Securitisation of Mortgage Loans, Regulatory Capital Arbitrage and Bank Stability in South Africa: Econometric and Theoretic Analyses

Thesis presented for the degree of

DOCTOR OF PHILOSOPHY

in the

Graduate School of Business

UNIVERSITY OF CAPE TOWN

By

Sophie Claude Annick Kasse-Kengne

Supervisor: Professor Janine Mukuddem-Petersen

August, 2017

Abstract

Mortgage loans are the major assets securitised by South African banks. Arguments from the literature indicate that the use of securitisation as an instrument for regulatory arbitrage weakened banks' soundness and caused, at least partially, the 2007-2008 Global Financial Crisis. In this regard, financial institutions continually took advantage of the loopholes in the Basel regulation, principally that of Basel I.

Undertaken from both the empirical and theoretical angles, this thesis investigated whether regulatory capital arbitrage under Basel II and III regulations, was a driver of mortgage loans securitisation by South African banks. Additionally, the effect of mortgage loans securitisation on the South African banks' stability was analysed. Furthermore, the project built upon the case of mortgage loans securitisation to deepen the insight on banks' behaviour towards risk, by considering a rare contractual relationship where banks are regarded as agents acting on behalf of regulators. The theoretical examination was carried out by means of perspectives from Agency and Institutional Theories.

The South African banking system is essentially monopolistic with five banks holding more than 90% of total assets, out of which four, with 70% of the assets, consistently report outstanding volume of mortgage loans securitised. Based on the data collected from these four major banks, this research project is the first in many regards. It involves an emerging economy, considers the influence of both Basel II and III regulations, covers the period

2008 to 2015, and focuses on well-capitalised banks exclusively. Moreover, it extends regulatory capital arbitrage analysis to the evidence of loans expansion, includes CAMELS as bank stability proxy and brings in Agency Theory and Institutional Theory to explain banks' behaviour with regards to risk in this particular context. In contrast, other studies were concentrated on Europe and America, mostly under Basel I, limited to one or two baseline models for regulatory capital arbitrage and often only the Z-score measure was used for bank stability.

In three major steps, this study first employed the Ordinary Least Squares statistical methodology to test the capital arbitrage theory of securitisation and other of its features whereby it causes the decrease of capital with little or no reduction of risk. The estimation results indicated that securitisation of mortgage loans lessened South African banks' regulatory capital, increased their overall risk level and moreover, suggested that the proceeds from securitisation were used to expand their loans portfolios. These outcomes tentatively imply that South African banks securitise mortgage loans for regulatory capital arbitrage.

The second step explored the impact of securitisation of mortgage loans on South African banks' stability. Two different measures of bank stability were involved: the CAMELS and the Z-score. CAMELS stands for C: capital (leverage ratio and not the regulatory capital); A: assets quality; M: management efficiency; E: earning; L: liquidity; and S: sensitivity to

market risk (interest risk). The Two Stage Least Squares and the Ordinary Least Squares statistical methods were used respectively for the analysis of the relationship between the two bank stability indicators and the outstanding volume of mortgage securitised. The empirical results from CAMELS showed that mortgage loans securitised negatively affected the level of capital proxied by the leverage ratio, eroded assets quality and increased South African banks' overall costs. However, they had a positive effect on South African banks' profit, they seemed to be an additional source of liquidity and represented a useful tool to curtail market risk sensitivity, especially the interest risk as they increased net interest income. With regards to the analysis with the Z-score, the results indicated a negative impact of mortgage securitised on South African banks' stability. The outcome remained unchanged when retained interests in the form of subordinated loans were included in the analysis, but retained interest had a positive influence on the Z-score.

The last step of this study pertained to the theoretical analysis based on the concepts of Agency Theory and Institutional Theory. Acting as regulators' agents in an agency relationship, the simple model of Agency Theory in its extended form explained that South African banks were first and foremost risk-taking players. They were more interested in the risk/reward trade-off in their decision-making attitude towards risk than pursuing the regulators' goal of the stability of the banking system. In that sense, it was not a surprise that they engaged in regulatory capital arbitrage despite knowing that it was risky but could provide gains in liquidity and profit. In addition to goals conflict, Agency Theory indicated

asymmetry of information between banks and regulators as the indirect origin of regulatory capital arbitrage, where the opacity of banks' activities, such as securitisation, rendered regulations ineffective and thus easy to shirk. Furthermore, it was found that the essentials of the behaviour-oriented contract suggested by the theory as the optimal contract, were already included in the formulation of the latest Basel Accords. However, the researcher believes that one key element, which is the reward or compensation that should benefit the banks (the agent) when they abide by the terms of the contract, is missing. Regulators should therefore include incentives in the regulations and combine the behaviour and outcome-oriented contracts to optimize their relationship with banks even though, as explained by the theory, the outcome of bank stability will remain partially uncertain due to uncontrollable factors such as the economic conditions. The concept of legitimacy, from Institutional Theory, explicated that banks' legitimacy came from their ability to comply with the regulations. From this stance, the results suggested that regulatory capital arbitrage seemed instead to undermine the legitimacy of South Africa banks well-capitalised position.

Key words: Securitisation; Regulatory capital arbitrage; Bank stability; Basel Accords; CAMELS; Z-score; Agency theory; Institutional theory

Acknowledgements

The achievement of this work would not have been possible without many journeying with me.

First and foremost, my indebtedness goes to my supervisor, Prof Janine Mukuddem-Petersen for her guidance, expertise, availability, patience and extended backing. I thank Dr Co-Pierre Georg for his essential involvement at the early stage of this work.

Besides my supervisor, I would like to express my gratitude to Dr Onojaefe Darlington and Dr Ephias Ruhode for endorsing my request to join this PhD programme.

A special note of thanks to the National Research Foundation for its financial provision at the critical steps of this project.

Thanks also to the Johannesburg Stock Exchange for providing the preliminary set of data, as well as The Standard Bank of South Africa Ltd, ABSA Bank Ltd, First Rand Bank Ltd, Nedbank Ltd and Investec Bank Ltd for their assistance with the data.

I would like to express my deep appreciation to my beloved husband, Prof Andre Pascal Kengne for his all-round support and resilience all through this journey. I am grateful to my three beautiful babies, Jacklyn, Charleen and their brother we are hoping for, for their love and understanding.

Likewise, my thoughts go to my dear parents, papa Charles Kasse and mama Lisette Djo whose lives have engraved in me the spirit of determination. My gratitude as well to my brother and sisters for their unconditional love and support.

Last but not the least, my gratefulness to my faithful and ever-supportive friends Mrs Adeline Magny, Dr Olutoyosi Ayeni, Mr Roger Tiomena, Mr Henri Moutalen, and Me Amade Kachala.

Dedication

To my Heavenly Father

Plagiarism declaration

This thesis/dissertation has been submitted to the Turnitin module (or equivalent similarity and originality checking software) and I confirm that my supervisor has seen my report and any concerns revealed by such have been resolved with my supervisor.

Name: Sophie Claude Annick Nguepi Kasse Epse Kengne

Student number: NGPSOP001

Signature: _____

Date: _____

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List of abbreviations

AT Agency Theory

ABCP Assets Backed Commercial Paper

BHC Bank Holding Companies

BSD Bank Supervision Department

CDO Collateralized Debt Obligation

CLO Collateralized Loan Obligation

GFC Global Financial Crisis

IDIOM Intricacy –Design - Information – Opaqueness – Mitigation

IRB Internal Rating Based approach

IT Institutional Theory

OLS Ordinary Least Squares

RA Regulatory Arbitrage

RCA Regulatory Capital Arbitrage

RWA Risk Weighted Assets

SA Banks South African Banks

SARB South African Reserve Bank

SIV Structured Investment Vehicles

SDA Standardised Approach

TSLS Two Stage Least Squares

TPS Trust Preferred Securities

Chapter 1
Introduction of the Study

"The deep cause of the financial crisis, on the financial side, is to be found in the flawed institutions and practices of the current financial regime" (J. Crotty, 2009)

Section 1.1. Background

The 2007-2008 Global Financial Crisis (GFC) revealed the devastating effect of regulatory arbitrage (RA). RA is defined as "the manipulation of the structure of a deal to take advantage of a gap between the economic substance of a transaction and its regulatory treatment"(Fleischer, 2010. 4). Specifically, regarding regulatory capital arbitrage (RCA), Mingo (2000) explained that securitisation, as well as credit derivatives, are the instruments big banks use to strategically align their assets and liabilities with the small risk-weights. Moreover, they shift their activities to transactions that require more economic capital than regulatory capital Similarly, Arnold (2015) views RCA as financial institutions' effort to compress the regulatory capital that would otherwise be required for a set of assets, by rearranging its configuration.

Regulatory Capital is the minimum level of capital required by the Basel Accords I, II, III. It is interpreted by some banks as a type of regulatory taxation (Gerding, 2013). This is justified by the view that the cost of capital is higher than the cost of debt because of the opportunity costs, added to the fact that the interests charged on debt are tax deductible. Also, the minimum capital requirement reduces the ability of banks to create liquidity as

they normally do through the collection of deposits (Van den Heuvel, 2008). Arbitrage is then involved when banks may be willing to comply with the requirement but will first proceed to the optimization of their risk-weighted assets (RWA). In other words, if the cost of capital as required by the regulator increases (the numerator of the ratio) and the managers foresee growth opportunities for the bank, they will then consider ways to minimize risk weights (the denominator of the ratio) thus giving preference to performance over stability (Beltratti & Paladino, 2013).

Even though it would be legitimate for a bank to reduce its cost at all times in order to maximize the shareholder value (Mingo, 2000), it can, however, be harmful to take excessive risk in the pursuit of higher return ignoring the potential future backlash. For example, it is hazardous to cherry pick to preserve securitising banks' reputation by not transferring lemon problems[1] to investors (Ambrose, Lacour-Little, & Sanders, 2005; Affinito & Tagliaferri, 2010). Equally, using RA to hedge against systemic risk in the case of regulatory error (Romano, 2010), or even seeing regulation adjusted to optimize the benefits of contractual business relationships due to RA (Gerding, 2013) is perilous. Gerding (2013) further pointed out some costs of RA such as deregulation to reduce competitive disadvantage between market participants, the erosion of effective regulations, competition alteration, risk covering, which all lead to more complex laws and

[1] Lemon problems refer to the inability of a buyer to know whether the goods he or she is buying are good or bad (lemon) due to asymmetry of information (Akerlof, 1970).

thus more RA opportunities, not to mention the fact that it creates a waste of legal and public resources.

In the aftermath of the 2007-2008 USA subprime mortgage crisis, RA via securitisation was pointed out as a partial cause because of what Petersen, Senosi Mukuddem-Petersen (2010) called the IDIOM hypothesis[2]. Originators accumulated massive risk within the banking system without holding enough capital to absorb unexpected losses (Ashcraft & Schuermann, 2008; Dell'Ariccia, Igan, & Laeven, 2012; Mian & Sufi 2009).

