedge is useless when the banking sector goes through a systemic crisis as all banks will be affected.

If deposit insurance were to be implemented in SA, individuals would be incentivised to place funds back with banks as there is now a greater risk of placing funds with asset managers as their deposit is fully covered against losses with banks but not with the asset manager. Deposit insurance affects the implementation of LCR as banks in the US, UK, and EU can use the insurance incentive to attract funds a lot easier than in a country like SA, where deposit insurance in non-existent.

Chapter 3 – Research Questions and Hypothesis

3.1 Research Question

What has been the impact of the Liquidity Coverage Ratio Regulation on the SA banking sectors ability to grow credit extension and adjust funding structures?

3.2 Hypotheses

H1: The implementation of the Liquidity Coverage Ratio will not have an impact on credit extension by the SA banking sector.

H2: The SA banking sector will reduce funding from assets managers as a result of the implementation of the Liquidity Coverage Ratio.

H3: The SA banking sector will increase medium and long funding from asset managers because of the implementation of the Liquidity Coverage Ratio.

3.3 Constructs

Table 3.1 Constructs

Hypotheses	Independent Variable	Dependent variable
H1: The implementation of the Liquidity Coverage Ratio will not have an impact on credit extension by the SA banking sector.	Implementation of LCR Regulation	Credit Extension
H2: The SA banking sector will reduce funding from assets managers as a result of the implementation of the Liquidity Coverage Ratio.	Implementation of LCR Regulation	Funding from Asset Managers
H3: The SA banking sector will increase medium and long funding from asset managers because of the implementation of the Liquidity Coverage Ratio.	Implementation of LCR Regulation	Medium and Long term Funding from Asset Managers

Chapter 4: Research Methodology

4.1 Choice of Methodology

Philosophy

The research philosophy that will be applied is to address the need to understand the research problem is Positivism. Saunders and Lewis (2012) explains the philosophy of positivism something that is concerned with being able to research observable and quantifiable variables in a closed system and be able to understand the impact of changes that one variable can have on another. This speak directly to trying to understand the relationships the research is trying looking to explain the impact of the implementation of the LCR regulation on changes in credit extension and balance sheet structure.

Approach

The approach that I will be taking is a deductive, explanatory approach. Saunders and Lewis (2012) define the deductive approach as the testing theoretical propositions by coming up with a research approach that is created specifically for what a researcher is trying to test for. In this research, we look at we are testing the theoretical proposition put forth by Banerjee and Mio (2017), in which the implementation of the LCR is tested against balance sheet structural changes in UK banks. This research covers the SA banking sector to structural differences in the economies of the UK and SA.

Strategies and Choices

The strategy that I will be using is one of case study. Saunders and Lewis (2012) explains case study research as providing in depth analysis of the subject matter and the activities occurring within the subject matter. For this research the data that will be analysed by looking at the SA banking sector as a single case study.

Yin (2013) in his book on Case Study Research Design and Methods states that case study research has been used to contribute to ones knowledge of individual, group, organisational, social and political phenomena. More specifically towards this piece of research Yin speaks about the fact that case study methodology is used to understand structural economics and the impacts on a given sector, city or country.

Gillham (2000) in his book on case study research methods explains that a case study approach is a method used to narrow down a very broad field of research into one easily researchable topic. He goes on to state that case study research design is also useful for testing whether scientific theories and models actually work in the real world. This is exactly what this research sets out to do in testing whether the initial theorised impacts surrounding the regulation will have on the SA banking sector.

The time horizon being used is Longitudinal. Saunders and Lewis (2012) define longitudinal design "is the capacity that it has to research change and development over time." This research will use historical secondary data over a 9 year time series to understand the strategies and impacts of the implementation of the LCR regulations on balance sheet structure and credit extension.

4.2 Population

The population would be the banking sectors. The Implementation of LCR regulations is facilitated and monitored by each country's regulator. The SARB has an arm dedicated to banking supervision which is responsible facilitating, providing oversight and monitoring the implementation of the LCR regulations. The regulator will provide directives to banks based on the regulations but which have been tweaked to make them more country specific. The research seeks to understand the impact on SA banking sector specifically.

4.3 Unit of analysis

For this research the unit of analysis will be the SA banking sector over a period of time. The total sector balance sheet structural data is analysed over a period of time.

4.4 Sampling method and size

The sampling method that will be used for this research is purposive sampling. The sector balance sheet data is compiled off an aggregation of each SA banks' balance sheet. From a data perspective, monthly data from January 2008 to December 2016 was available. The sample of data will also be over a 9 year time horizon, five years prior to the point at which SA banks start making structural changes to balance sheets and four

years post the start of the structural changes. This was split into a pre-intervention and post-intervention dataset that was used for model building and testing purposes.

4.5 Data gathering process

Hox and Boejie (2005) explains that for testing of certain research questions, it is possible to use data collected by other organisations or researches such as administrative statistics or official records or other data routinely collected by organisations.

Historical secondary data will be sourced from the SARB website on the SA banking sector from the monthly BA900 regulatory return which contains a breakdown of assets and liability into client and product types where balances are split by whether an asset or liability has short, medium or long term maturity. The banking sector data is an aggregation on each banks BA900 regulatory return.

The data for each months BA900 was attracted off the SARB website and data was aggregated to the variable of interest for each hypotheses. The aggregation was a simple summing of lines that a particular variable pertained to.

4.6 Analysis approach

The approach that this research sets out is to understand what have been the impact of the LCR regulations on credit extension, bank funding from asset managers and the term structure of funding from asset managers post the implementation. The analysis provides insight into how the SA banking sector has been affected relative to other countries while adhering to the SARB's minimum requirements on the LCR ratio.

The analysis was done by firstly getting the data into a format that could be used for statistical analysis. The variables that were calculated for each of the hypotheses needed to be aggregated using multiple lines in the BA900 return.

Credit extension values for each bank for each month was calculated by taking the sum of advances in instalment sales, mortgage advances, credit-card advances, public sector advances, private sector advances and other loans and advances.

The type of funding variable which was the proportion of funding that banks raised from asset managers was calculated by taking the balance of funding from an asset manager

in a given month and dividing this by the total funding that a bank had at that point in time.

The term of funding from asset managers variable which is the proportion of funding that is considered as medium and long term was calculated by taking the medium and long term balance from asset managers in a given month and dividing this by the sum of overnight, short, medium and long term funding. Medium and long term funding would be any funding greater than 30 days, which is considered outside the LCR window.

The analysis of the LCR inputs over time will also provide an indication of how the banks has adjusted their balance sheet structures to reduce their net cash outflow over a 30 day period and hence whether they have benefited from holding a smaller portfolio of HQLA.

4.7 Statistical tests

The approach to the statistical tests were to understand whether the implementation of the LCR had a significant impact on credit extension, the type of funding that a bank attracted and the term of funding from asset managers that it attracted for the SA banking sector.

This was carried out via a time series analysis to understand whether there was a statistically significant difference in balance sheet structure pre and post an intervention point. The intervention point being the point at which banks started making structural changes to their balance sheets.

It was initially thought that a simple t-test could be used to test for differences pre and post intervention but one of the assumptions of a t-test is that groups consist of independent observations with equal variances. This assumption is violated by time-series data due to the temporal dependencies known as autocorrelation hence the approach taken to test the hypotheses was an ARIMA approach.

The statistical tests were run in a software package R and the methodology was adapted from Wei (2006) Time Series Analysis – Univariate and Multivariate Methods.

The metrics being used for each of the hypotheses are found in the table below.

Table 4.1 Metrics for each hypothesis

Metrics for each Hypothesis	
H1	Absolute amount of credit being extended to the market
H2	Proportion of funding sourced from Asset Managers
H3	Proportion of medium and longer term finding from Asset Managers

For each of the hypotheses, monthly balances for each of the bank's metrics being tested, prior to the implementation was used to forecast what the balances would be post implementation using an ARIMA approach. Confidence bounds were then created at a 90% and 95% confidence interval for forecasted model and a comparison was done to understand how many of the 48 data points being forecasted sit within the confidence interval and how many sat outside of the interval. A decision to reject or fail to reject the nil hypothesis was based on the proportion of points that sat outside the interval. This approach was adapted from Wei (2006).
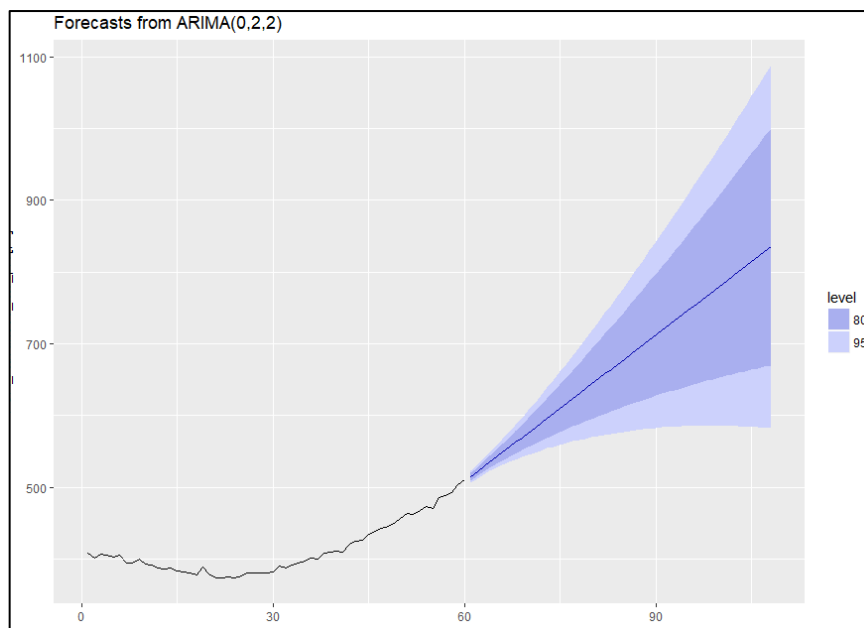
Figure 4.1 Example of confidence intervals for forecasts

The image above depicts an example of confidence bounds being created.

4.8 Limitations

Ideally, this analysis should have been done including income statement impacts as the decisions banks take on the implementation of LCR and the three hypotheses being tested directly affects the net interest margins that banks make. The reason that the income statement impact were not covered was due to income statement data only being available on an annual basis and hence one would only have four data points post the implementation to test against.

Finding literature on the impacts of the LCR was difficult given the fact that certain banks and banking sector in certain countries are only understanding the impact of the regulations as they go through the implementation phases. There wasn't a mass amount of literature using empirical analysis on how banks were going to restructure balance sheets and how credit extension was affected in order to meet regulatory minimum requirements due to the fact the implementation is a very recent phenomena.

From a data perspective, ideally one would have wanted data going further back in time to use for forecasting purposes but this data was not available. The other limitation of the data is that, it includes a financial crisis between 2007and 2008, which could possibly skew results. Ideally as a rule of thumb one would use a data series two times the size of the forecast period but due to the limitations on data, the data used to forecast was 1.5 times the forecast period.

Chapter 5: Results

5.1 Data Description

The data used for the analysis was extracted of the total SA banking sector's publically available regulatory return called the BA900 which is available of the SARB website. The sector return data is aggregated off each banks regulatory return by the SARB.

The data used for this analysis was monthly data from January 2008 to December 2016.This consisted of 108 data points. Data used in the development of the predictive model for each hypothesis was from January 2008 to January 2012 as this was the data that was available preceding the point at which banks started making structural changes to their balance sheets. This was called the pre-sample and had 60 data points.

Table 5.1 Data description

Metrics	Credit Extension	Percentage of Funding From Asset Managers	Percentage of Asset Managers Funding in the Medium and Long Term
Mean	2 527	42%	64%
Min	1 931	37%	52%
Max	3 459	46%	71%
Variance	219 747	0.05%	0.12%
Standard Deviation	469	2.24%	3.52%
Number of Data Points	108	108	108
Start Date	Jan-08	Jan-08	Jan-08
End Date	Dec-16	Dec-16	Dec-16

5.2 Variable description

Each of the hypotheses being tested had their own variable. A definition of each variable can be found in the table below.

Table 5.2 Definition of variables

Definition of Variables	
Credit Extension	This is the loans balance at month end for the SA banking sector.
Percentage of Funding From Asset Managers	Banks receive funding from Retail and SME clients, non-financial corporates, public sector and asset managers which is sometimes referred to an institutional or professional funding. This variable tracks the proportion of the total funding pool that comes from asset managers for the SA banking sector.
Percentage of Asset Managers Funding in the Medium and Long Term	Funding from asset managers comes in the form of short, medium and long term funding. Short term funding is considered as cheque deposits, savings deposits and other deposits that mature in a 1 month time frame. Medium term funding is considered as deposit that mature between 1 and 6 months. Long term funding is deposits that have a maturity greater than 6 Months. This variable is the sum of the sector deposits in the medium and long term from asset managers over the total sector deposit balance from asset managers.