Securitisation is pooling loans into packages and selling the pooled assets by issuing securities collateralized by the pooled assets (MacDonald & Koch, 2006). Securitisation can be driven by the transfer of credit and interest rate risks, provision of liquidity, diversification, specialization in lending, an increase of fee income or the improvement of capital ratios (MacDonald & Koch, 2006; Ambrose et al., 2005). It can also be motivated by the reduction of asymmetries information (Uzun & Webb, 2007).

The 2007-2008 GFC has proven that RCA via securitisation carries risks that can jeopardize the stability of a financial Institution (South African Reserve Bank - Bank Supervision Department, 2007). The shift by banks from their traditional Originate-and-

[2] (Petersen et al., (2010) postulate that the subprime mortgage crisis was largely caused by the *intricacy* and *design* of subprime mortgage origination and securitisation that led to *information* (asymmetry, contagion, inefficiency and loss) problems, valuation *opaqueness* and ineffective risk mitigation.

hold or loans model to the Originate-to-distribute or securitisation model[3] led to the decline of the lending standard causing unprecedented credit expansion (Brunnermeier, 2009). As an example of RCA preceding the 2007-2008 GFC, Acharya, Schnabl and Suarez, (2013) showed evidence that from 2003 to 2007, banks in the USA alleviated their level of regulatory capital through such structures as Assets-Backed Commercial Paper (ABCP) conduits or other Structured Investment Vehicles (SIVs)[4]. They created these structures in the shadow banking that was not regulated, where they relocated part of their assets, specifically the securitised mortgages. Furthermore, they provided these structures with credit and liquidity enhancements, which represented a binding commitment to collect back the assets from investors should they default (Acharya, et al., 2013).

Other ways identified by Acharya et al., (2013) and other authors was the massive investment in Collateralized Debt Obligation (CDO)[5] and in Collateralized Loan Obligation (CLO)[6] as means through which banks relieved their minimum of regulatory capital required. From the regulatory perspective, the AAA-rated tranches of these products made of securitised mortgages were qualified to hold less capital. The problem is that the rating was flawed, resulting from pernicious incentives on the one hand and their

[3] A business model of financial intermediation, under which financial institutions originate loans such as mortgages, repackage them into securitised products, and then sell them to investors (IMF, 2008).

[4] A legal entity whose assets consist of asset-backed securities and various (SIV) types of loans and receivables. An SIV's funding liabilities are usually trenched and include short- and medium-term debt; the solvency of the SIV is put at risk if the value of the assets of the SIV falls below the value of the maturing liabilities (IMF, 2008).

[5] CDOs are asset backed securities of which the underlying collateral is constituted of corporate or sovereign bonds, or bank loans (Duffie & Gârleanu, 2001).

[6] CLOs are CDOs backed by whole commercial loans, revolving credits facilities or letters of credit (IMF, 2008).

opaqueness and complexity that render their pricing difficult on the other hand. The underlying mortgages were in fact of bad quality. Furthermore, the freed capital in the process also opened opportunities to grant more risky loans (Acharya & Richardson, 2009; Crotty, 2009). In both cases, when the crisis started triggered by the house prices bubble in the United States, banks that engaged in such RCA were unable to face the volume of mortgage defaults due to lack of sufficient capital and they eventually became insolvent.

The third RCA engineering known took a more insidious form. Basel II offered to choose between the Standardised (SDA) and the Internal Rating Based (IRB) approaches to calculate the minimum level of capital. It set the risk weights for mortgages at 35% (reduced from 50% in Basel I) and 15% to 20%, respectively. It happened that some banks such as Citi or Northern Rock anticipated their option for the IRB and started accumulating an unreasonable volume of mortgages because of its comparative advantage in terms of capital charge and return on capital. The latter reached a level of 75% of assets made up of mortgages before Basel II was even enforced. In 2007, their risk-weighted assets (RWA) dropped from 30% of assets under Basel I to 16.7% under Basel II, with a Tier 1 capital of only 2% of total assets. Consequently, at the onset of the crisis, this bank experienced a liquidity run and later on collapsed (Blundell-wignall, Atkinson, & Lee, 2008).

Other analyses revealed that in order to free up some capital, low franchise value Bank Holding Companies in the USA utilized assets-backed securities (Boyson, Fahlenbrach, & Stulz, 2014). Some also used Credit Default Swap (CDS) (Yorulmazer, 2013). Many financial institutions went further by providing liquidity and credit enhancement to securitisation conduits or switched from loans to investments in AAA-rated tranches of CDOs (collateralized debt obligations) and CLOs (collateralized loan obligations). All this 'financial engineering' concentrated huge risk within the banking system (Acharya et al., 2013). More empirical studies are attached in Appendix 1.

The next section on the context and the problem statement explains in details why this study is focused on South Africa. In a nutshell, the GFC has lift the veil on the hidden-risks that accompany securitisation transactions and to the best of my knowledge, little empirical research has been conducted on securitisation of mortgages in South Africa, especially the risky side.

Existing studies include:

Tensfeldt, Firer and Bendixen (1993) researched South African (SA) banks executives' views on whether the securitisation process will experience a momentum in South Africa, using a survey. As results, savings on capital, increase in non-interest income, improvement of return on capital and return on equity ratios, and the source of diversification for investors were identified as the benefits of assets securitisation. They

also found that these benefits are likely to stimulate the process in South Africa. However, the participants were sceptical on: whether it reduces bank funding costs or credit risk; whether it results in cheaper bank credit; or whether it makes bank funding more available. They were also concerned about the complexity of the process, the fact that it is time consuming with high transactions cost and high initial set-up costs. Additionally, they found the acceptance by investors to be a slow process and the new credit rating agency lacked credibility (Tensfeldt, et al., 1993).

Fleishman (1999) discussed the problems inherent in the different approaches to securitisation used in South Africa from the taxation point of view. This author used the case of securitisation of a debtor's book of a retailer selling goods on credit to its customers. She suggested possible solutions to any adverse tax consequences and their likely taxation treatment.

Saayman and Styger (2000) focused on how SA banks can benefit from securitisation to improve their liquidity ratios and access to liquidity. In 2003, these same authors investigated the reason why securitisation lacked growth in South Africa between 1980s and 1990s. They found that the regulation was not favouring this type of transactions. Also, there was no strong demand for and supply of assets and Mortgage Backed Securities (MBS).

Moodley (2003) explored the possibility of replicating the USA subprime mortgage-backed securitisation model in South Africa for low-to-moderate income. His recommendations included a sharing risk between the government (i.e. provision of guarantee) and the private sector.

Cumming and Nel (2005) found that under Basel I (1988), SA banks raised additional capital to comply with the capital requirements and shifted toward low-risk assets. However, the private sector loans and mortgage loans suffered.

Karoly (2006) studied all aspects of the four Commercial Mortgage Backed Securitisation (CMBS) programmes launched at that time in SA. Through interviews, she found that they triggered more competition between banks and reduced their interest rate on debts.

Smith (2007) examined the future impact of Basel II on securitisation transactions of banks before its implementation. He found that among others, it will align regulatory capital more closely to actual economic risk of banks' book assets and will therefore reduce RCA opportunities.

Moyo and Firer (2008) looked at the development of securitisation in SA between 2000 and 2007. They noticed the exponential growth but predicted a slowdown given the crisis,

the narrow investor base and concluded that the future of securitisation will depend on the demand of asset-backed paper.

Locke (2008) researched the aspects of traditional securitisation in the South African Law. She aimed to recommend the best practices in the structuring of the traditional securitisation scheme for better benefits from the legal point of view. Among her recommendations are the need of a certification of particular rating agencies for greater investors' confidence, and security regulated only by the Trust Property Control Act and not the Company Act. Furthermore, she recommended the transfer of assets by way of cession only and SPV so that the auditors ensure that the originator is solvent and will be left solvent after the securitisation transaction.

Gerdes (2008) studied the emergence of low-income home loan securitisation in the South African residential mortgage market. He looked specifically at the 2007 Standard Bank RMBS transactions (R 2.4 billion) named the "Siyakha Fund", the first in this subprime category in South Africa. From an interview with the expert involved in the process, he discovered that the motivation behind this project was to provide the investors co-signatories of the Financial Services Charter, namely Investec, Liberty Life and Old Mutual, with the charter points they needed.

Mgwabi (2009) assessed the securitisation activity post-financial crisis in South Africa. She concluded the volume issued has declined but not the volume traded, indicating that securitisation went through a crisis. Also, investor confidence was found to be affected by liquidity, the reliability of ratings and consumer credit demand concerns.

(Kasse-Kengne & Mukuddem-Petersen, 2015) looked at the regulators' responses post-financial crisis regarding securitisation in South Africa. They found that traditional and synthetic securitisation are clearly excluded from the business of banks. Special Purpose Vehicles (SPV) must provide audited and certified information to the Reserve Bank quarterly and the capital for securitisation exposure must be based on their economic substance.

To the best of my knowledge, no study has shown whether RCA is a determinant of mortgage loans securitisation transactions by SA banks. Furthermore, no study has examined the impact of mortgage loans securitisation on SA banks' financial stability.

Section 1.2. Context and Problem Statement

As a brief history of securitisation, the first Mortgage-Backed-Securities were issued in the United States in the 1970s by the Government National Mortgage Association, also called Ginnie Mae (White, 2011). In South Africa, the first was launched in 1989 by the former United Building Society for 250 million of mortgage backed securities. The development

of this market was slowed by regulatory constraints and it is only in 2001 that the market was revived with SA Home Loans, a non-bank, issuing a 1.25bn deal (Van Vuuren, 2004). Since then, there was a continuous remarkable growth up until the GFC hit.

The International Monetary Fund (IMF) in its 2015 assessment recognised that the SA banking system is highly compliant with the Basel Accords and other audit/accounting international standards. Moreover, it is large and sophisticated with a level of tier 1 capital (2013: 13.4%) that make SA banks comparable to their developed countries peers (International Monetary Fund, 2015). The country is equally part of the BRICS[7], the leading emerging economies.

Likewise, at the national level, South Africa is viewed as benefiting from a financial system commonly agreed to be robust, primarily due to its sound financial regulatory framework (Nene & Treasury, 2012). This system is also efficient as a liquidity distribution mechanism in good time (Nene & Treasury, 2012; Georg & Brink, 2011) as well as its major banks before and even during the GFC (Erasmus & Makina, 2014). According to the South African Reserve Bank (SARB), SA banks were preserved from the GFC because they did not expose themselves directly to the USA subprime mortgage market (SARB, 2007). In line with the robustness of its regulatory framework, South Africa is already compliant with Basel III Accord's requirements (BIS, 2010), issued after Basel I (BIS, 1998) and Basel II (BIS, 2004). The country started implementing Basel III since January 2013 and it will be phased in until January 2019 (Groepe, 2015). More specifically,

[7] Brazil-Russia-India-China-South Africa

regarding securitisation, the Securitisation Notice of 2008 provides guidance for securitisation transactions by SA banks. Since the end of the GFC, the spill-over effects of the crisis and the cyclical downturn in South Africa have a negative impact on the banking sector. Mortgage lending is slow and the real estate market is in the doldrums (SARB, 2013). The motives behind securitisation by SA banks seem mainly to be for liquidity and capital management strategies (SARB, 2007).

Unlike other American and European securitisation transactions, securitisation schemes in SA are characterised as in the simplest form and their assessment follows similar processes as the normal credit (BSD, 2008). Syndicate One described the securitisation process in SA as one whereby the originator (financial institution) pools mortgage loans, a special purpose vehicle (SPV) obtains the ratings of the loans from credit rating agencies and look for potential investors. These investors are provided with sufficient information on the mortgages to make informed investment decision. Offers are then made via the special purpose vehicle (SPV) by auction. The offer with the lowest cost will be accepted. In the next step, the originator receives the payment from the SPV while remaining the servicer of the loans. The duration of the notes in SA is 5 years in average during which the investors are paid the interests according to the rate and repayment conditions agreed upon prior to the sale (Mamaregane, Mothibi, Moon, Govan, & Makotoko, 2009).

The securitisation market is essentially shared among 5 banks accounting for 91%[8] of total SA banks assets, and dominated by one type of assets, the mortgage loans. As illustrated in Table 1.1 following, mortgage loans alone account for 40.5% in average of total loans and advances to banks' customers.

Table 1.1: Volume mortgage to total loans and advances by the big five banks in South Africa

(Big 5)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
% Mortgage to loans and advances	36.5	38.6	39.2	40	42	44.6	45.1	42.3	39.4	37.3	-	-

Source: SARB (retrieved by the author from SARB annual reports). Information for 2014 and 2015 are not available

Furthermore, as exhibited in Table 1.2, under previous Basel I and II regulations, the major players held a regulatory capital ranging from 13.6% to 15.4% in 2015 (13.7% to 15.7% in 2014). This level is far above the minimum of 8% required by the Basel Accords, adjusted at 9.5% minimum for 2013 and 10% for 2014/2015 by the SARB. Such a 'well-capitalized' status granted by the SARB means 'safe and sound' and subsequently improve SA banks' market demand as a counterpart in a variety of financial contracts (Mingo, 2000).

[8] Standard Bank 26% - ABSA Bank 20% - First Rand Bank 20% - NedBank 17% - Investec 7% - Other 10% (International Monetary Fund, 2015)

Table 1.2: Regulatory capital big 4 banks compared to minimum regulatory capital requirements

	Standard Bank Ltd	Absa Bank Ltd	Investec Ltd	Nedbank Ltd
Capital level (%)	2013 2014 2015 16.5 15.7 15.3	2013 2014 2015 15.6 13.7 13.6	2013 2014 2015 16.2 15.3 15.4	2013 2014 2015 14.5 14.7 14.1
SARB minimum Requirement (%)	2013 2014 2015 9.5 10 10	2013 2014 2015 9.5 10 10	2013 2014 2015 9.5 10 10	2013 2014 2015 9.5 10 10
Basel III minimum Requirement (%)	8%	8%	8%	8%

Source: Banks' Financial Statements and SARB reports (retrieved by the author)

However, as posited by Alan Greenspan (1998), former Chairman of the USA Federal Reserve, a well-capitalized bank can still mask its true level of insolvency probability when securitisation is inappropriately carried out for RA purpose. As an example, he said a bank with 12% capital might be well-capitalized from the regulatory point of view, but its overall internal risks require an economic capital of 15%. Also, as through securitisation the best assets are transferred and the riskiest are kept on the bank's balance sheet, Greenspan said this 'cherry picking' raises two concerns. The first one is with regards to the assessment by the originators of the appropriate capital required for these 'riskiest' assets and the second one, the level of capital hold for the residual risk from the assets securitised (Greenspan, 1998). His view was later supported by Mingo (2000); Jones (2000); and Dionne and Harchaoui (2008). As for South Africa, in 2014, Daniel Mminele (2014), the

Deputy Governor of the SARB, echoed a concern that "fragmentation and arbitrage" are "having a big impact on the efficiency and financial stability", " increasing the business costs for both the providers and the users of financial services" (Mminele, 2014. 10). Considering these comments and given the contribution of arbitrage through securitisation in the latest financial crisis, this research project addresses part of the concerns by measuring the impact of the utilization of this instrument on SA banks' stability to adjust the regulatory framework accordingly and subsequently, reduce systematic and systemic risks.

Section 1.3. Purpose

Based on the period 2008–2015, this thesis will quantitatively:

i) investigate whether RCA under Basel II and III is the driver of residential mortgage loans securitisation by SA banks. Alternatively, the researcher will test the funding hypothesis as theoretically supported by the literature on securitisation in South Africa if the RCA hypothesis is rejected;

ii) examine the impact of residential mortgage loans securitisation, whether for RCA or funding reason, on SA Banks' stability;

iii) use Agency theory (AT) and Institutional theory (IT) to explain banks' behaviour towards risk.

Section 1.4. Research Aims and Objectives

1.4.1. Aims

1.4.1.1: To evaluate the consequences of mortgage loans securitisation driven by RCA on securitising banks.

1.4.1.2: To identify various banks stability proxies currently used such as CAMELS, Z-score, Expected Default Frequency, Leverage ratio, Non-Performing Loan ratio.

1.4.1.3: To estimate a model of mortgage loans securitisation impact on Total Regulatory Capital ratio, Risk ratio, Loan ratio and Bank Stability measured by CAMELS/Z-score for SA Banks. Additionally, to analyse the relationships between these variables.

1.4.1.4: To use key concepts of AT and IT to explain SA banks' approach to risk in the context of regulatory restrictions.

1.4.1.5: To formulate structured recommendations related to the findings.

1.4.2. Objectives

1.4.2.1: To draw a critical analysis from the related studies of the consequences of RCA (reduced Regulatory Capital Ratio accompanied with increased Loan ratio) via mortgage loans securitisation (Volume securitised) on banks' stability (CAMELS/Z-score).

1.4.2.2: To assess bank stability indicators used in the related empirical literature and in general (CAMELS, Z-score, Expected Default Frequency, Leverage ratio, Non-Performing Loan ratio) to choose and justify the best fit for SA Banks.

1.4.2.3: To determine the direction of the relationship between Securitisation, Total Regulatory Capital ratio, Risk ratio and Loan ratio, CAMELS/Z-score and Control variables (Size, Concentration, House Price, GDP) using Ordinary Least Squares (OLS) and Two Stage Least Squares (TSLS) methods.

1.4.2.4: To interpret the results with AT and IT

1.4.2.5: To build an illustrative framework of the findings with the associated recommendations.

Section 1.5. Research Questions

1.5.1 What are the contributing factors, theoretically, that affect banks' decisions to securitise mortgage loans in South Africa? How do these factors theoretically influence banks' soundness?

1.5.2 Why do SA banks, empirically, securitise residential mortgage loans? Do they securitise mortgage loans for RCA or Funding purposes? In other words, what is the relationship between residential mortgage loans securitised and SA banks' capital?

1.5.3 If securitisation of residential mortgage loans is RCA driven, what is the empirical impact on SA banks' risk? In other words, what is the relationship between residential mortgage loans securitised and SA banks' risk?

1.5.4 In a highly-regulated environment, how can SA banks' behaviour towards risk, from the AT and IT perspectives, be explained?

1.5.5 What are the adequate policies prone to mitigate SA banks' risk taking behaviour, if any?

Section 1.6. Hypotheses

Quantitative methodology is used in this study. The hypotheses are formulated based on the AT and IT perspectives – presented in Chapter 2- as follows:

1.6.1. From Agency Theory

Null hypothesis H0 (1): If SA banks are risk-averse agents (AT), then they do not securitise mortgage loans for RCA purpose. Consequently, mortgage loans securitisation does not negatively affect total risk-based capital ratio of securitising SA banks, nor positively affect their risk and loan ratios.

Alternatively, Hypothesis H1(1): If SA banks are risk-averse agents (AT), then they securitise mortgage loans for funding purposes. Consequently, mortgage loans securitisation positively affect SA banks' liquidity ratios.

Null Hypothesis H0(2): From AT, outcome uncertainty is due to random effects. Because banks are assumed risk-averse, if random effects are favourable, then mortgage loans securitisation do not negatively affect banks' stability.

Alternatively, Hypothesis H1 (2): if random effects are unfavourable, then mortgage loans securitisation negatively affect banks' stability.

1.6.2. From Institutional Theory:

From IT, legitimacy derives from complying with the legal or quasi-legal requirements. The following hypothesis will be tested in accordance with this definition and thus do not need statistical analysis. Funding motive will be interpreted as conforming to legal requirements and RCA as non-conformity.

Hypothesis formulation: If complying with legal requirement is a source of legitimacy, then RCA is negatively related to legitimacy and funding positively related to legitimacy.

Section 1.7. Contribution

1.7.1. The study expands the discussion on the principal-agent problem of Agency Theory, specifically in the rare cases where the principal is the regulator and the agent the bank, acting for the regulator. Additionally, the decision-making process to securitise is better understood through the AT concepts.

1.7.2. The study contributes to the discussion on the concept of legitimacy as in Institutional Theory, in an organizational field, in this case, banking. Legitimacy is so crucial in the banking field where confidence underpins legitimacy. The lack of confidence may well jeopardize a bank's stability or the whole system as it creates runs of deposits that result in liquidity dried up (Gorton & Metrick, 2010).

1.7.3. Additionally, as far as we know, this is the first study of its kind in South Africa, over the period 2008-2015, covering RCA under Basel II and Basel III.

1.7.4. Furthermore, related empirical studies are concentrated on the American continent and Europe. This study thus provides new insights on the link between securitisation, RA and bank stability from well-capitalized banks in an emerging economy context.

1.7.5 The two most common measures of bank stability are used in parallel in this study and the findings compared and discussed. This represents another novelty in comparison to other studies, and for South Africa.

Section 1.8. Limitations and Delimitations

1.8.1 Limitations

1.8.1.1. The researcher was willing to start the analysis from 2005 with all the banks. But, data collected showed that only 4 banks consistently hold outstanding balance of RMBS from 2008.

1.8.1.2. This study is based on information available mostly on the public domain. Details of securitisation transactions were provided by the Johannesburg Stock Exchange, banks, SPVs reports and other financial statements. Data such as the different ratios, were retrieved by the researcher from the annual reports published on the banks' websites. This means these data where not independently verified.

1.8.2. Delimitations

1.8.2.1. The purpose of the study is limited to looking at RCA and funding as determinants of securitisation. It does not include other determinants such as credit risk transfer, reputation, performance and specialisation.