5.3 Results of statistical tests on hypothesis 1

H_0: The implementation of LCR regulations will not have an impact on credit extension by the SA banking sector.

H_1: The implementation of LCR regulations will have an impact on credit extension by the SA banking sector.
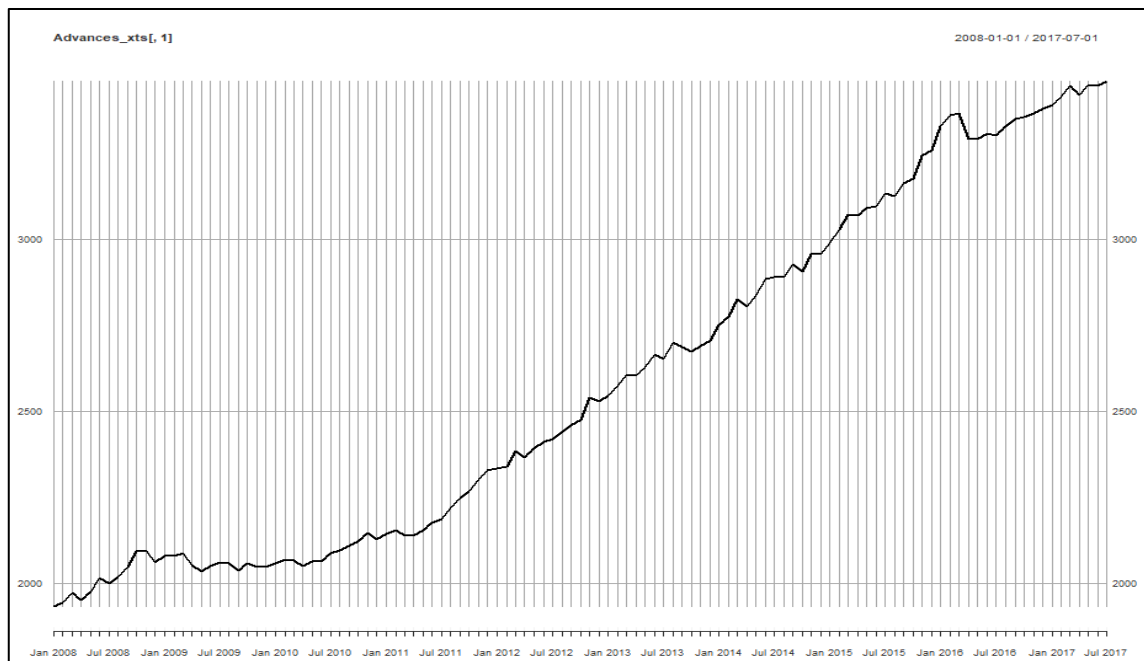
Figure 5.2 Hypothesis 1 time series graph

The image above provides a view of what the actual time series looks like pre and post the intervention.

Table 5.3 Hypothesis 1 model outputs

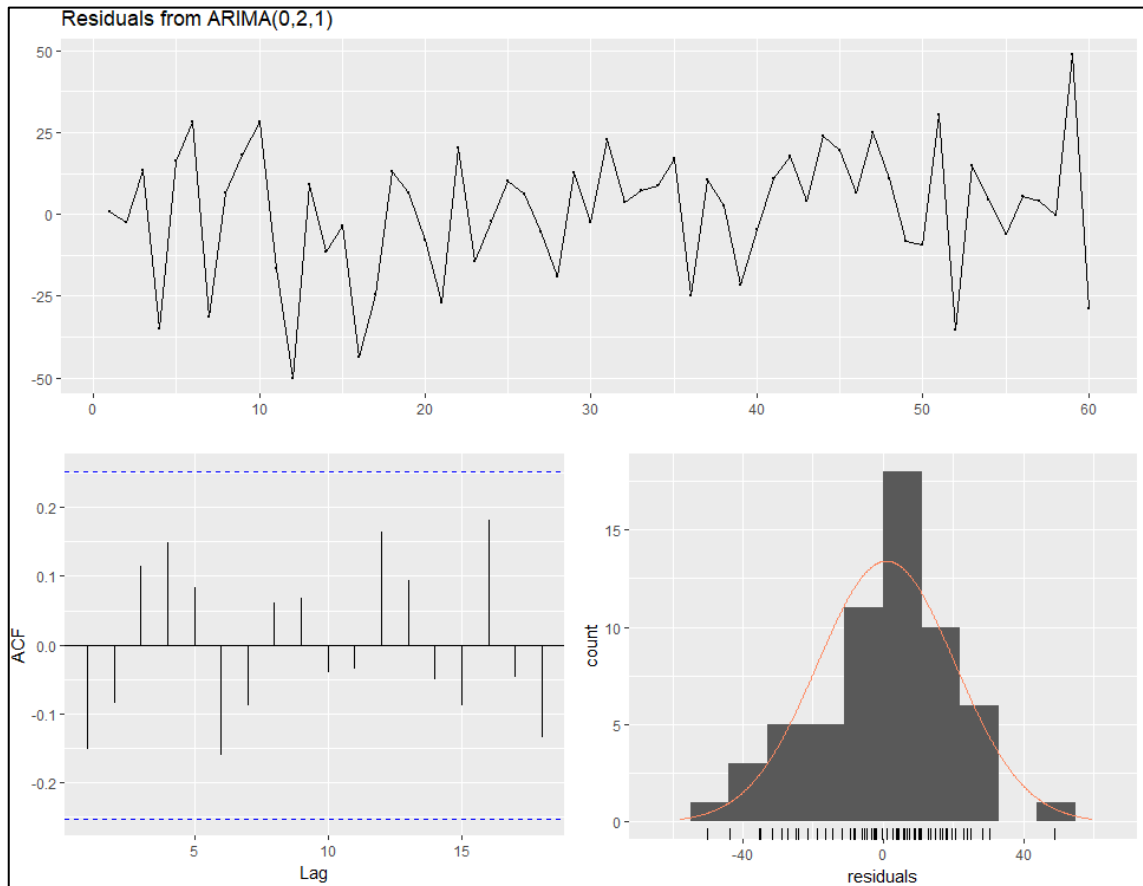| Model Output	
ARIMA(0,2,1)	
Coefficients	ma1
	-0.9065
s.e	0.0634
Sigma^2 estimated as 398.8	
Log likelyhood = -256.31	
AIC-516.62	
AICc-516.84	
BIC=520.74	

The table above provide the outputs of the model that was fitted.

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Once the model was built, tests were carried out to check the significance of the parameter estimate as well as whether the residuals were independent.

Table 5.4 Hypothesis 1 significance of parameter estimate

Significance of Parameter Estimate	
ma1	1.28E-20

The above result shows that the parameter estimate is significant.


Figure 5.3 Hypothesis 1 residuals output

**Table 5.5 Hypothesis 1 Ljung-Box test**

Ljung-Box Test
Data: Residuals from ARIMA(0,2,1)
Q* =7.7706, df =9 , p-value =0.5574
Model df: 1.   Total Lags used: 10

The histogram shows visually that the residuals are fairly normally distributed and the Ljung-Box test, which states that under the null hypotheses that the residuals are independent, provided a p-value greater than 0.05. Based on this we fail to reject the null hypothesis and conclude that the residuals are in fact independent.
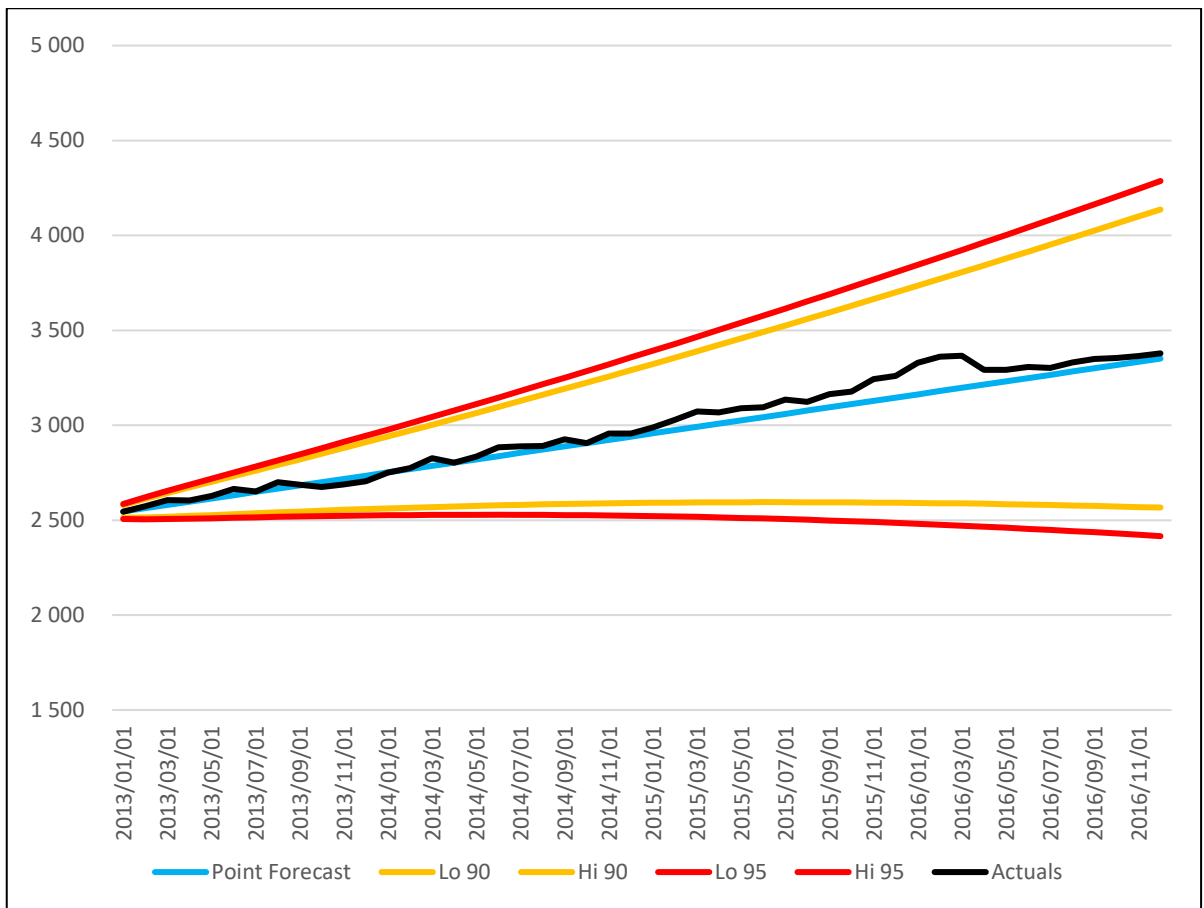
Figure 5.4 Hypothesis 1 Model Forecast vs Actuals vs Confidence Bounds
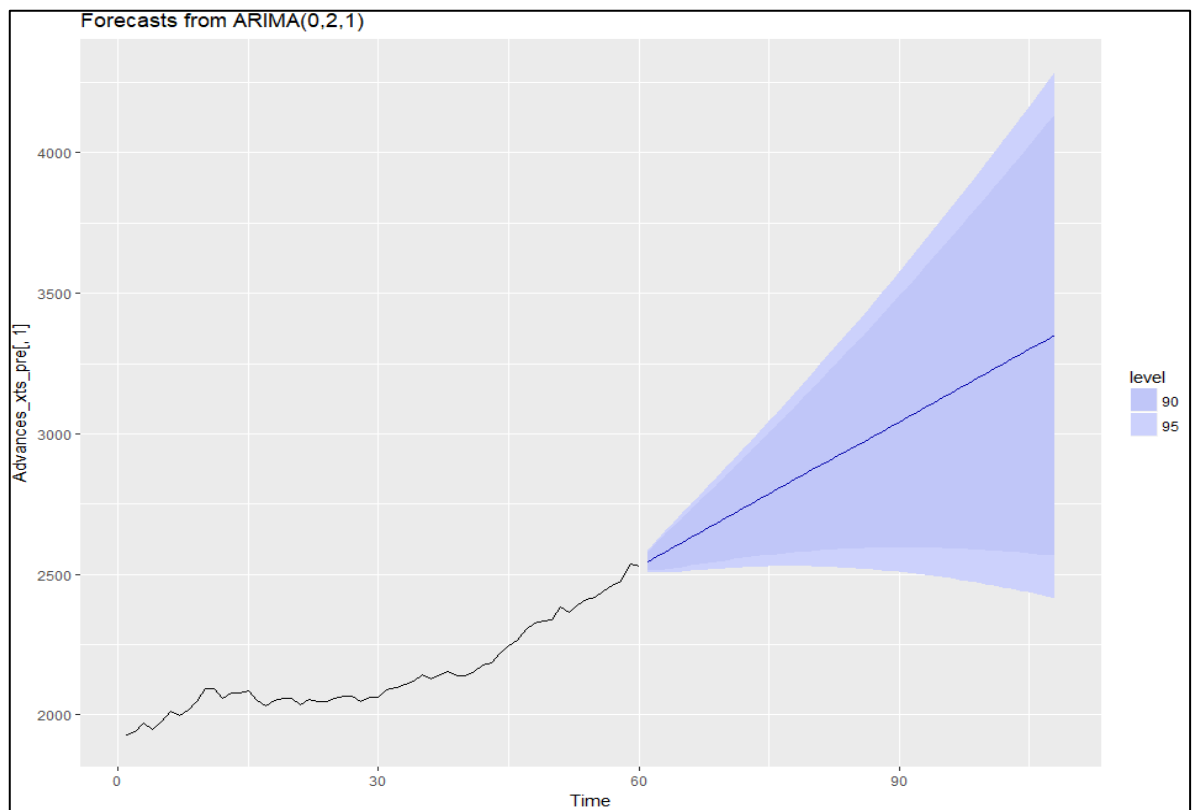
Figure 5.5 Hypothesis 1 Model Forecast and Confidence Bounds

The two figures above provide a view on the how well the forecast model was fitted as well as the confidence bounds for the forecasted model.

The next step was to test the model on the forecast period.

For the Post Model we tested the significance of the parameter estimate as well as the indicator variable which was 0 for the pre-test and 1 for the post-test.

We then check the significance of the model estimates on the post model.

Table 5.6 Hypothesis 1 significance of post model estimates

Significance of Parameter Estimate	
ma1	Indicator
3.16E-52	1.74E-01

Table 5.6 shows that the indicator variable is not significant showing that the intervention has not had an impact on credit extension.
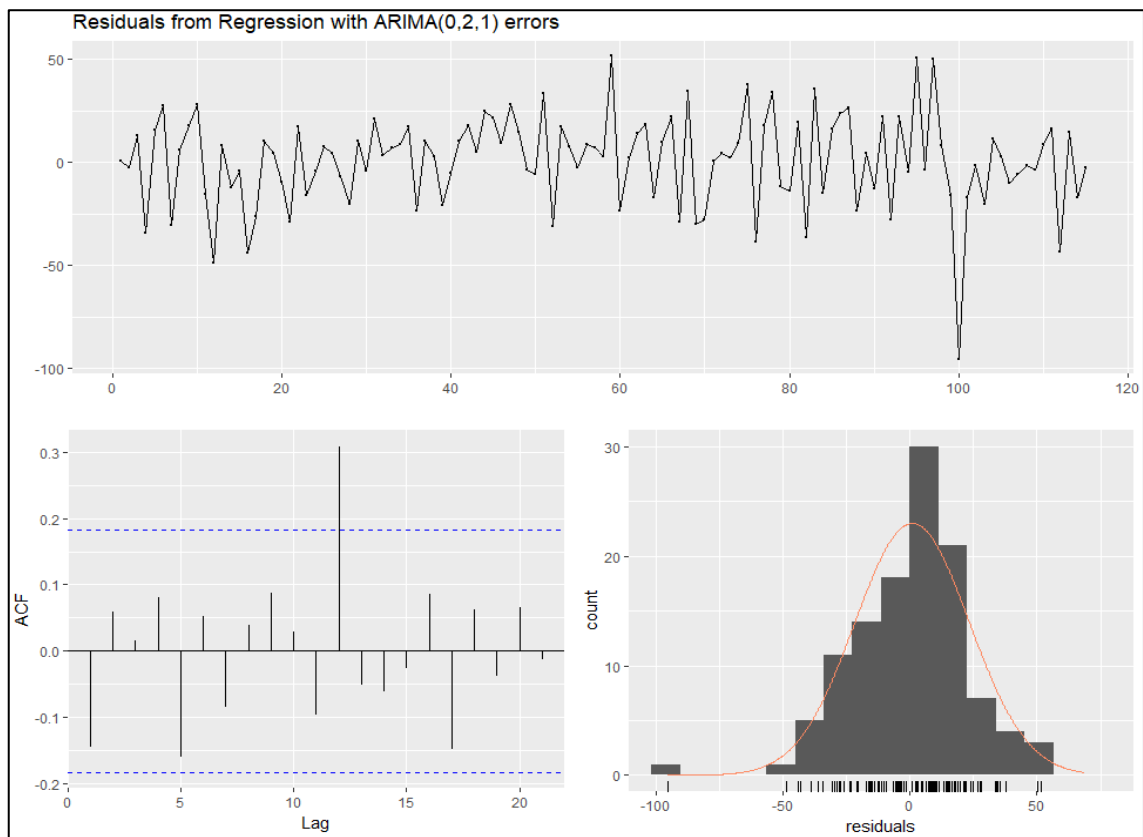
Figure 5.6 Hypothesis 1 output of residuals in post model

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Table 5.7 Hypothesis 1 Ljung-Box test

Ljung-Box Test
Data: Residuals from regression with ARIMA(0,2,1) errors
Q* =9.4066, df =8 , p-value =0.3092
Model df: 2.   Total Lags used: 10

The histogram and Ljung-Box test shows that the residuals are in fact independent.

The last test that was done was to check the number of data points in the actual data that breached the confidence bounds at 95%. This was done in the figure below using a simple count function. If the number of points that lie outside the confidence bounds were greater than 5% of the total number of forecasted values, which in this case is two data points, then one would reject the nil hypotheses.

```
> #If this is 3 or more we conclude then reject H0 at 5%, or 5 or more at 10%
> sum(ifelse(as.numeric(Advances_xts_Actuals[,1])
+            < as.numeric(Advances_xts_forecast$lower[,2])
+            | as.numeric(Advances_xts_Actuals[,1]) > as.numeric(Advances_xts_forecast$upper[,2])
+            ,1,0)  )
[1] 0
```

**Figure 5.7 Hypothesis 1 number of points outside 95% confidence interval**

Result: Fail to Reject H_0

Conclusion: The implementation of the LCR has not had a significant impact on credit extension.

5.4 Results of statistical tests on hypothesis 2

H_0: The SA banking sector will not reduce the proportion of funding from assets managers as a result of the implementation of the Liquidity Coverage Ratio Regulations.

H_1: The SA banking sector will reduce the proportional of funding from assets managers as a result of the implementation of the Liquidity Coverage Ratio Regulations.
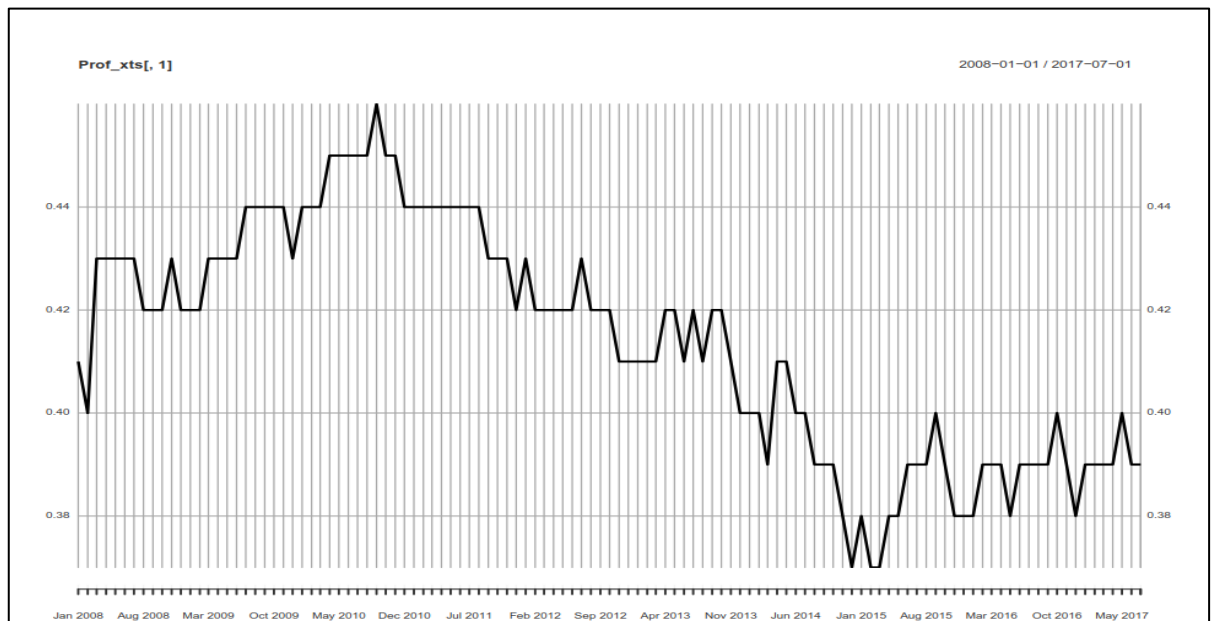
Figure 5.8 Hypothesis 2 time series graph

The image above provides a view of what the actual time series looks like pre and post the intervention.

Table 5.8 Hypothesis 2 model outputs

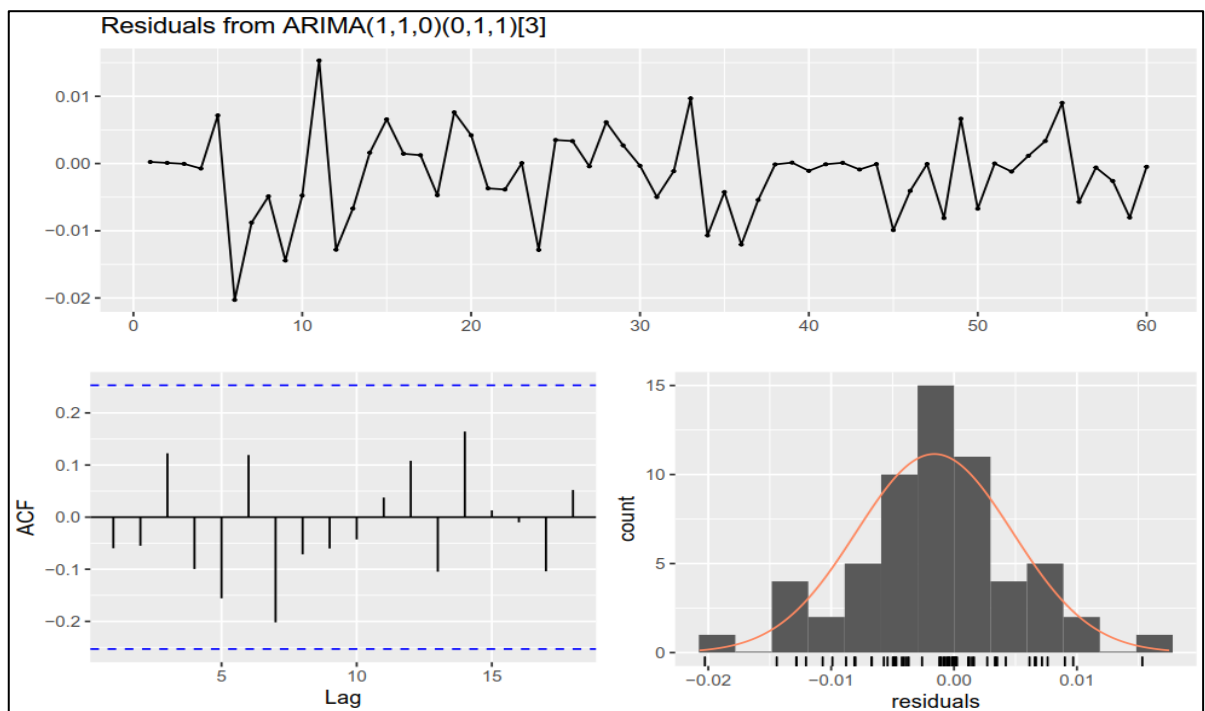| Model Output		
ARIMA(1,1,0)(0,1,1)[3]		
Coefficients	ar1	sma1
	-0.3342	-0.8201
s.e	0.125	0.1173
Sigma^2 estimated as 4.716e-5		
Log likelyhood = 198.74		
AIC-391.48		
AICc-391.01		
BIC= -385.4		

The table above provide the outputs of the model that was fitted. A seasonality component was added to this model to the mild seasonality found in the data.