1.8.2.2. This study is focused on the securitisation of one type of asset, the residential mortgage loans. It does not cover other assets such credit cards receivables, vehicles, commercial mortgages and so on. Mortgage loans are the assets securitised by all the big five banks in South Africa. Other Assets Backed Commercial Papers, Commercial Mortgage-Backed securitisations are excluded from the study because they are issued by one or two banks only and sporadically.

1.8.2.3. The hypotheses are articulated and the results further interpreted within the AT and the IT frameworks.

1.8.2.4. The population under investigation is made of banks exclusively. This excludes other special purpose conduits and shadow banking involved in the securitisations of mortgages in South Africa.

1.8.2.5. The banks selected for the study are those that have consistently been engaged in securitisations transactions in South Africa at least before Basel II was implemented in 2008.

1.8.2.6. These banks are also those with total assets greater than 300 billion Rand because studies showed that the size of a bank influences its decision to securitise.

Section 1.9 Data and methodology

This section summarises the data and the methods of analysis used in this study. Chapter 3 describes these points in more detail.

1.9.1 Data

The sample consists of the four big banks in South Africa. The data are annual time series covering the period 2008-2015. From the literature, the researcher has identified the following variables: securitisation, namely the outstanding volume of residential mortgage-backed securities issued to total assets; RCA and risk retention hypothesis would be materialised by the reduction of capital as a result of the increase in risky assets in proportion to total assets (Uzun & Webb, 2007). So, the dependent variables are: Total Bank capital to Risk-Weighted Assets, Risk-Weighted Asset to Total Assets and Total Loans to Total Assets; bank stability is measured by two different proxies: Capital – Assets Quality – Management Efficiency - Earnings – Liquidity- Sensitivity to Market Risk (CAMELS) and Z-score; funding hypothesis is captured in the liquidity ratios.

1.9.2 Methodology

This study uses the OLS method and the TSLS method to analyse the data. The detailed steps are exhibited in Figure 1 below. The results are then interpreted and discussed in light of the two theoretical perspectives – AT and IT - presented extensively in Chapter 2.

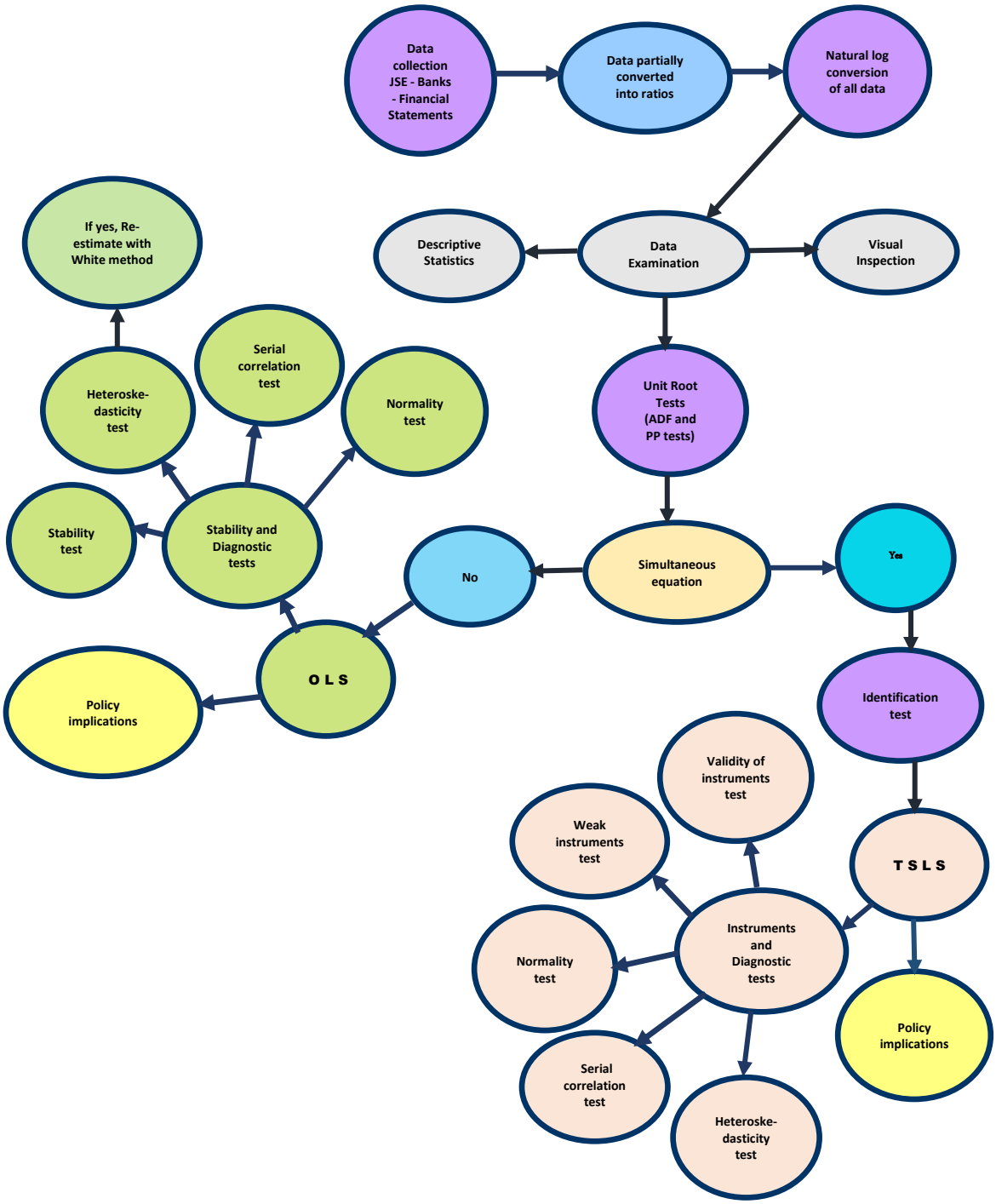


Figure 1: Diagrammatic Overview of the Statistical Methodology implemented in this Study

Section 1.10. Thesis Chapters Outlines

Chapter 1: Introduction to the Study

This chapter presents the background of the study, the context and the problem statement. In particular, the role of securitisation and RCA in the 2007-2008 Global Financial Crisis is explained. The chapter ends with the purpose of the study, the research aims and objectives, the research questions, the hypotheses, the contributions of the study, the summary of data and methodology, the limitation and delimitation, and the thesis chapters' outline.

Chapter 2: Theoretical Framework and Literature Review

This chapter opens with the introduction of the Basel Accords: Basel I (1988), II (2004) and III (2010) and discusses its contribution in the prevalence of RCA via securitisation. The following sections present the theoretical lenses selected for the study. The RCA theory of securitisation is first considered from the principal-agent problem framework view (Agency Theory). Specifically, the concepts of asymmetry of information constituted of moral hazard and adverse selection, and outcome uncertainty are used to explain the origin, prevalence and consequences of the phenomenon of RCA via securitisation. The key conversant with regard to this first aspect of the theoretical framework is Eisenhardt (1989). Secondly, the concept of legitimacy from Institution Theory further brings some

insight on banks' behaviour towards risk. The main conversant is Scott (2001). This chapter ends with the survey of the related empirical studies.

Chapter 3: Research Design, Data and Statistical Techniques

This chapter discusses the methodology selected for the study, presents the data and the data sources.

Chapter 4: Empirical Results

This chapter presents, analyses and discusses the research findings.

Chapter 5: Conclusion

This chapter summarises the research results, provides their theoretical interpretation, suggests some recommendations and indicates the direction for future research.

Chapter 2

Literature review

"What we see and judge to be important and accept as adequate depends not only on the evidence but also on the "conceptual lenses" through which we look at the evidence" Graham. T Alisson

This chapter encapsulates three parts. First, it introduces the Basel Accords, Basel I (1988), II (2004) and III (2010), specifically its provisions on banks' capital adequacy for credit risk on mortgages, and discusses how each version fuels or has fuelled the prevalence of regulatory capital arbitrage (RCA) via securitisation. The second section presents the theoretical lenses selected for the study i.e. Agency Theory (AT) and Institutional Theory (IT). In the third section, thesis-related empirical studies are surveyed.

Section 2.1. The Basel Accords

In 1974, the Herstatt Bank in Germany and the Franklin National Bank of New York collapsed following the meltdown of the foreign exchange trade market. These failures impacted negatively on other banks with whom they had business relationships around the world. Subsequent to these events, Central Bank governors of the G-10[9], gathered in Basel (a city of Switzerland), and formed a committee that is known as the Basel Committee on Banking Supervision (BCBS). The ultimate purpose of the BCBS was and still is to improve international financial stability through banking regulations and supervision

[9] G-10 is composed of the 11 top most industrialised countries. Today, the members of the BCBS are 28

(BIS, 2015b). Basel I was the first of the series, later followed by Basel II and now Basel III.

2.1.1 Basel I (1988)

Basel I, also called The Basel Capital Accord, is the first of the series. The idea underpinning this Accord was to harmonise national capital requirements[10] while strengthening international banking system against systemic risk (Bank for International Settlements [BIS], 2015b). It focused on the credit risk faced by banks by establishing the minimum regulatory capital requirements (MRCR) for banks at 8%[11] of their Risk-Weighted Assets (RWA)(BIS, 1998). This regulatory capital is the minimum level of capital required, which aims to equip banks with a lifebelt that will absorb their unexpected losses should they occur during downturns. For banks to be able to determine the RWA, the Accord categorised banks' assets into roughly four risks buckets. This method was labelled the standardised approach (SDA). Assets such as cash were assigned 0% risk weight, claims on other banks, 20%, and claims on the private sector, 100%. Loans totally secured by a mortgage on residential property attracted 50% risk weight. This means, if for example, a bank had a portfolio of residential mortgage loans of R 100 million, the total MRCR would be calculated as follows: 100 X 50% X 8% = R 4 million.

[10] Meaning levelling the international playing field

[11] Including a core capital of at least 4%.

2.1.1.1 How Basel I fuelled RCA

Where objections were raised to this first Accord was its lack of sensitivity in terms of risks, specifically the way the Risk-Weighted Assets (RWA - denominator of the MRCR) were calculated. The SDA fixed risk-weighted regardless of the specific risk of each asset (Agostino & Mazzuca, 2011; BIS, 2014). Its one-size-fit-all format made it easy to cherry pick within a category and perform 'cosmetic adjustments' to reach the targeted ratio while concealing the exact risk the regulation intended to address (Jones, 2000). Grouping the assets into only 4 categories opened the doors of the phenomenon called Regulatory Capital Arbitrage[12] (RCA). In practice, RCA manifest by the fact that when two assets with different risk profiles were subjected to identical capital requirements, the bank would raise its overall level of risk without facing a parallel increase in its regulatory capital requirements by selling the assets with lower risk and retaining the riskier ones (BIS, 2011). In other words, securitisation became a major instrument for RCA. The reason is that regulatory capital is perceived as too high (Calem & LaCour-Little, 2004; Dionne & Harchaoui, 2008). (Jackson, 1999) posited that banks that engage in RCA try to do so to minimise their cost of funding. This author identified cherry-picking, securitisation with partial recourse, remote origination and indirect credit enhancements as the predominant forms of RCA.

[12] (Awrey, 2012) defined regulatory arbitrages as the transactions or strategies designed to exploit gaps or differences within or between regulatory regimes, ultimately with the intention of either reducing costs or capturing profits.

The gap created by the utilization of different measures of risks by both the regulators and banks is at the root of RCA due to information asymmetry between banks and regulators. The information asymmetry is reflected in the difference between banks' economic capital and the regulatory capital requirements as defined in the first Basel Accords regulation (Jones, 2000). Regulatory capital is different from the economic capital known as the intrinsic amount of capital kept by banks to cover their risk exposures. Through moral hazard[13] and adverse selection[14] (Mishkin, 2001), asymmetry information creates regulatory arbitrage opportunities. The fact is that the regulators barely know the banks' real internal risk exposures. Thus, the MRCR was inappropriately calibrated, specifically the RWA. That is why some banks intentionally misused securitisations to reduce their capital requirements or take more risk, for example, in the presence of a deposit insurance scheme[15] (moral hazard) (Acharya & Richardson, 2009).

2.1.2 Basel II (2004)

Basel II, also called the Revised Capital Framework, is the second Accord. It aimed to rectify the weaknesses of the first Accord, mainly by making capital requirements more risk sensitive to reduce RCA and encouraging more robust risk management practices

[13] Moral hazard is defined as "actions of economic agents to maximize their own utility to the detriment of others in situations where they do not bear the full cost or consequences of their actions"(Alexander, 2006)

[14] Adverse selection: doubts about the quality of the assets (Tirole, 2011). Jean Tirole is also the 2014 Nobel prize winner in Economics.

[15] Moral hazard: because of the deposit insurance scheme, banks managers may now behave differently from the way they would have if they were fully exposed to the risk (Naciri, 2009).

(BIS, 2004). This new framework was issued with three pillars: the MRCR, the supervisory review (SR) of banks' capital adequacy and market discipline (MD). Regarding the MRCR, the BCBS maintained the minimum level at 8% of RWA and improved the SDA to credit risk initiated in Basel I. However, it added a new approach termed the Internal Ratings Based approach (IRB).

Under the SDA for credit risk, risk weight buckets increased from four in Basel I to six (0%, 20%, 50%, 100%, 150% and 100%). Risk weights were now attributed to assets according to the rating allocated by external credit rating agencies recognised by national supervisors (NS). Out of the standard buckets, risk weight for loans secured by mortgages on residential properties was reduced from 50% to 35%[16], which means the MRCR for R 100 mortgage loans, for example, would now be 100 X 35% X 8% = R 2.8 million.

Under the IRB for credit risk, the main idea was giving banks the opportunity to determine their capital requirements internally to close the breach between regulatory capital and economic capital. However, the methods of risk assessment had to be approved by the national supervisor (NS). The Basel Committee provided some guidance though. The methods had to include the probability of default (PD), the loss given default (LGD), the exposure at default (EAD) and the maturity (M). The Committee also subdivided the IRB into Foundation (FA) and Advanced Approaches (ADA). With FA, banks could estimate

[16] However, supervisors in different countries had latitude to increase the risk weight depending on the risk involved.

PD and the national supervisor appraise LGD, EAD and M. With ADA, banks estimated all the components (BIS, 2004).

Regarding residential mortgage loans, the second Accord classified them as retail exposures. Risk on retail exposures, in turn, were to be assessed entirely by banks themselves, meaning PD, LGD (but not below 10%) and EAD could be determined internally. FA and/or ADA did not matter here. So, the formula for the calculation of capital requirements for residential mortgage loans looked like this:

Capital requirements (K) = LGD × N [(1 – R)^-0.5 × G(PD) + (R / (1 – R))^0.5 (0.999)] – PD x LGD, where correlation (R) = 0.15 and RWA = K x 12.5 x EAD.

The new Accord was also enriched with a credit risk securitisation framework. In a nutshell, this framework indicated that securitisation exposures included Asset Backed Securities (ABS), Mortgage Backed Securities (MBS), credit enhancement, liquidity facilities, credit derivatives, and interest or currency swaps. Banks that opted for the SD approach were subjected to RWA for long-term rating categories as follows:

External Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ and below or unrated
Risk weight	20%	50%	100%	350%	Deduction

This means that, for example, R 100 Ms residential mortgage loans securitised (RMBS) and rated between AAA to AA- would have a RWA of 100 x 20% = R 20 Million.

Banks using the IRB approach (approved beforehand by the NS) for the securitised exposures, were subjected to the following categories as in the table below:

External rating (Illustrative)	Risk weights for senior positions and eligible senior IAA exposures (*)	Base risk weights (**)	Risk weights for tranches backed by non-granular pools (***)
AAA	7%	12%	20%
AA	8%	15%	25%
A+	10%	18%	35%
A	12%	20%	35%
A-	20%	35%	35%
BBB+	35%	50%	50%
BBB	60%	75%	75%
BBB-	100%	100%	100%
BB+	250%	250%	250%
BB	425%	425%	425%
BB-	650%	650%	650%
Below BB- and unrated	Deduction	Deduction	Deduction

N: number of underlying exposures – (*) For N>=6; (**) For all others; (***) For N<6

Source: (BIS, 2004)

From this table, an RMBS of for example R 100 Ms, classified 'others' and rated AAA, would have a RWA of 100 x 12% = 12 Ms.

2.1.2.1. RCA opportunities remained in Basel II

Basel II was published in 2004 but was to be implemented only by end 2006. This means, in many countries quantitative impact studies were still being conducted (specifically for the IRB approach) when the GFC started. For example, both the USA and South Africa implemented Basel II in 2008. This also means that most of the banking institutions were still under Basel I (Caruana & Narain, 2008), hence the extent of RCA via securitisation. Introducing the IRB in Basel II was a way of mitigating RCA incentives. However, maintaining the SDA kept perverse incentives ongoing. Also, with the IRB, even though securitised assets were no more transferred, it sufficed to get an advantageous rating from credit rating agencies (CRAs) to see the capital requirements for securitised assets substantially reduced. As López-Andión, Iglesias-Casal, López-Penabad & Maside-Sanfiz, (2015) explained, capital freed up here was able to compensate the higher level required from riskier tranches. It therefore, preserved dynamic RCA. Also, the use of IRBs approved by regulators that do not fully understand banks' risk exposures was an additional source. Furthermore, some banks such as Northern Rock and Citi anticipated the exploitation of the loopholes in Basel II before it was even implemented[17].

In general, loopholes were the first comparative advantage between originating and holding, and originating and securitising mortgage loans. Assuming a bank was faced with

[17] See details in Chapter 1: Introduction, Background Section.

assets rated equally, in the first case the mortgage loans would have a risk weight (RW) of 35% when the same mortgage in the case of securitisation would be subjected to only 12% of RW. Other authors (Moosa, 2010; da Veiga, Chan & Mcaleer, 2012) argued that the Value-at-Risk (VaR) suggested in the IRB approach for market risk provided banks with the opportunity to use their own models. Unfortunately, concerned with saving some capital (RCA) and safeguarding their return on equity, banks' models were far too optimistic regarding the valuation of risk exposures. Furthermore, a study on the relationship between Basel II/III AIRB and portfolio risk proxied by loan performance, showed that the risk-weights determine with A-IRB are more risk sensitive than the fixed one with Basel I, because it is based on the portfolio risk (Barakova & Palvia, 2014). Fullenkamp & Rochon, (2014) pointed out the fact that the IRB made the regulation more complex and thus prompted the game. In the same vein, in a study by Mariathasan & Merrouche (2014) on 'the manipulation of Basel Risk-Weights' evidenced that soon after certain banks received the approval for using the IRB, they set up modelling strategies intended to reduce their risk weights. In this same study, it is reproached to Basel II a lack of correlations[18], its reliance on short time series as well as the ignorance of endogeneity resulting in a disproportionate level of indebtedness and maturity transformation. From a different perspective, a study on the quality of bank rating by Hau, Langfield & Marques-ibanez (2012) demonstrated the fact that during the period preceding the GFC, credit

[18] The authors referred to the Probability of Default (PD) parameter that is determined internally by banks but used in the calculation of capital charge defined instead by the Basel Committee.

rating agencies attributed a favourable rating to large banks on a complete arbitrary basis as long as the latter provided them with substantial volume of securitisation business.

In summary, just like in Basel I but to a lesser extent, holding assets in the balance sheets required more capital than securitising. Secondly, a comparative advantage also appeared between the SD approach and the IRB approach. The same mortgage was assigned a 35% RW under the SDA and only 12% to 35% under the IRB. The RWA could continue being subjected to gaming through the IRB approach on the one hand and with the help of credit rating agencies on the other hand. The BCBS recognised that RWAs were inadequately calibrated because some securitisation exposures were over-rated and others under-rated. The Committee also denounced the mechanic utilisation of credit rating agencies and the limited risk insensitivity of the framework (BIS, 2014). In conclusion, Basel II still failed to address the problem of RCA.

2.1.3 Basel III (2010)

Basel III, the latest Accord, is the response of the BCBS to the 2008 GFC. The BSBC's assessment of the risk factors that amplified the crisis is the fact that banks were highly leveraged with inadequate liquidity buffers, they engaged in poor governance and risk management, and some set up inappropriate incentives structures (BIS, 2015b). The purpose of Basel III was to adjust banks' capital requirements at a level that would absorb

unexpected shocks. The phase-in implementation started in January 2013 and full implementation is expected in January 2019.

In summary, Basel III renewed the MRCR but more specifically defined the regulatory capital in insisting on a higher quality of Tier 1 capital and repealing Tier 3. It also introduced a conservation buffer ratio, a countercyclical buffer ratio, a leverage ratio, a liquidity coverage ratio and net stable funding ratio as follows:

Basel III Capital

- Total Capital Ratio = Regulatory Capital / Risk-weighted Assets = 8%
- Conservation buffer = 2.5% of Risk-weighted assets (from 2016)
- Countercyclical capital buffer = 0 to 2.5% of Risk-weighted assets
- Leverage Ratio (LR) = Capital measure[19] / Exposure measure[20] >=3%
- Liquidity Coverage Ratio (LCR) = Unencumbered stock of high quality liquid assets[21] / Total net cash outflows[22] over 30 days of significant stress period >= 100%

[19] Capital measure is the Tier 1 capital of the risk-based capital framework

[20] A bank's total exposure measure is the sum of the following exposures: (a) on-balance sheet exposures; (b) derivative exposures; (c) securities financing transaction (SFT) exposures; and (d) off-balance sheet (OBS) items.