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Once the model was built, tests were carried out to check the significance of the parameter estimate as well as whether the residuals were independent.

Table 5.9 Hypothesis 2 significance of parameter estimate

Significance of Parameter Estimate	
ar1	1.287762e-0.2
sma1	5.40E-09

The above result shows that the parameter estimates are significant.


Figure 5.9 Hypothesis 2 residuals output

Table 5.10 Hypothesis 2 Ljung-Box test

Ljung-Box Test
Data: Residuals from ARIMA(1,1,1)(0,1,1)[3]
Q* =8.3044, df =8 , p-value =0.4043
Model df: 2.   Total Lags used: 10

The histogram shows visually that the residuals are fairly normally distributed and the Ljung-Box test, which states that under the null hypotheses that the residuals are independent, provided a p-value greater than 0.05. Based on this we fail to reject the null hypothesis and conclude that the residuals are in fact independent.
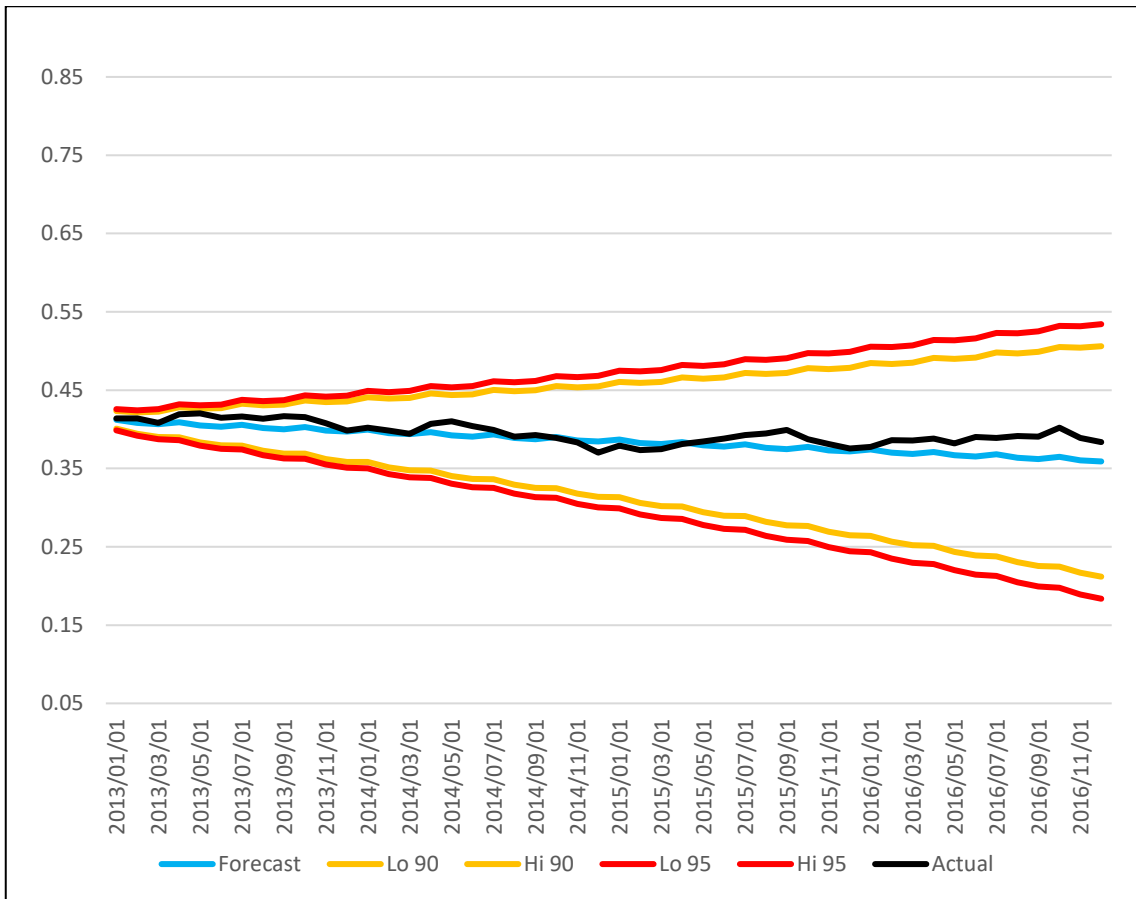
Figure 5.10 Hypothesis 2 Model Forecast vs Actuals vs Confidence Bounds
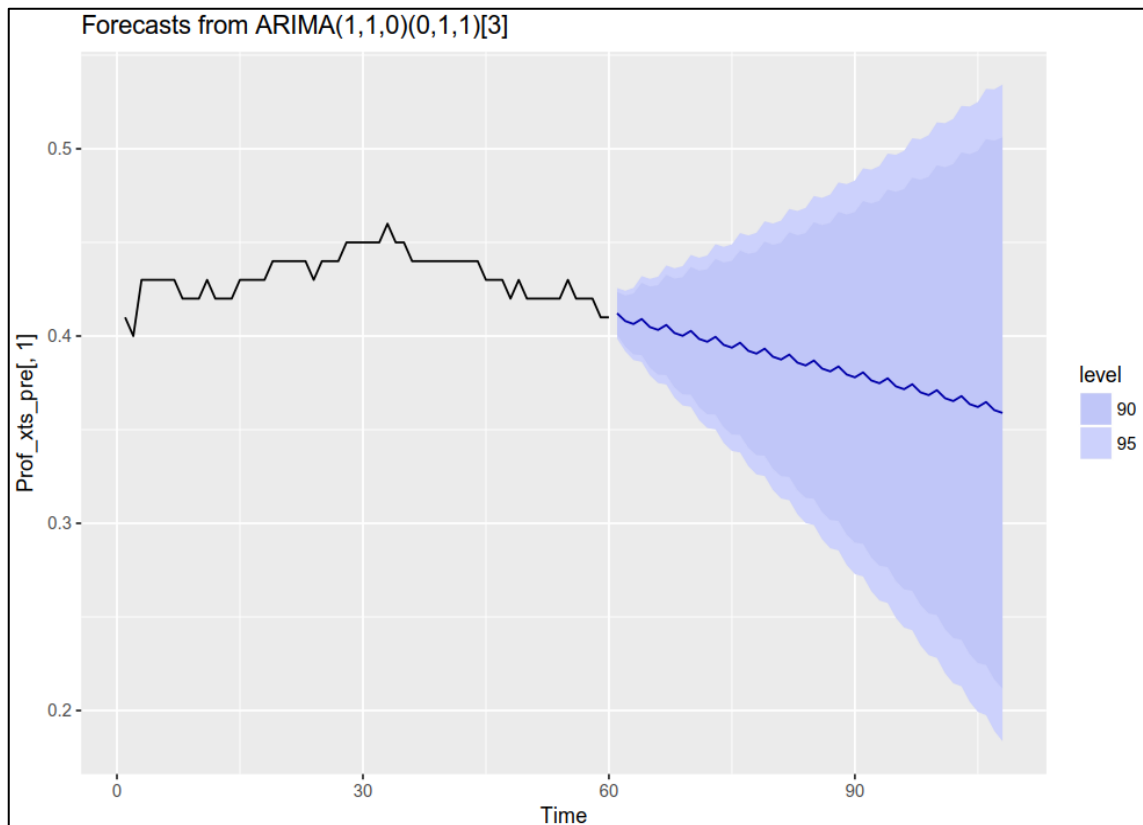
Figure 5.11 Hypothesis 2 Model Forecast and Confidence Bounds

The two figures above provide a view on the how the forecast model was fitted as well as the confidence bounds for the forecasted model.

The next step was to test the model on the forecast period.

For the Post Model we tested the significance of the parameter estimate as well as the indicator variable which was 0 for the pre-test and 1 for the post-test.

We then check the significance of the model estimates on the post model.

Table 5.11 Hypothesis 2 significance of post model estimates

Significance of Parameter Estimate		
ar1	sma1	Indicator
5.73E-03	8.05E-10	3.07E-01

Table 5.11 shows that the indicator variable is not significant showing that the intervention has not had a statistically significant impact on the proportion of funding from asset managers.
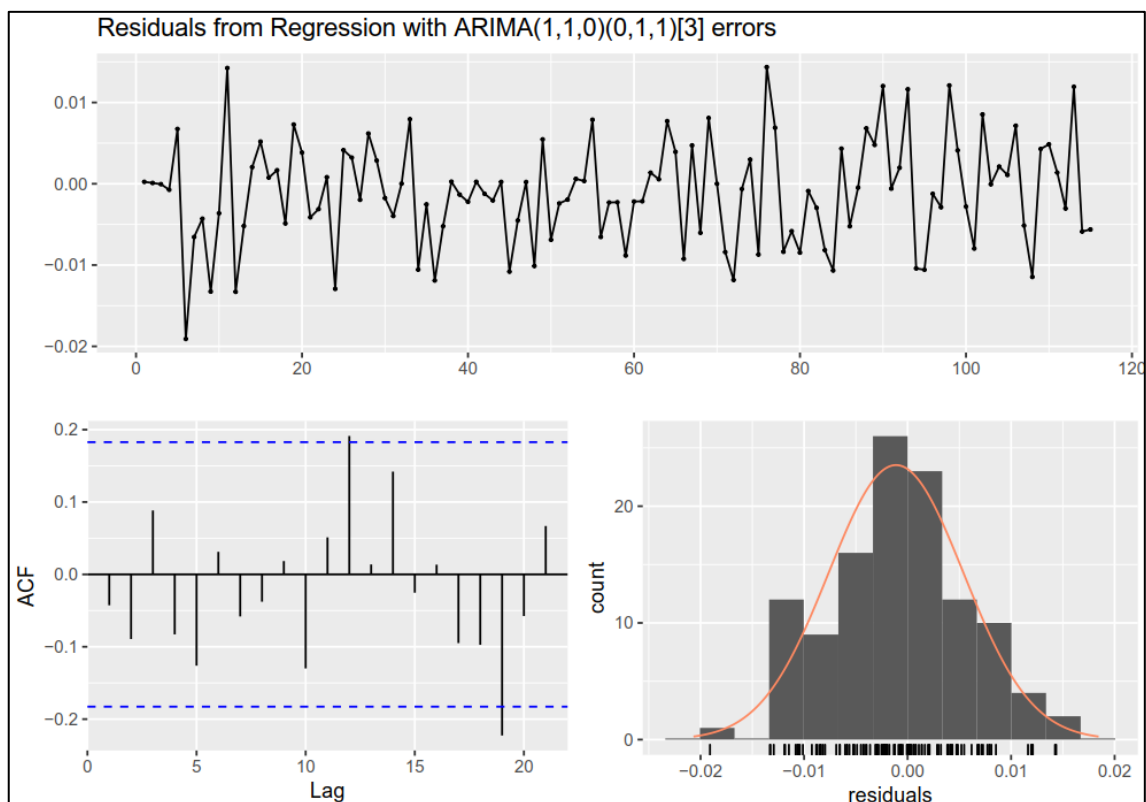
Figure 5.12 Hypothesis 2 output of residuals in post model

Table 5.12 Hypothesis 2 Ljung-Box test

Ljung-Box Test
Data: Residuals from regression with ARIMA(1,1,0)(0,1,1)[3]errors
Q* =7.8076, df =7 , p-value =0.3499
Model df: 3.   Total Lags used: 10

The histogram and Ljung-Box test shows that the residuals are in fact independent.

The last test that was done was to check the number of data points in the actual data that breached the confidence bounds at 95%. This was done in the figure below using a simple count function. If the number of points that lie outside the confidence bounds were greater than 5% of the total number of forecasted values, which in this case is two data points, then one would reject the nil hypotheses.

```
#If this is 3 or more we conclude then reject H0 at 5%, or 5 or more at 10%
sum(ifelse(as.numeric(Prof_xts_Actuals[,1])
         < as.numeric(Prof_xts_forecast$lower[,2])
         | as.numeric(Prof_xts_Actuals[,1]) > as.numeric(Prof_xts_forecast$upper[,2])
         ,1,0)  )
] 0
```

**Figure 5.13 Hypothesis 2 number of points outside 95% confidence interval**

Result: Fail to Reject H_0

Conclusion: The implementation of LCR regulations has not had a significant impact the proportion of funding that banks receive from asset managers.

5.5 Results of statistical tests on hypothesis 3

H_0: The SA banking sector will increase medium and long term funding from asset managers because of the implementation of the Liquidity Coverage Ratio.