[21] At least 60% level 1 assets (cash, central bank reserve, sovereign debt qualifying for a 0% risk weight under the Basel II SDA for credit risk) and no more than 40% level 2 assets (sovereign debt qualifying for a 20% risk weight under the Basel II SDA for credit risk and corporate bonds and covered bonds of at least AA- rating

[22] Net cash outflows is Total expected cash outflows minus Total expected cash inflows during the 30 days of stress period.

- Net Stable Funding Ratio (NSFR) = Available amount of stable funding[23] / Required amount of stable funding >= 100%

Under the SD approach, revised and published in July 2016 (BIS, 2016b), general RWAs are 0%, 20%, 50%, 100% and 150%. For residential mortgage loans, the BCBS reduced the dependency on rating agencies and distributed the risk weights as follows:

1- Cases where repayment are not materially dependent on cash flows generated by the property

	LTV≤40%	40%<LTV≤60%	60%<LTV≤80%	80%<LTV≤90%	90%<LTV≤100%	LTV>100%
Risk Weights	25%	30%	35%	45%	55%	75% for individuals 85% for SMEs

LTV (loan-to-value ratio) = Amount loan[24] / Value of the property[25]

Source: (BIS, 2016b)

2- Cases where repayment are materially dependent on cash flows generated by the property

	LTV≤60%	60%<LTV≤80%	LTV>90%
Risk Weights	70%	90%	120%

Source: (BIS, 2016b)

[23] Portion of capital and liabilities expected to be reliable over one year

[24] Outstanding loan amount + undrawn committed amount of the mortgage loan

[25] Appraised independently

3- Cases that do not meet the requirements of the framework have a 150% risk weight.

With regards to IRB approach, a consultative document was issued in March 2016 on "Reducing variations in the credit risk-weighted assets – constraints on the use of internal model approaches". The revised version has not yet been published.

The BCBS also revised the Basel III securitisation framework but the new version is scheduled to come into effect only in 2018. For this reason, it is not in the scope of this study and will not be presented further. However, it is worth noticing the Basel III design distinguishes the internal ratings-based approach, the external ratings-based approach and the standardised approach. The choice now depends on the information available/analysis/estimations of banks and no more on the bank's role in the securitisation process or the credit risk approach used for the underlying exposures (BIS, 2016a).

2.1.3.1. RCA persists in Basel III, at least for now

Basel III (2010), published following the GFC, has unfortunately not addressed the Basel II risk-weighted assets calculations problems (Petersen & Mukuddem-Petersen, 2014). RCA may continue to occur. Among the reasons pointed out, the fact that banks still have

the latitude to use a combination of approaches in the calculation of their RWA maintains the state of flux (Le Leslé & Avramova, 2012). Berg, Gehra, & Kunisch (2011) pointed out the discrepancies between the RWAs in banks' credit risk (loans book) and market risk (trading book, ex: bonds). They demonstrated that, given a similar risk profile, under Basel I and Basel II, the asset correlation parameter (the degree of systematic risk given by the regulator), lead to 30% to 50% more capital requirements for corporate loans exposures than in the trading business. They believe this RCA opportunity will be repeated under Basel III in view of the fact that asset correlation is provided by the regulators for loans exposures and determined by banks for the trading business (Berg, Gehra, & Kunisch, 2011).

Blundell-Wignall & Atkinson (2010) described a case where bank A lends some money to a company through a bond acquisition. To this type of loan, the Accord allocates 100% risk weight. Bank A can then buy a Credit Default Swap from bank B on the bond. Because of the move of the promise from bank A to bank B, there is a shift of risk weight of the loans from 100% to 20%. In definitive, bank A will now determine its regulatory capital based on 20% risk weight instead of 100%.

In conclusion, as noticed by Haldane (2012), the granularity of the Basel risk weights opens doors for 'near-limitless' arbitrage.

Section 2.2. Theoretical perspective

Financial regulation and supervision are meant for i) microeconomic stability, ii) consumers or investors' protection and proper behaviour, and iii) efficiency and competition (Giorgio & Noia, 2001). Regulation is justified by banks' balance sheet opaqueness. However, regulations have become more and more complex. Subsequently, opaqueness and complexity cause asymmetry of information. This is an appropriate canal for regulatory arbitrage. Regulatory arbitrage is for the banking sector what inefficiencies are for the financial market (Fleischer, 2010). An efficient market is a market in which prices always fully reflect all available information (Fama, 1969). Fama (1969) also reported from Niederhoffer & Osborne (1966) and Scholes' (1969) works that two groups of actors actually have monopolistic access to information: the specialists on major security exchanges and the corporation insiders. This lack of information homogeneity among participants of the financial market is commonly termed asymmetry of information or principal-agent problem[26]. Similarly, in the banking sector, information asymmetry is for example reflected in the difference between the economic capital and the regulatory capital defined in the Basel Accords regulation.

[26] The principal agent problem is a situation where for example a person (the agent) acts in the interest of another (the principal). The problem is, they both hold different information and different incentives. It is thus difficult for the principal to have control over the agent's action. This is where moral hazard (hidden action) and adverse selection (hidden information) occur (Alexander, 2006).

Looking at banks' behaviour under regulatory pressure (capital requirements) and the impact on their stability, AT and IT perspectives provide complementary interesting insights to assist the researcher in examining the relationship between the regulator and banks at the micro and macro levels. Because these theories focus on the pivotal concepts of *asymmetry information* (with sub-concepts of moral hazard[27] and adverse selection[28]), *principal-agent problem* and *outcome uncertainty* from the former and *legitimacy* from the latter, it is believed that they override the usefulness of other theories as they are perfectly aligned with the subject of this research.

2.2.1 Presenting Agency Theory (AT)

AT is credited to several authors, but the most cited are Jensen and Meckling (1976), and Fama and Jensen (1983). AT derives from of the New Institutional Economics. It is viewed as a theory of human behaviour and performance outcome and further analyses organizations from the contractual and efficiency standpoints (Nilakant & Rao, 1994). It deals with incentives and control, which are the essence of organizational analysis (Moe, 1984). AT is thus viewed as valid even though it is criticised for ignoring the complexity of organizations, lacking rigor and being tautological (Eisenhardt, 1989). That is why Eisenhardt (1989) and Hirsch, Michaels & Friedman (1987) suggested complementing the use of AT with other theoretical perspectives.

[27] hidden information (Alexander, 2006) or agent falsified ability (Eisenhardt, 1989)

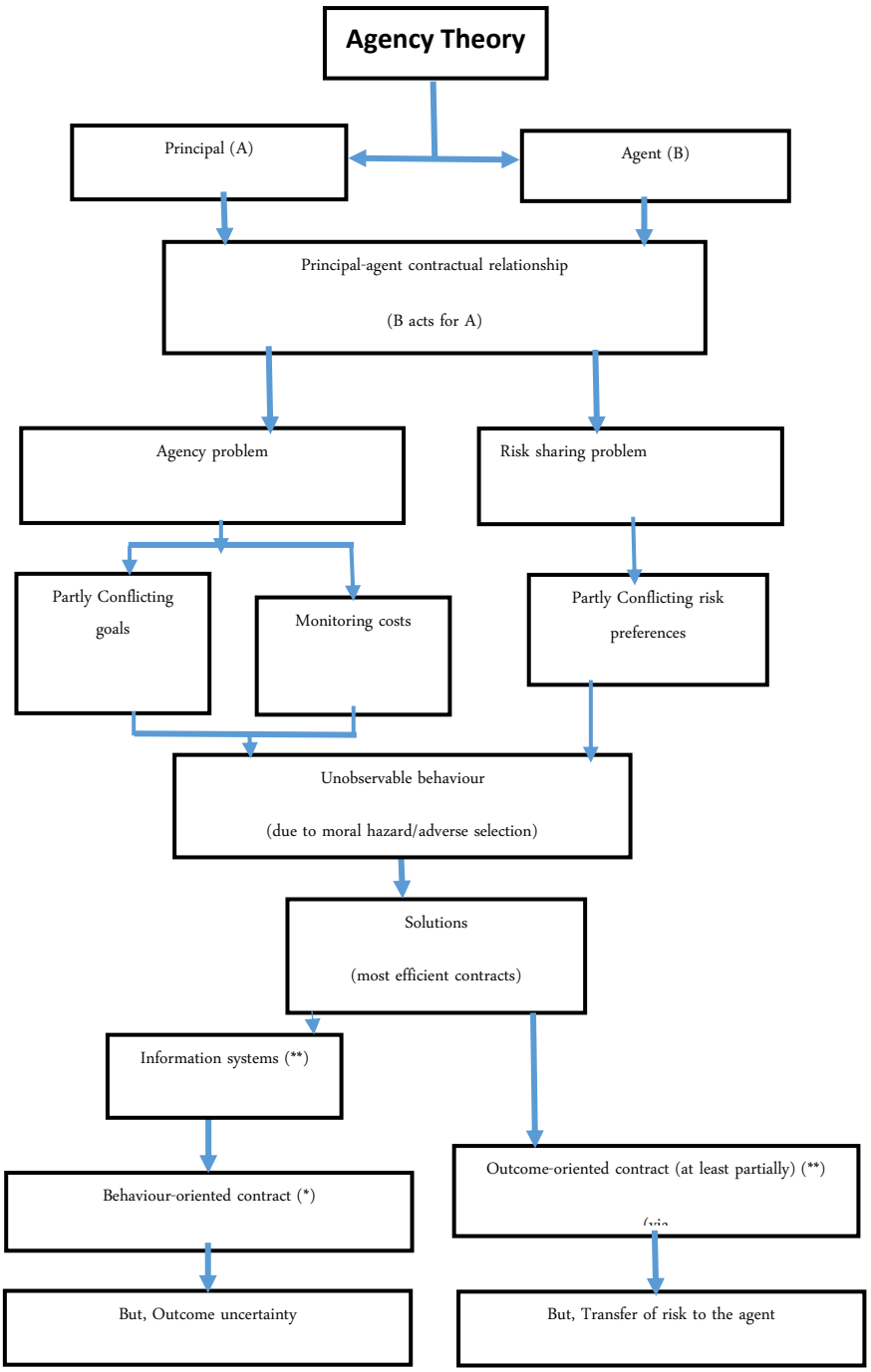
[28] hidden action (Alexander, 2006) or agent lack of effort (Eisenhardt, 1989)

Examples of studies that combined AT and IT perspectives include: compensation (Eisenhardt, 1988); monitoring and tradition (Conlon & Parks, 1990); performance evaluation (Young, Stedham, & Beekun, 2000); and franchise relationship (Doherty, Chen, & Alexander, 2014). Examples of studies using AT in South Africa comprise corporate strategy (Wright & Ferris, 1997) and corruption (Rispel, Jager, & Fonn, 2015). Examples of studies using IT in South Africa encompass state capacity in housing system (Jenkins & Smith, 2001), and entry strategies of foreign investors (Meyer, Estrin, Bhaumik, & Peng, 2009).

Eisenhardt (1989) explained that AT examines the problems arising from the contractual relationships between the agent and the principal (the so-called principal-agent problem) and proposes an optimal contract. This would take the form of behaviour-oriented contract or outcome-oriented contract to minimise agency costs from monitoring and incentives schemes. In the contractual relationship between the principal and the agent, the principal delegates the decision making to the agent. The latter therefore acts for the principal. However, as assumptions, [1] the relationship is tainted by partial conflicting goals, [2] due to asymmetry of information (categorised into adverse selection and moral hazard) between the principal and the agent. [3] Efficiency is accounted as the effectiveness criterion for information organisation and risk bearing costs (Eisenhardt, 1989). In effect, the agent is suspected of holding private information and pursuing self-interests that are

contrary to the principal's without the possibility for the latter to verify the agent's behaviour. Thus, the principal is obliged to provide some incentives to the agent to make sure the latter aligns its goals to the principal's or is obliged to introduce a control system that allows him or her to collect the information needed. [4] That is why information is also assumed to be a purchasable commodity. The risk bearing costs emanate from the risk sharing problem. AT assumes that the principal and agent's risk preferences are antagonist and discordant actions are consequently taken because [5] the principal is risk neutral while the agent is risk averse. For example, the outcome-based contract aligns the preferences of both participants but transfers the risk from the principal to the agent. However, the outcome is said to remain uncertain no matter the agent's behaviour because of exogenous random factors such as economic climate, competition and so forth.

There are two trends in the literature on AT: the positivist and the principal-agent. The former relates to ex post contracts, the separation between ownership and control, incentives schemes, external labour and capital markets; the latter is more centred on ex ante contracts and information systems (Nilakant & Rao, 1994). Figure 1. below depicts a summary of Agency Theory.



(*) if agent's behaviour is known to the principal – (**) if agent's action is not known to the principal

Source: Diagram created by the author inspired by (Eisenhardt, 1988) and (Eisenhardt, 1989)

Figure 2.1: Diagrammatic Summary of Agency Theory

2.2.1.1 Establishing a principal-agent relationship between regulator and banks

According to Eisenhardt (1989), AT is suitable for *regulatory policy issues, goal conflict* with possible *agent opportunities, outcome uncertainty* together with *risk.* The literature commonly refers to an agency relation between shareholders (principal) and managerial teams (agent) (Berger & Patti, 2006), taxpayers (Mishkin, 2001) or other stakeholders in the economy (principals)(Alexander, 2006) and regulator (agent), and finally depositors (principal) and banks (agent)(Murphy, 2015). However, an agency relationship between a regulator and the regulated firm where the regulator is the principal and the regulated firm is the agent acting for the regulator is scarce in the literature. This level of agency was first pictured by (Loeb & Magat, 1979), followed by (Besanko & Sappington, 1986), then by (Caillaud, Guesnerie, Rey, & Tirole, 1988), and Baron (1988).

Baron designed a model where he assumed that:

(i)the regulator is facing incomplete information from the regulatee and limited observability of its behaviour;

(ii) Regulator and regulatee have consequently adopted strategic behaviours;

(iii) the regulator's policies are endogenous reactions to the preceding problems;

(iv) The regulatee, described as profit-maximizer, optimally pursues its goal within the regulatory framework. This goal, from the normative viewpoint, conflicts with the regulators' objectives of maximizing total surplus of consumers;

(v)Lastly, the regulator controls aspects such as the price or has authority over certain aspects of the regulatee's operations. In the model, the regulator expects the regulatee to conform to its requirements, such as satisfying all demands at the specified price, in order for the regulatory mechanism to remain efficient. The regulator first formulates a regulation in the take-it-or-leave-it form. Because of asymmetry of information such as hidden action and hidden information from the part of the the regulatee, the regulation has some flaws. The regulator then offers a menu of policies, designed efficiently, from which each regulatee can choose according to the nature of its activities.

From the delegation view, Baron posited that because the regulatee is given the choice of policy, the regulator has thus delegated the decision making to the regulatee, who is now its agent and can for instance choose the price. In terms of incentives, the regulatee will then naturally pick the option that increases its profit. That is, for instance in the price example, choosing the too high price from the menu or increase its cost to benefit from a higher price).

From this agency relationship where the regulatee acts on behalf of the regulator, all the implications pertaining to the AT ensue, for example control, performance measurement, and incentives schemes among others, as described above.

2.2.1.2 Applying Agency Theory to the study

In applying AT to this study, a parallel, anchored by Baron's case, can be made. The Basel Accords requirements are enforced in South Africa by the South African Reserve Bank (SARB) and are being implemented by South African (SA) banks. The relationship between these banks and their regulator can be regarded as a contractual relationship, specifically an *implicit administered contract*, because of its ongoing relationship and agency features (Goldberg, 1976). It is in effect, a long-term relationship because the first Basel Accords was issued in 1988, implemented in South Africa since 2001, and has only undergone changes over time with no indication of a future expiry date. In terms of agency, SARB's goal is to safeguard the stability and the soundness of the SA banking system. In a certain sense, SARB relies upon SA banks to see this aim fulfilled by complying with the Basel Accords' provisions. Here, I see an analogy with Baron's case and explain the possible choice of SA banks for regulatory capital arbitrage as the result of partial delegation by the SARB, (the regulator whom for Baron is the "total surplus of consumer's" maximizer), of risk-weighted assets determination to banks. Basel I, for example, grouped assets into only four categories, ignoring the risk sensitivity pertaining to different kinds of assets. It offers only one performance metric (a single ratio) for capital requirements instead of a holistic approach (Acharya & Schnabl, 2009). This facilitated moral hazard and adverse selection from banks' part. As 'profit-maximizers', banks thus were given the opportunity to exploit the gap between the regulatory capital required and their economic capital due to the lack of sufficient information available to regulators

(*asymmetry of information)* regarding the level of risk of their assets, as well as the risks and uses of such financial innovations as securitisation. Banks exploited the opaqueness of the securitisation transactions to carry out *self-interested goals* such as regulatory capital arbitrage[29]. The agent's goals thus *conflict* with the principal's goals. For many, it has resulted in unintended consequences (outcome uncertainty), such as a negative impact on banks' stability. Examples are banks in Spain before 2007(López-Andión, Iglesias-Casal, López-Penabad, & Maside-Sanfiz, 2015); banks in EU and Switzerland before 2007 (Michalak & Uhde, 2011). Banks' goals in these cases conflicted with the regulators' goal of safety and soundness of the whole banking system via an upholding of an adequate level of capital for unexpected losses. Basel II, meant to improve Basel I in this regard, reinforces my view of *decision-making delegation*. It offered a 'menu of policies' (Baron, 1989) from where banks could choose between the standardised approach and the internal rating based approach to calculate their risk-weighted assets. The consequences are now known: the 2008 global financial crisis. Despite some adjustments, the same option remains in the latest formulation of the Basel Accords III with uncertain outcome. More locally, the delegation is materialised by the fact that South African banks are given the opportunity to use the risk weight splitting method. With this method, when a single residential property loan is totally covered by mortgage, SA banks split the loan into several proportions and attribute different risk weight to each portion, depending on their own assessment of risk for each these portions. That can be below or

[29] See process of RCA described in the context of the study.

greater than the 35% risk weight for the whole loan as prescribed by the Basel Accords (BIS, 2015a).

To further the parallel with the simple model of AT, with regards to the optimality of the contractual relationship between SA banks and their regulators, the researcher assumes that Basel I was an implicit *outcome-based contract* where the regulator expected banks to comply with its provisions, such as to preserve their stability. Because of the flaws of the initial contracts (Basel I and II) as explained earlier, the regulator added a *monitoring system* (for example, in Basel III) which consist of a set of required information that must be reported monthly by SA banks that are active in the securitisation transactions. In 2012 for example, under the Banks Act, 1990 (Act No 94 of 1990), the Minister of Finance issued regulations where the SARB requires a monthly reporting from banks that indicates the amount of assets securitised, the amount of capital and reserve funds in respect of securitisation exposures, the role the reporting bank played in the securitisation scheme and so forth (Gazette, 2012). Because of the inclusion of the monitoring system and the fact that the outcome (bank stability) is measurable, the researcher now believes that the contractual relationship between regulators and banks has evolved into a combination of *behaviour-based* and *outcome-based* contracts as it has elements of both types of contracts. When one looks at the propositions formulated by Eisenhardt (1989), both the outcome-based contract and the behaviour-based contract would be efficient in aligning the agent's interest to the principal's, if the principal has enough information on the agent's behaviour. She noted that information systems and outcome uncertainty are

positively related to the behaviour-based contract. She further mentioned that conflicting goals between the principal and the agent and outcome measurability are positively related to the outcome-based contract.

However, from the AT, banks are supposed to receive a compensation or a reward of some sort from the regulator should the expected outcome realized. In this regard, the 2012 Regulations under the 1990 Banks Act only indicates that if a bank fails or is unable to comply, that bank must provide the reasons for the failure otherwise an action will be taken or that bank will be given the opportunity to comply within a certain period (Gazette, 2012). The vacuum with regards to *compensation* or *reward* will serve as a starting point to tentatively suggest some policy recommendations that can improve the efficiency of the contract in Chapter 5.

Considering the AT concepts and Baron's model, the leading logic of this study is as follows: securitisations, characterised by their opaqueness (thus with embedded *hidden information* that causes *asymmetry of information*) are used by banks (the regulator's agent) to engage in regulatory capital arbitrage (a *hidden action* that also questions its *risk-averse* position), versus regulatory compliance (*conflicting goals*) or as a funding source (if agent is *risk-averse*). However, any of these actions can affect banks' stability negatively or positively (*outcome uncertainty*) depending on how much risk from the regulator was shifted to banks (*risk transfer*), and other *random exogenous effects* such as economic conditions.

2.2.2 Presenting Institutional Theory

Institutional Theory attempts to answer the question of how and why organisations behave as they do, with inherent consequences (Greenwood, Oliver, Suddaby & Sahlin, 2008). For this analysis, I lean on organizational institutionalism, which is the institutional perspective of organizational behaviour. The common ground between Agency Theory (AT) and Organisational Theory (OT) is their concern to reduce uncertainty. However, moving from the contractual perspective, OT looks at the structural and cultural aspects such as shared values, traditions, beliefs and commitments through organization design, trust and collaboration (Nilakant & Rao, 1994).

Since 1977, that marked the beginning of the neo-institutionalism (Greenwood et al., 2008) with the works of Meyer and Rowan (1977), Zucker (1977, 1983), Meyer and Scott (1983) and DiMaggio & Powell (1983), various concepts such as rationalised myths, de-coupling, cultural persistence, stability, deinstitutionalization, environment, organisation, isomorphism, change, relational networks, organizational field, institutional context, and legitimacy (Currie & Swanson, 2009) underpin this theory. The last concept, which is *legitimacy*, anchors the analysis of the contextual aspect of this research.

Scott (2001) viewed institutions as "social structures that have attained a high degree of resilience". These institutions are "composed of cultured-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life. They are carried by various types of carriers, including symbolic systems, relational systems, routines, and artefacts, and they operate at multiple levels of

jurisdiction". He further posited that institutions are by definition stable but they are subject to change processes.