H_1: The SA banking sector will not increase medium and long term funding from asset managers because of the implementation of the Liquidity Coverage Ratio.
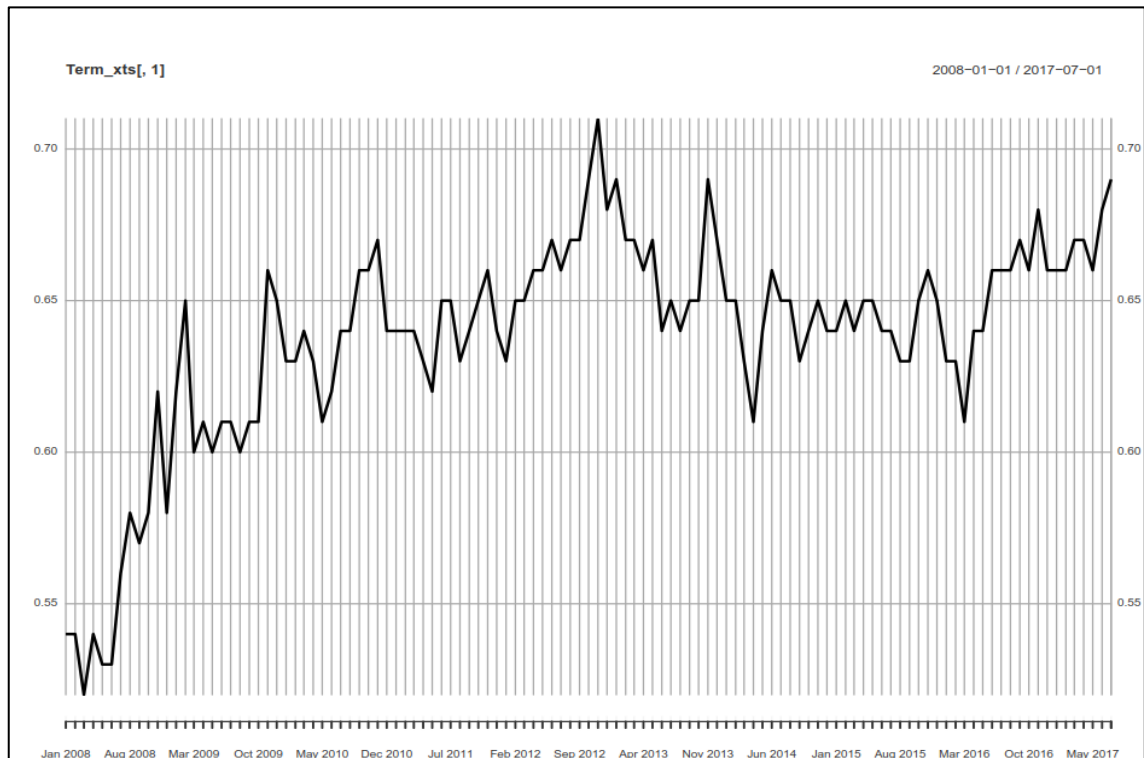
Figure 5.14 Hypothesis 3 time series graph

The image above provides a view of what the actual time series looks like pre and post the intervention.

Table 5.13 Hypothesis 3 model outputs

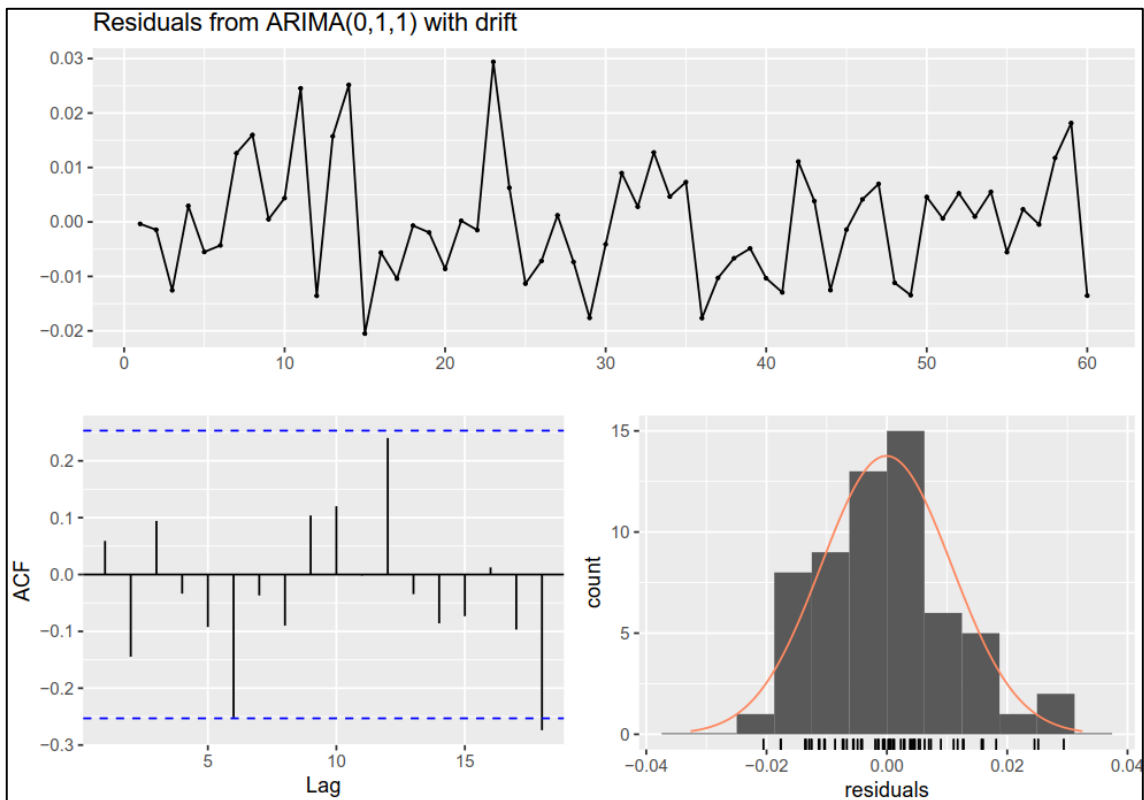| Model Output		
ARIMA(0,1,1) with drift		
Box Cox Transformation: Lamda = 1.999924		
Coefficients	ma1	drift
	-0.4908	0.0016
s.e	0.135	0.0007
Sigma^2 estimated as 0.000122		
Log likelyhood = 183.01		
AIC = -360.03		
AICc =-359.59		
BIC = 353.79		

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The table above provide the outputs of the model that was fitted.

Once the model was built, tests were carried out to check the significance of the parameter estimate as well as whether the residuals were independent.

Table 5.14 Hypothesis 3 significance of parameter estimates

Significance of Parameter Estimate	
ma1	0.000927868
drift	4.02E-02

The above result shows that the parameter estimates are significant.

Figure 5.15 Hypothesis 3 residuals output

Table 5.15 Hypothesis 3 Ljung-Box test

Ljung-Box Test
Data: Residuals from ARIMA(0,1,1) with drift
Q* =9.6876, df =8 , p-value =0.2876
Model df: 2.   Total Lags used: 10

The histogram shows visually that the residuals are fairly normally distributed and the Ljung-Box test, which states that under the null hypotheses that the residuals are independent, provided a p-value greater than 0.05. Based on this we fail to reject the null hypothesis and conclude that the residuals are in fact independent.

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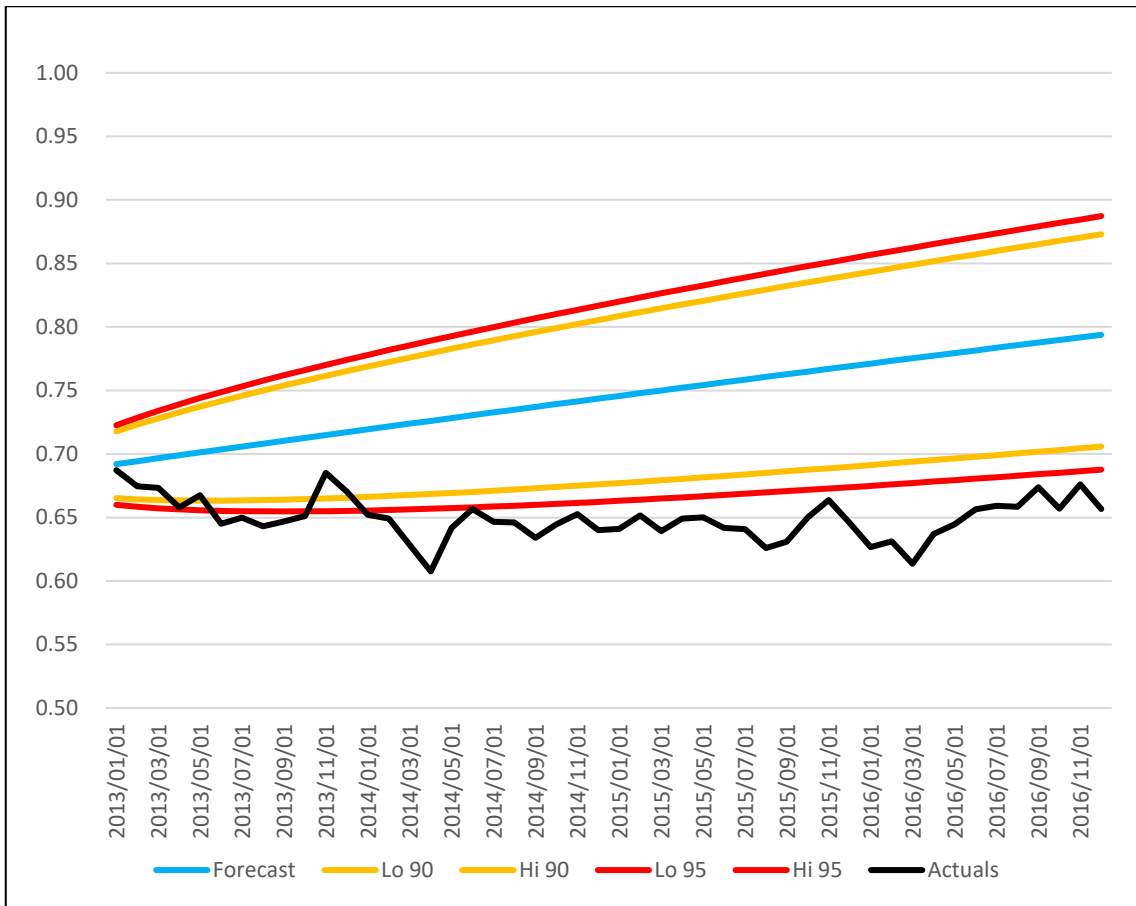
Figure 5.16 Hypothesis 3 Model Forecast vs Actuals vs Confidence Bounds
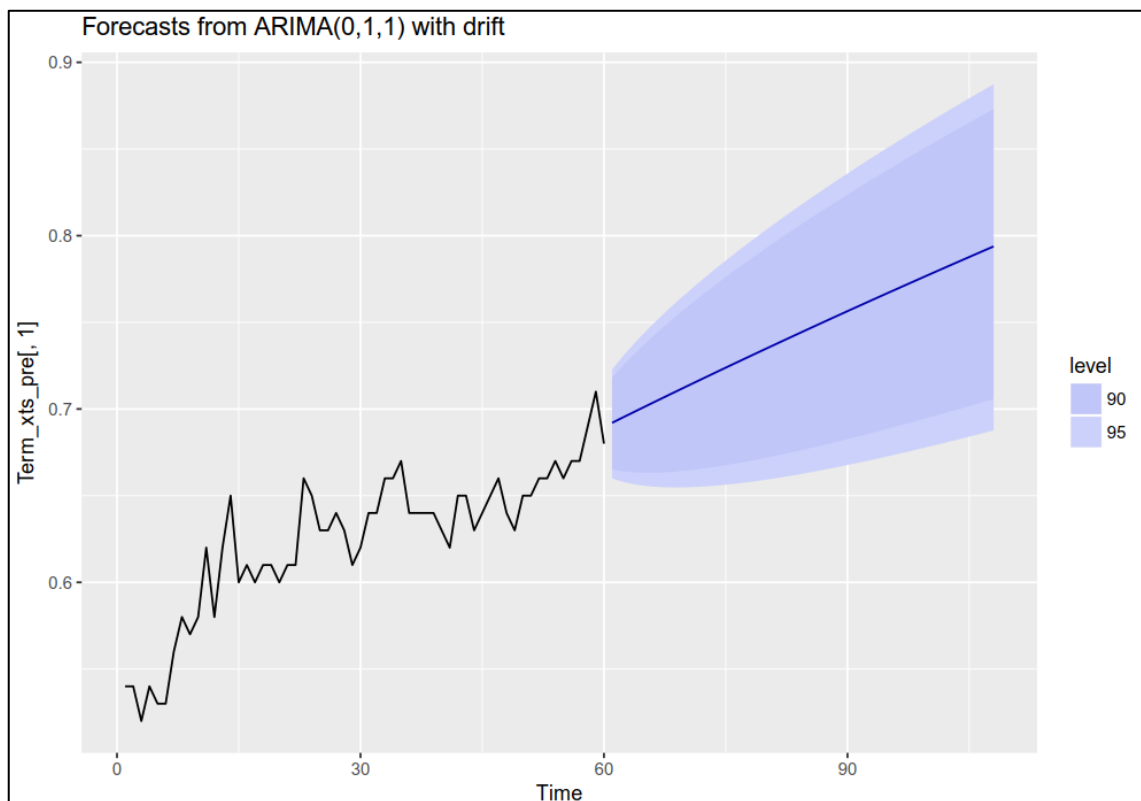
Figure 5.17 Hypothesis 3 Model forecast and confidence bounds

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The two figures above provide a view on the how the forecast model was fitted as well as the confidence bounds for the forecasted model.

The next step was to test the model on the forecast period.

For the Post Model we tested the significance of the parameter estimate as well as the indicator variable which was 0 for the pre-test and 1 for the post-test.

We then check the significance of the model estimates on the post model.

Table 5.16 Hypothesis 3 significance of post model estimates

Significance of Parameter Estimate	
ma1	Indicator
6.12E-04	9.08E-02

Table 5.16 shows that the indicator variable is significant at 10% showing that the intervention has had a statistically significant impact on the proportion of funding medium and long term funding from asset managers. From figure 5.16 we see that although the indicator variable suggests that the intervention has had a significant impact on medium and long term funding, it has in fact reduced as opposed to increase.
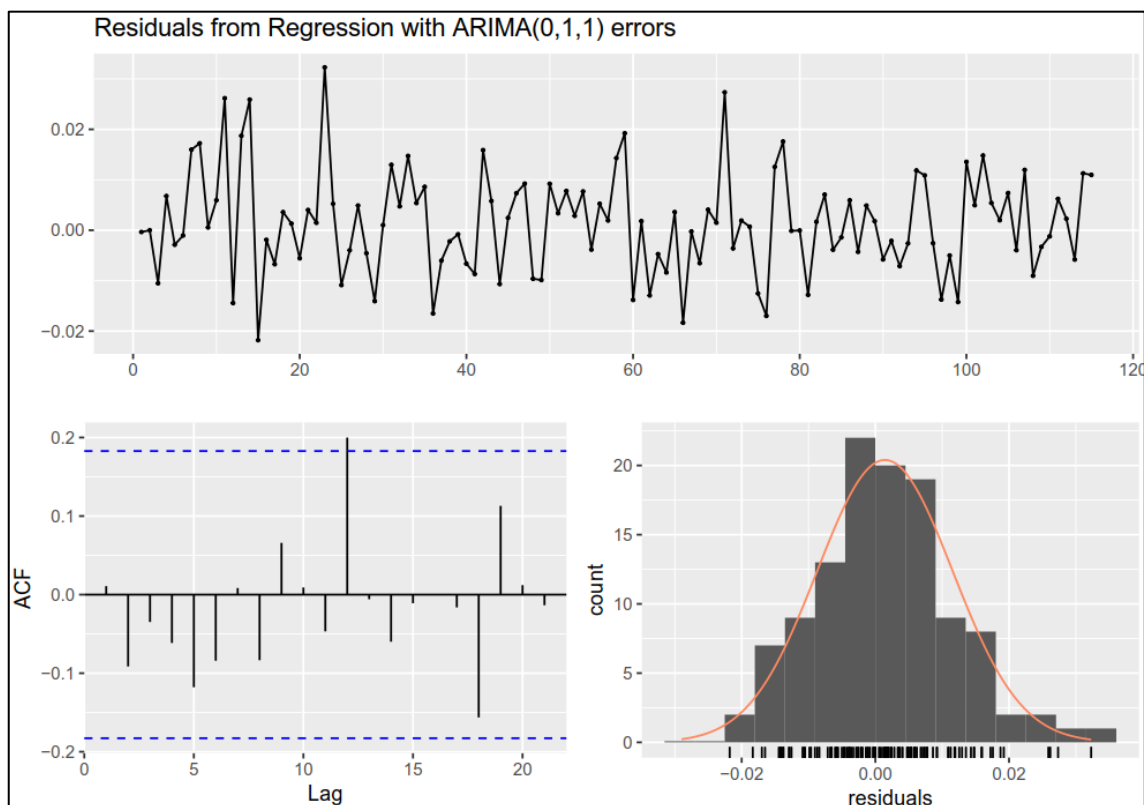
Figure 5.18 Hypothesis 3 residuals output in post model

Table 5.17 Hypothesis 3 Ljung-Box test

Ljung-Box Test
Data: Residuals from regression with ARIMA(0,1,1) errors
Q* =5.6329, df =8 , p-value =0.6883
Model df: 2.   Total Lags used: 10

The histogram and Ljung-Box test shows that the residuals are in fact independent.

The last test that was done was to check the number of data points in the actual data that breached the confidence bounds at 95%. This was done in the figure below using a simple count function. If the number of points that lie outside the confidence bounds were greater than 5% of the total number of forecasted values, which in this case is two data points, then one would reject the nil hypotheses.

```
> #If this is 3 or more we conclude then reject H0 at 5%, or 5 or more at 10%
> sum(ifelse(as.numeric(Term_xts_Actuals[,1])
+          < as.numeric(Term_xts_forecast$lower[,2])
+          | as.numeric(Term_xts_Actuals[,1]) > as.numeric(Term_xts_forecast$upper[,2])
+          ,1,0)  )
[1] 40
```

Figure 5.19 Hypothesis 3 number of points outside 95% confidence interval

Result: Reject H_0

Conclusion: The implementation of the liquidity coverage ratio has not resulted in an increase in medium and long funding from asset managers.

Chapter 6: Discussion of results

6.1 The impact on credit extension

For the first hypothesis, one sets out to test whether the implementation of the LCR regulation had a statistically significant impact on reducing the credit extension that the banking sector provides to the economy.

The results of our test showed that the implementation of LCR did not have a significant impact on credit extension.

We know from the bank's SARB Pillar 3 public disclosures, that none of the banks have dropped below the minimum LCR requirements since the 1st January 2015. This leads us to believe that banks have increased HQLA without compromising on credit extension. I.e. there hasn't been a significant shift in the asset structure of the sector.
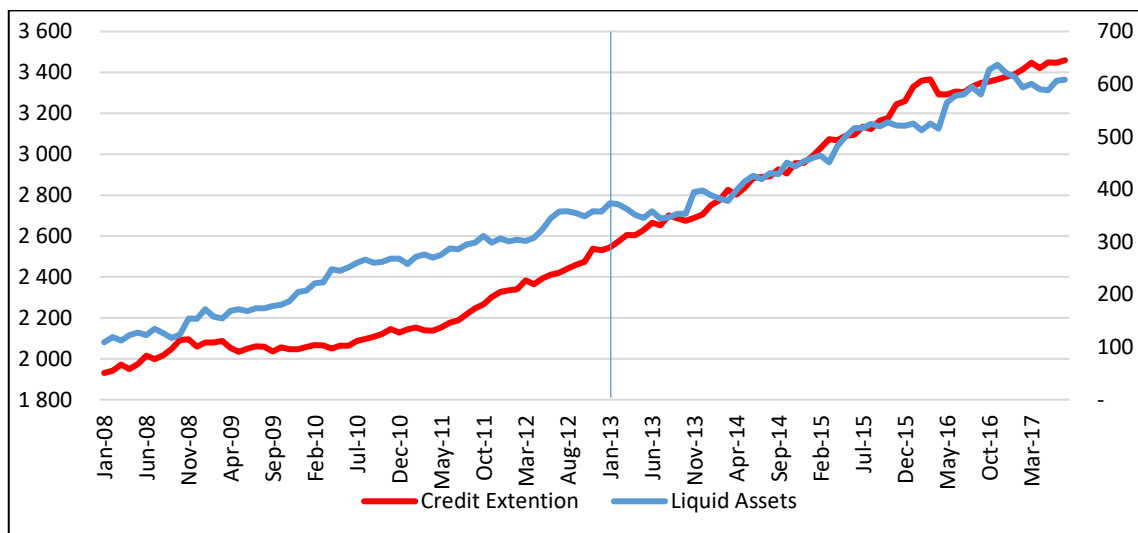
Figure 6.1 HQLA vs Credit Extension

From the above graph, it seems that credit extension and HQLA of the banking sector grew at the similar rates post the point at which banks started making structural changes to their balance sheets.

The result of this analysis is in line with that found in Banerjee and Mio (2017), showed that although there was shift in asset structure, it was not significant enough to show that the implementation had an effect on credit extension.

Analysis on the change in the asset mix between credit extension and HQLA can be found in the graph below. Similar to what Banerjee and Mio (2017) found, the proportion of assets in HQLA changed from 5% in 2008 to 15% in 2017 but did not affect the amount of credit being extended. Please take not of the scale on the y-axis of the graph below.
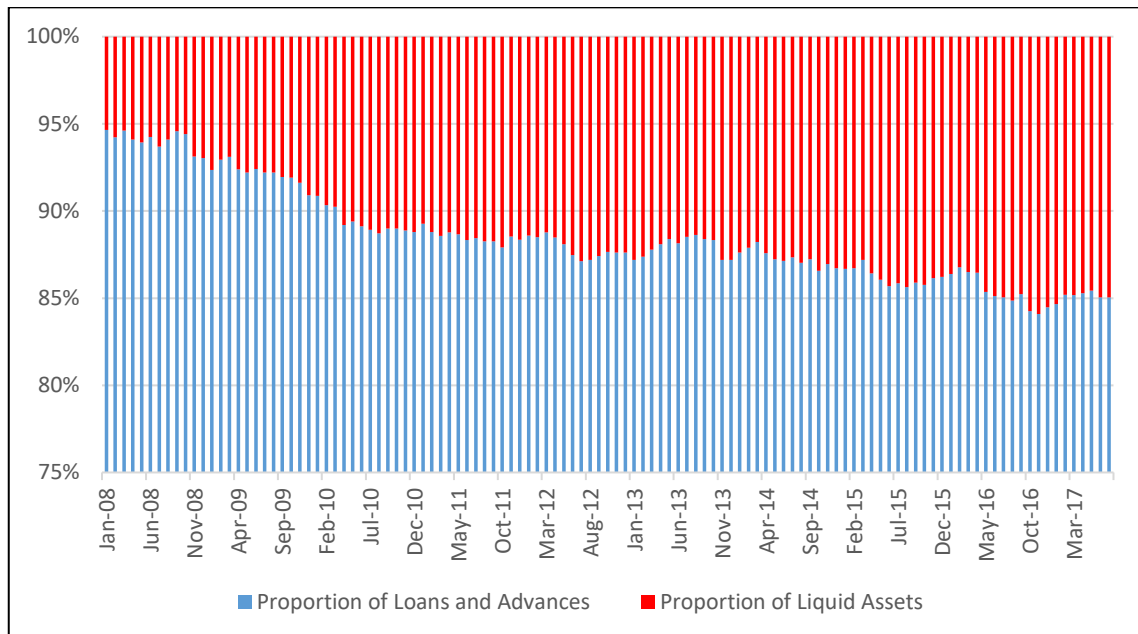
Figure 6.2 HQLA vs Credit Extension as % of Total Assets

The result is in line with what Banerjee and Mio (2017), Bonner (2012), De Haan and van den End (2013), Duijm and Wierts (2014) who also found that there was not significant impact on credit extension. All of these research used empirical evidence by back testing over periods where the actual regulation wasn't implemented.

Vousinas (2015), Van den End and Kruidhof (2013), Gambacorta (2011), Yan, Hall and Turner (2012), Allen, Chan, Milne and Thomas (2012), Gavalas (2015) all found that the implementation would have an effect on credit extension.

Vousinas (2015) was based on a critical analysis and no empirical data was used. Van den End and Kruidhof (2013) used a simulation model to draw their conclusion. Gambacorta (2011) research was used macroeconomic variables specific to the US and one can't conclude whether the same analysis done on SA macroeconomic variables would produce different results or not.

Yan, Hall and Turner (2012) in their analysis also back tested the impact of the regulations between 1998 and 2010 specifically in the UK and used UK based macroeconomic variables in their modelling process.

The researches that did agree with our results were analysis taken from the UK and Holland. Banerjee and Mio (2017) results differed from Yan, Hall and Turner (2012) although both research used the UK banking sector for their analysis. The one differentiating factor between these researches was the fact that Banerjee and Mio (2017) didn't use any macroeconomic variable in their analysis as they chose to stick to banking sector specific metrics in their analysis.

The research based on analysis from Holland, namely, Bonner (2012), De Haan and van den End (2013) agreed with out result. The other aspect that we draw on from earlier analysis is that prior to the test period used in their analysis by De Haan and van den End (2013), the Dutch banks already had a large amount of HQLA due to their own in-country regulatory requirements so the regulation did not require them to purchase additional HQLA at the expense of growing their loan books.

As mentioned earlier, the manner in which in-country regulators treat the HQLA requirement is an important differentiator in the impact of the regulations. Banerjee and Mio (2017) stated that the UK regulator offered UK banks the opportunity to place reserves with them so that they didn't need to buy additional HQLA due to the good rate they were receiving from the regulator on reserves.

In the case of Dutch banks, they already had high levels of HQLA due to the regulators requirement prior to any discussions around HQLA. With UK and Dutch banks not needing to use funding purchase additional HQLA, it is understandable why credit extension was not affected by the regulation.

When comparing our result with Bonner (2012), he first looked at the implications of the regulations on pricing and then drew conclusions of high pricing reducing demand for credit whereas this research didn't consider an intermediate variable in understanding the impact on credit extension. Although both the research done by Bonner and this research have the same conclusion on the impacts on credit extension.

In terms of what the literature in chapter 2 has to say about the impact of the LCR on banking sectors in different countries, the literature was divided on what the impact would be on credit extension. As previously mentioned, Vousinas (2015) and Ramlall and Mamode (2017) was based on a critical analysis of the regulation, whereas some used empirical evidence but was back tested over a period where the implementation didn't actually occur. In the case where the back testing occurred, the effects of bank managerial decision making was completely removed from the analysis whereas this

research covers the period pre and post the actual implementation of LCR to understand whether there has been significant change in credit extension post the point at which banks started making structural changes to their balance sheets, hence bank managerial decision making is included.

The bank decision making process is extremely important as a bank can choose to continue with credit extension as planned and grow their HQLA portfolio provided the funding to do so is forthcoming in the funding strategies that it executes on.

In term of the result of this analysis, banks have managed to meet the SARB regulatory minimum for the LCR ratio with increasing the proportion of HQLA in their asset structure and still growing credit extension. The tests on the SA banking sector's ability to move away from asset manager funding and to increase the proportion of medium and long term funding from asset managers is covered in the next two sections.

6.2 The impact on the proportion of funding from asset managers

For the second hypothesis, one set out to test whether the SA banking sector will reduce funding from assets managers as a result of the implementation of the Liquidity Coverage Ratio.

The results of our test showed that the implementation of LCR did not have a significant impact on the proportion of funding that the sector gets from asset managers. So SA banks were able to meet LCR requirements in country and not shift away from their reliance of funding from asset managers.
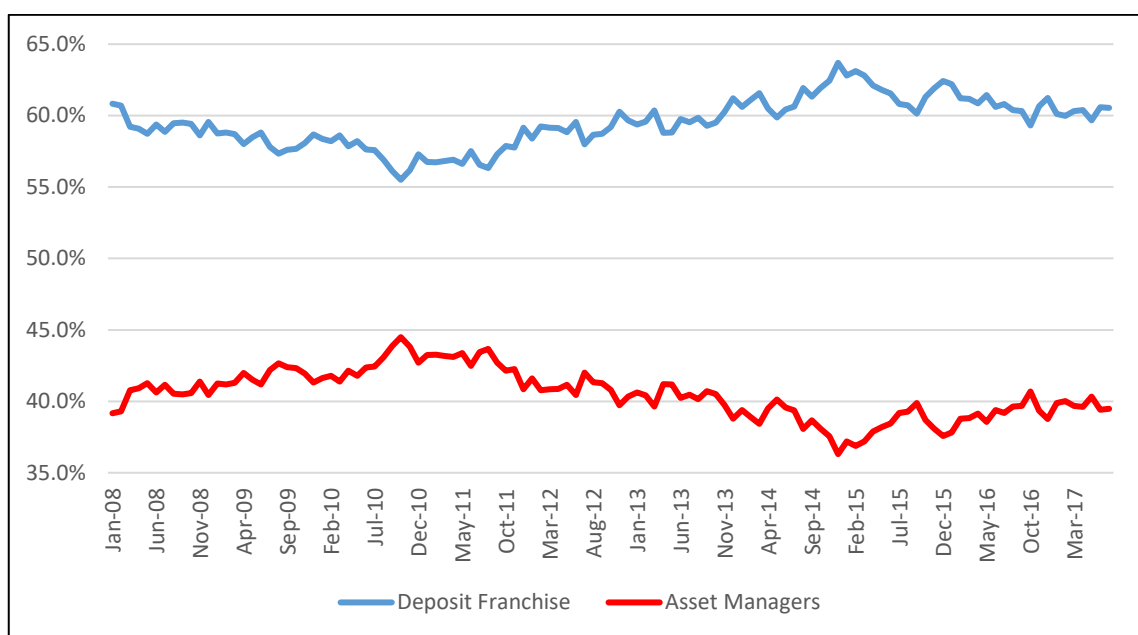
Figure 6.3 Deposit Franchise vs Asset Manager Funding

Although the above graph shows that the proportion of funding that the SA banking sector receives from asset managers has decreased over time, this decrease starts in January 2011, a long time before banks started making balance sheet structural changes in anticipation of LCR. The result is that this research can't conclude that it was the LCR that caused the reduction as the effects of LCR would only be seen after 2013, which is three years into the downward trend seen in the above graph.

The results of this research contradict those of Banerjee and Mio (2017) who found a decrease in asset manager funding. This could have been due the incentive that UK retail depositors are offered deposit insurance on their deposits as opposed to investing in asset managers money market funds which offer no insurance.

The difference could also be due to the timing of the analysis as well as Banerjee and Mio (2017) used a back testing approach to a time when the implementation hadn't taken place and managerial decision making effects were excluded from their analysis whereas this research covers the actual implementation period.

When comparing the results of this research to that of Bonner and Eijffinger (2016), we find that a valid point is raised as to whether it is possible to move away from asset manager funding and still grow credit extension. As mentioned earlier money market and other fixed income funds in SA have attracted retail investor's funds as well as funds from pension funds and insurers due to banks offering such poor deposit rates on deposits historically.

In order for banks to change this behaviour and at least try to attract retail investors funds away from asset managers won't be as simple as increasing the rate on deposit products. The banking sector will need to change retail investor's investment behaviour which happens over a long period of time hence the shift away from asset manager funding in SA won't happen until banks make a concerted effort to change retail investor behaviour. From the graph on the previous page, this does seem to be happening as the proportion of funding from the deposit franchise has grown from 55% in 2010 to 60% in 2017.

The other factor affecting the SA banking sector's ability to move away from asset manager funding is the poor savings rate in SA. From Trading Economics (2017), we see that SA has an exceptionally poor savings rate of just under 16.5% of GDP. This poor savings rate is another factor that influence the impact of the SA banking sector to move away from its reliance on asset manager funding. The SA banking sector is not able to attract savings as easily as the US, UK or EU.

Giordana and Schumacher (2013), in their research found that the ability of Luxemburg banks to move away from asset manager funding depends on the size of the bank. They found that smaller backs would have to reduce funding from asset managers as a result of LCR and reduce credit extension due to the fact that they would now be able to replace this asset manager funding with funding from retail and non-financial investors.

This is very similar to the SA banking sector in that besides for the big four banks and Capitec, the other players in the market rely heavily on asset manager funding although the other banks make up 10% of the banking sector in SA.

When comparing the results of this research to Ritz and Walther (2015), their paper provides possible reasoning as to why the implementation hasn't caused a significant decline in asset manager funding. The cost to move away from asset manager funding comes at an increased cost in retail funding. Banks would need to increase the rates they pay on retail deposits which makes up a roughly 65% of the SA banking sectors funding.

One has to question whether the only cost will be an increase in the rates. One need to take into account the cost of servicing the retail banking channel with marketing information in branches and other mediums of advertising, cost of training staff with new product information to attract retail deposits and other information technology cost that accompany a change process.

The other point from the figure 6.3 is that the SA banking sector might have other factors that caused them to start moving away from asset manager funding since 2010. From figure 6.3 we see a roughly 5% shift between 2010 and 2016.

This could be due to the fact that banks already started challenging the money market funds for a greater proportion of the countries retail funds by offering money market like rates on overnight deposit products thereby diversifying liquidity risk over a larger population rather than the industry of asset managers.

The fees associated with SA asset managers might have changed client behaviour to move funds away from asset managers which directly into the hands of banks. This could also be a shift in the education in financial literacy of the population that where individuals and small business were taking a greater interest in the return that their investments gave them for a certain level of risk.

The other route that banks could have taken was to reduce asset manager funding and not replace this loss of funding. The result would be a reduction in the asset side of the balance sheet. Given that the LCR requires banks to purchase more HQLA to meet regulatory minimums on the LCR ratio, this would result in a reduction in credit extension.

As principle on funds are repaid bank to the banks from client loans they won't be used to provide more loans in the economy but would rather find their way back to asset managers until the optimal level of funding from asset managers is reached. We know from the first hypotheses on credit extension, that this was not the route that the SA banking sector took as they were still able to grow their balance sheets and hence the

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economy. This approach aligns more to the studies conducted by Yan, Hall and Turner (2012), Allen, Chan, Milne and Thomas (2012) and Gambacorta (2011).

The manner in which banks go about reducing asset manager funding is by lowing the pricing curve on which asset managers receive a return for a certain term for which they place cash for. Banks can incentivise asset managers to place cash for longer or shorter periods of time by simply shifting the curve or parts of the curve up or down depending on the term for which a bank is trying to raise money for.

The results of this hypothesis leads one to believe that the pricing curve started coming down in 2010 due to reduction in asset manager funding that bank received. Asset managers were possibly shifting funds that sat in their fixed income and balanced portfolios out of banks and into other fixed income securities such as government bonds, T-bills and corporate bonds. It would have just been their money market funds that would have been difficult to shift away from banks due to the restriction on the type of instruments that money market funds can invest in.

From the research done by Huang and Ratnovski (2011), Demirgüç-Kunt and Huizinga (2010), Acharya and Merrouche (2013), they highlighted the dangers over reliance on asset manager funding, the fact that asset managers don't think in a social optimal way and that banks need to shift towards more stable sources of funding in order to create a banking system that can better withstand shocks and deal with periods of stress.

Although the result of this hypothesis was that the LCR has not caused a significant reduction in the SA banking sector's proportion of short term funding it is plain to see that although the LCR doesn't seem to have caused a significant reduction, a reduction has been taking place since 2010 which leads one to believe that with the reduction in asset manager funding, the SA banking sector is a lot more resilient.

6.3 The impact on the proportion of medium and long term funding from asset managers

For the third hypothesis, one set out to test whether the SA banking sector will increase medium and long funding from asset managers as a proportion of total funding from asset managers because of the implementation of the LCR.

The results of our test showed that the implementation of LCR did not have a significant impact on the proportion of medium and long term asset manager funding. So SA banks were able to meet LCR requirements in country and not shift away from their reliance of funding from short term funding.
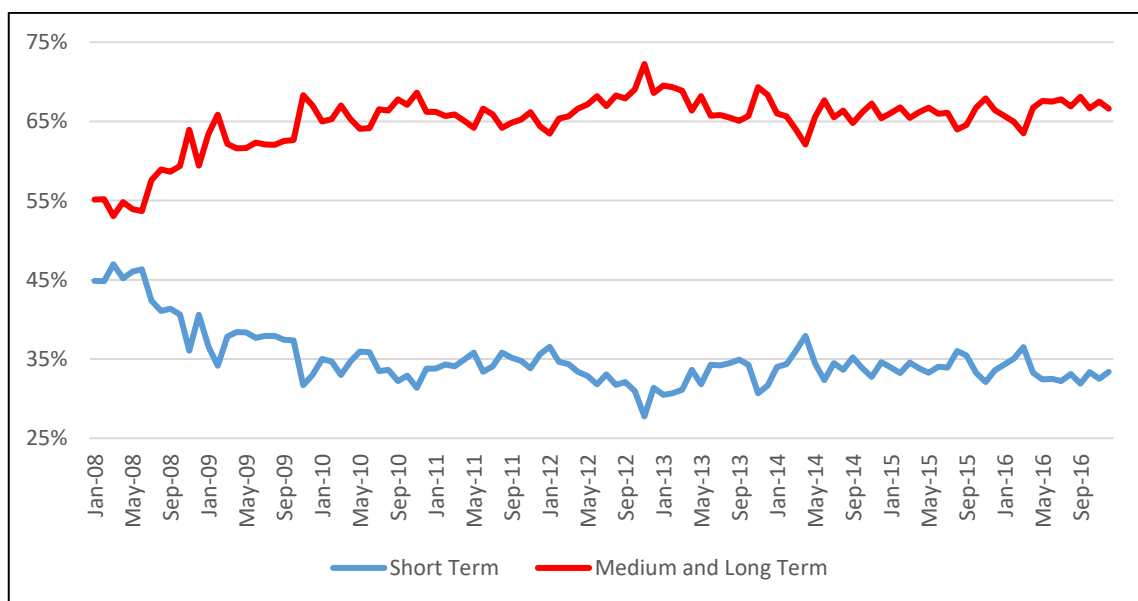
Figure 6.4 Asset Manager Short Term vs Medium and Long Term Funding

The graph above shows an increasing trajectory of medium and long term funding from January 2008 up to January 2010 where the proportion of asset manager medium and long term funding was around 68%. Between January 2010 and December 2016 the proportion seems to oscillate between 60% and 70% with no general direction hence based on the statistical tests, this research concludes that the implementation of LCR did not lead to an increase in medium and long term funding from asset managers.

All the researches spoke to the fact that banks will need for to extending the maturity profile of their funding from asset managers and the additional costs that accompany this action.

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Wei, Gong and Wu (2017) in their research on the impacts of Basel III requirements on banks choice of debt maturity drew on the conflict of interests between bank managers and shareholders, on the one hand you have the shareholders who want a more sustainable funding structure so that the bank has a better chance of survival during a crisis and the bank manager who wants to maximise profits due to the bonus incentives he receives. The research states that bank managers would still issue short and long term debt although due to their incentives the bank manager's decision will lead to a higher proportion of short term debt than what the social optimum would entail.

This conclusion drawn from this research was very similar to the results of our testing. Whether bank managers were acting in the best interests of the organisations that they're representing has not been tested but the lack of shift towards longer term asset manager funding leads one to believe that approach taken is not socially optimal.

The results of Banerjee and Mio (2017) contradicts the finding in this research on the reduction in short term funding from asset managers. This could be due to the fact that their research excluded management action in the implementation of the regulation. The other reason that the results could differs is based on the earlier discussion around the fact that US and UK banks are coming off a higher base of asset manager funding hence for banking sectors in these countries to see a significant shift might prove a lot easier than the SA banking sector.

As discussed earlier, the SA banking sectors main source of funding is in the form of deposits from retail and non-financial corporates at 70% of total labilities where 40% originated from corporates and 25% from retail clients. In contrast, the US and UK sectors only had deposit funding which covered 37% of liabilities.

The impact of the implementation of LCR would differ between banks in SA and the US due to the lower base that the US would be starting with. Structural changes to US banks' balance sheets could be much larger than SA, who already have a high base of retail and non-financial corporate funding.

When comparing the results to Handorf (2012) where he made the conclusion that due to the cost of the regulations will be a factor in how banks go about meeting the regulators requirements, the results of this research line up to his theory that bank managers are not incentivised to come with the most optimal solution for society but act in their own interests to a degree as they need to protect bank margins but at the same time meet the regulators required minimum ratio. This conflict of interest is a balancing act that the

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entire SA banking sector will have to go through in order to please both shareholders with return and regulators and depositors with a more resilient banking system.

When comparing the results of this research to Ramlall and Mamode (2017), one finds that the increase in medium and long term funding happened a lot earlier in the SA banking sector, Figure 6.4 shows that during 2008 and 2010, the SA banking sector increased medium and long term funding from 55% to 68% which is a substantial move over a three year period but this move could not be attributed to the implementation of the LCR as this only started in 2013.

Ramlall and Mamode (2017) expected a greater shift in the proportion of medium and long term funding post 2013. Their view was that the higher cost of funding from extending the term profile of funding from asset managers would be passed onto the clients with higher rate loans which would in turn reduce credit extension in the economy. This approach is in contrast to what this research proved in the first hypothesis as well as this one.

The reason for this could be due to the fact that the Mauritian banking sector that was covered by the Ramlall and Mamode (2017) is duopolistic. It's a lot easier for two banks to decide to pass on new costs to clients rather than for say the big five in SA to do that. If a single bank decides to increase the cost of its loans to clients and the other don't then the single bank prices itself out of the market whereas if all the banks decide to do it then it has the negative impact on credit extension.

Getting all banks to act in a similar fashion on pricing might lead competition authorities to consider investigating collusion hence the impacts that Ramlall and Mamode (2017) speak to would be very different for the SA banking sector.

When comparing the results of this research to Bonner and Eijffinger (2016) and Ramlall and Mamode (2017), although the two researchers agreed that the LCR will cause an increase in the medium and long term funding, they differed in how the increased cost would be handled. Bonner and Eijffinger (2016) found that banks will bear the increased cost in the form of reduced net interest margins and not pass the cost onto clients as shown by which would affect credit extension.

Bonner and Eiffinger (2016) covered the Dutch banking sector who at the time carried excess HQLA prior to the implementation of the LCR. They didn't have to be concerned with an asset structural shift in their balance sheet as they had more HQLA than the

regulations required and as a result did not see a reduction in net interest margin due to the purchase of low yielding HQLA. Due to the Dutch banking sector not having net interest margin affected by an asset structural shifts on their balance sheets gave them the opportunity to absorb the reduction in net interest margin that came from extending the term structure of asset manager funding as opposed to passing it on to clients like was a result of and Ramlall and Mamode (2017).

This research did not cover the impacts of how the additional costs were passed on or absorbed by the SA banking sector but the results of the hypotheses tested leads one to believe that did in incur significantly higher costs than were expected by the 2 papers above as the result of this hypothesis shows that banks did not increase the term structure of funding from asset managers due to the implementation of LCR.

PSG (2015) in their investor relations website, explained that the LCR will have the effect of reducing spreads in the short term money market instruments and increasing spread on medium and long term instruments. This details the way in which banks go about trying to change the term structure of their funding from asset managers. They incentivise asset managers to place funds for longer periods on time based on the return the asset manager will receive.

This incentive might not always be enough to get the asset manager to invest in the longer term. Asset managers invest their funds with banks based on their risk appetite for longer term funding as well as their own liquidity needs. For example, given the elevated level political tension that SA is going through at the moment, asset managers place the bulk of their funds in up to 12 month maturity, purely due to uncertainty in the current market. They are not willing to take a view of the risk of their investment greater than 12 months ahead.

As mentioned earlier, one of the reason why the SA banking sector might not have experienced an significant increase in medium and long term funding from asset managers is that SA banks were coming off a higher base of medium and long term funding from asset managers relative to the US, UK And EU banking sectors .

Chapter 7: Conclusion

7.1 Principal findings

The effects of the implementation of LCR on credit extension in the economy and structural changes in the balance sheet in the SA banking sector have been found to contradict early research on the topic. Most research to date has either been a critical analysis of the regulations and their impacts or an empirical analysis performed by back testing the regulation over a period when the regulation wasn't actually implemented. This removes the effects of management and regulatory action in dealing with the unintended consequences that accompanies the regulations.

This empirical research is the first to test the impacts of the LCR pre and post the actual implementation to understand the impacts on the changes in balance sheet structure hence the data should account for management and regulatory action during the implementation.

The results on the impact on credit extension is favourable as the regulation has not had an effect on the amount of credit extended to the South African economy. This could be due to the manner in which the SA banking sector and SARB collaborated to come up with a staggered implementation over a 4 year period.

The second finding of this research was that the implementation of the LCR has not had a significant impact on the amount of funding that the SA banking sector gets from asset managers. Although the research did show that there has been a decline in the proportion of funding that is sourced from asset managers, the decline started in 2010 and hence cannot be attributed to the implementation of the LCR.

The 3rd finding of this research was that the proportion of asset manager funding in medium and long term deposits has not increased as expected by most of the literature. Again what the research found was that although there was an increase in medium and long term funding from asset managers from January 2008 to December 2013, it was mostly flat or downward trending after banks started making structural changes to their balance sheets in January 2013 in anticipation of LCR hence the initial downward movement could not be attributed to LCR.

7.2 Implications to management

The research provides an argument as to why the close collaboration between the banking sector and in country regulators are important to manage adverse effects and unintended consequences that the regulations could have. Research by Vousinas (2015), Allen, Chan, Milne and Thomas (2012), Van den End and Kruidhof (2013) and Gavalas (2015) based on back testing of the regulation, all found that the regulation would have a damaging effect on the economy but their analysis was based on the exclusion of management and regulator intervention to curb these impacts.

The other implication that arose was for new entrants into the market having a better understanding of how the South African banking sector has fared in their implementation of the LCR regulations and to have a target of what sort of funding mix they should strive to achieve between a deposit franchise and asset manager funding and the term structure of funding that they should aim to exceed based of the SA banking sector industry average.

The impacts of this research provide key take aways for other stakeholders around the SA banking sector. The fact that the regulation has not had a significant impact on credit extension is important for debt and equity investors as they would want to make sure that the banking businesses that they've invested in, are growing their asset bases to increase in value going forward. The fact that banks have not extended term structure of asset manager funding as a result of LCR also provides positive impacts as this means that banks have not incurred a reduction in net interest margin and therefore profitability.

7.3 Limitations of research

Due to the staggered approach being taken by the SA banking sector to complete the implementation of the LCR by the 1st January 2019, the full effects of the regulation might not have been felt yet. Given that the South African banking sector has needed to be at an LCR ratio of 60% on the 1 Jan 2015 and at 80% by the end of our testing period, it is clear to see that the collaboration between the SA banking sector and the SARB is working to remove the adverse or unintended consequences that the regulation could have.

7.4 Suggestions for future research

Research should be done at the end of the implementation phase to understand the full effects of the regulation although there is a very good chance that the results will not differ from that of this research given the behaviour of banks in getting from a ratio of 60% to 80% without having any unintended consequences.

Research on the income statement impact should be covered by future research if granular income statement data is made available. The income statement data will provide a greater understanding into the decision making process of SA banks and how banks have been incentivised by the impacts of the regulations on earnings. Other conclusions regarding how the increase in costs were managed via pricing to customers or balance sheet optimisation could also be drawn if granular income statement data is made available.

The other future consideration should be analysis of the implementation of LCR using post implementation data in other jurisdictions to gain a greater understand of how banking sector have fared relative to what research on the impacts on their jurisdiction said prior to implementation or when tested without having the effects of management and regulatory action. If research is carried out on the actual effects of the regulation using post implementation data, in other jurisdiction, it provide greater in depth understanding of the impact of the regulation of different market and economic structures.

The other big factor that could influence the balance sheet structure going forward is the change in the concentration of the South African banking sector. With Discovery banks and Commonwealth bank entering the market to aggressively compete for a piece of the pie, this could dilute the market share of the big four banks in South Africa and the increased competition will have various effects on deposit pricing. The raise of Capitec also provides another challenge for other players in the sector and could affect balance sheet structures of other banks going forward as banks as they broaden their product offering to the market.

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13 July 2017

Shrinesan Pather

Dear Shrinesan,

Please be advised that your application for Ethical Clearance has been approved.

You are therefore allowed to continue collecting your data.

We wish you everything of the best for the rest of the project.

Kind Regards

GIBS MBA Research Ethical Clearance Committee

22. APPENDIX 6 CERTIFICATION OF DATA ANALYSIS SUPPORT

(Additional assistance retained or not - to be completed by students who used Quantitative or Mixed methodology)

Please note that failure to comply and report on this honestly will result in disciplinary action

I hereby certify that (please indicate which statement applies):

- *I **did not receive** any additional statistical assistance (i.e. did not retain the services of a statistician) to run the data analysis for my research report:* …I agree with the above statement……………………………………………….

- *I **retained the services of a statistician** in running the data analysis for my research report:* …………………………………………………………

If a statistician was retained – ***please supply contact name and details of said statistician:***

NAME: …………………………………………………………………………………...

EMAIL ADDRESS: …………………………………………………………………..

CONTACT NUMBER: ………………………………………………………………

I hereby declare that all *statistical interpretations/ analysis and write-up of the results for* **my study was completed by myself without outside assistance**

Name of student: Shrinesan Pather
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Signature:
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