The institutional context is defined as the rules, norms and ideologies of the wider society (Meyer and Rowan, 1983, 84). Emirbayer and Mische, (cited in Scott 2001, 195), said that in fact, an agent's action reflects the temporal-relational contexts and the agency itself.

Where legitimacy comes into play is that, as posited by Dowling and Pfeffer (1975), organizational legitimacy occurs when the social values associated with or implied by the organizations' activities coincide with the norms of acceptable behaviour in the larger social system of which they are part.

Suchman, (cited in Scott, 2001), defined legitimacy as a "generalized perception or assumptions that the actions of an entity are desirable, proper, or appropriate within some socially constructed (institutional frameworks) systems of norms, values, beliefs, and definitions".

Under the regulative pillar of institutions, Scott (2001) posited that legitimacy is based on conforming to rules. He further stated that it is complying with the legal or quasi-legal requirements that confer legitimacy to an organization. Moreover, this legitimacy must be observable to outsiders and convened by cultural or political authority.

2.2.2.1 Applying the Institutional Theory to the study

Relating the concept of legitimacy as defined above to the study, the researcher postulates that banks are financial institutions with a large component of government intervention and public visibility that need legitimacy for their survival (Dowling & Pfeffer, 1975). From Scott's (2001) point of view, the survival of organizations does not only hinge on material resources and technical information, but also on their social acceptability and credibility.

Confidence (credibility) is so important for financial institutions that the lack of it can trigger runs in liquidity (Gorton & Metrick, 2010) and eventually lead to a shut down. Given the impact of RCA on banks' capital and ultimately on banks' risk level, RCA is likely to go against the definition of legitimacy. Engaging in RCA would consequently question the 'well-capitalised banks' ' status of South African Banks granted by the South African Reserve Bank, which is the authority conferring legitimacy. On the contrary, securitising for funding motives would possibly sustain this status.

Section 2.3 Empirical studies

This section presents key empirical studies that are related to the subject of this thesis. It concludes with the similarities and differences between these studies and the thesis. Table 2.1 exhibited in Appendix 1 condenses the survey of the existing studies with the authors,

the periods covered, the variables used and the findings. Their brief descriptions are as follows:

[1] Calomiris and Mason (2004) explored two views of the motivation for RCA employing the securitisation of credit card receivables during the year 1996 in the USA, a year reflecting the peak of recourse events. They tested the securitisation with implicit recourse from the efficient contracting view where capital is set in line with the market to avoid information asymmetry, and the safety net abuse view, where the deposit insurance subsidy is maximised by increasing the level of risk comparative to capital. Ninety-six bank credit cards observations were involved in the study. Findings demonstrated the significance of the efficient contracting view at the expenses of the safety net abuse view.

[2] Ambrose, Lacour-Little & Sanders (2005) examined whether taking advantage of asymmetry of information to securitise low-risk mortgage loans while retaining the riskier portion on the balance sheet, was motivated by RCA or was a reputation concern. Looking at 14 285 conventional fixed rate mortgages in USA banks, they first built a model that predicted the prepayment and default probabilities of mortgages. The purpose was to analyse whether a mortgage is securitised or held in portfolio. To test the role of asymmetric information in this decision, they measured the level of effective yield spreads at the origination of the loans. They found that higher risk loans were retained and lower risk loans securitised. This was the evidence supporting both the RCA and reputation

motives.

[3] Martin-Oliver and Saurina (2007) investigated the determinants of assets securitisation by Spanish banks. Specifically, they tested whether liquidity needs drive covered bonds backed by mortgages and whether capital arbitrage and risk transfer motivated ABS issuances. Using solvency and liquidity ratios, as well as risk profile measurement to see whether riskier banks securitise, they found that liquidity needs are the main driver of covered bonds, ABS issuance and RMBS, not capital arbitrage. They also concluded that the originate-to-distribute model does not apply to Spain as ABS do not depend on banks' risk profile. However, looking at securitised loans to small and medium enterprises, they also established that capital arbitrage may well justify banks' decision to securitise them.

[4] Uzun and Webb (2007) studied the difference between securitising and non-securitising banks, and the way securitisation of different type of assets impacts bank risk using capital ratios. Their purpose was to show evidence of the securitisation likelihood and the capital arbitrage theory of securitisation. Based on data from 112 USA banks and 3000 bank-quarters, they found that larger banks are more eager to securitise. So, the size is a determinant of the likelihood to securitise. With regards to capital arbitrage, in general, securitisation negatively impacts banks' capital ratio. But taken separately, only credit cards ABS were negatively related to banks' total risk-based capital ratio. They

advocated that this type of asset is securitised for capital arbitrage purpose and others, such as mortgages or car loans, instead, have a positive relationship and thus exclude the idea that risky assets remain in the portfolio.

[5] Dionne and Harchaoui (2008) considered the relationship between securitisation, bank capital and risk-taking. They employed Canadian financial sector data over the period 1988 to 1998. Their findings established a negative relationship between securitisation and Tier 1 as well as Total risk-based capital ratios, suggesting regulatory capital arbitrage. The results further conclude a positive relationship between the level of securitisation and banks' risk taking. This suggests that securitizing banks with higher capital ratio are likely to be riskier.

[6] Hänsel & Bannier (2008) examined firm-specific and macro determinants of the CLOs securitisation of 316 EU countries' banks over the period 1997 – 2004. Their findings are mixed regarding RCA. They revealed mostly that the predominant purposes were funding and risk transfer even though their significance remained limited. Also, securitising CLOs served as a path for accessing capital market-based businesses with the associated fee income, thus increased their performance.

[7] Cardone-Riportella, Samaniego-Medina & Trujillo-Ponce, (2010) looked at the reason why Spanish banks securitised. They oriented their focus on liquidity, credit risk transfer,

RCA and performance motives. Based on 408 observations during 2000 to 2007, they found that liquidity and performance were the divers of securitisation by banks in Spain and not RCA, nor transfer of credit risk. Additionally, they drew the differences between banks securitising assets and banks securitising liabilities. In both cases, liquidity remained the main determinant of securitisation.

[8] Agostino and Mazzuca (2011) analysed whether the probability of securitising was affected by RCA, funding and specialisation. Their study is based on data from Italian banks covering the period 1999 to 2006. Securitisation, in general, was found positively related to the funding reason while taken individually, RCA and funding drove RMBS. On the contrary, the needs of funding and specialisation lead to the securitisation of non-performing loans.

[9] Cerato, Choudhry, Crosby & Olukuru (2012), similar to the previous studies, explored the reason why banks securitise. This time, data were drawn from UK banks for the period 2000 to 2010. Interestingly, the period starts from the pre-financial crisis through to the post-financial crisis. This study investigated three hypotheses: RCA, liquidity and risk transfer. They also looked particularly at ABS from the assets side and CDOs from the liabilities side. Furthermore, they examined the impact of the Originate-to-Distribute (OTD) model on these ABS and CDOs. In addition, the impact of securitisation on UK banks' profitability was studied. Liquidity was found to be the leading factor generally.

However, individually, RCA and credit risk transfer motivated ABS, while RCA and funding influenced CDOs. The OTD model created a high defaults rate for both, but even more for ABSs. Finally, large banks, particularly investment banks, improved their profitability via securitisation during the period referenced.

[10] Jiangli and Pritsker (2008) investigated the impact of mainly mortgages but also other assets on US Banks' Holding Companies' insolvency risk, profitability and leverage ratio from 2001 to 2007. They considered three methods: when securitised assets are placed back in these banks' balance sheets; compared average performance of securitising and non-securitising banks; and used banks' size as an instrument of securitisation. For the first time, time deposit premium was used as the measure of bank insolvency risk. In all cases, their results showed that mortgages securitisation reduced the latter, increased profitability as well as banks' leverage ratio.

[11] Michalack and Uhde (2011) considered the impact of cash and synthetic securitisation on 60 EU and Switzerland banks' financial soundness. Data were composed of 749 securitisations transactions. Authors used two proxies of bank soundness, the accounting based Z-score and the market-based Z-score. They remarked that these banks were freeing up some capital via securitisation for RCA purposes. In effect, freed up capital were used to accumulate riskier assets on the balance sheets. Furthermore, they were holding most of their credit risk exposures within the first loss position. Consequently,

evidence indicated a negative impact of securitisation on these banks' financial soundness, thus supporting the 'securitisation-fragility' view. It also presented a negative impact on their profitability. Moreover, it showed that securitisation rendered these banks' return volatile. The authors further noticed that a combination of market concentration, strict regulatory and supervisory environment and market discipline fostered stability. Surprisingly, high-developed capital markets with high-quality legal institutions seemed to expose banks to fragility.

[12] Ben Salah and Fedhila (2012) employed data on 174 US banks from 2001 to 2008, looking at the impact of securitisation on their risk behaviour and stability. As measures of risk, they took RWA/total assets and the Z-score, which encompasses capital, profitability and return volatility measures. Outcomes showed that the quality of US banks' loans portfolio had deteriorated because of the high volume of securitisation and their credit risk, which accordingly worsened as they continually increased their level of riskier assets. With regards to banks' stability, mortgage loans securitised were found to have a stabilising effect on these banks but not on non-mortgage assets. They explained that the risk retention that followed the former group of assets acted as incentives for better monitoring, while the later did not.

[13] López-Andión et al., (2015) studied the impact of securitisation on 61 Spanish banks over the period 1998 to 2012. They dissociated assets securitisation and liabilities

securtisation (covered bonds). Using Z-score as a measure of bank financial solvency, assets securitisation were found to have a slightly negative effect on banks' stability. It is worth noticing that this result is valid for the period before the financial crisis (1998-2006) and is justified by RCA. After the crisis, the impact is not significant. Regarding the liabilities securitisation (covered bonds), given that covered bonds do not by nature transfer risks, their impact on banks' stability was found insignificant because the liquidity from their sales was invested in assets that preserved the stability of these banks' financial solvency.

The researcher remarks are as follows: similar to studies [1] to [9], this thesis will seek evidence whether RCA is a motive of securitisation, under the Basel Accords. Study [4] is the closest to this project in terms of choice of variables. Furthermore, just as studies [10] to [13], the author will look at how securitisation can impact a bank's stability.

However, 99% of these studies [1] were conducted over the periods when banks were mostly subjected to Basel Accord I only. This thesis covers a more extensive period, from Basel II to Basel III, partially. Moreover, the studies above [2] were concentrated on developed countries in Europe and America while the author, in a first study of its kind, will fill the gap by focusing on South Africa, an emerging economy with a banking system qualified as robust, sophisticated and aligned to international standards (International Monetary Fund, 2015). Concerning the variables, the studies [10] to [13], on the impact

of securitisation on banks' stability, used mostly the Z-score as a proxy of banks' stability. Only one case employed a different measure, the time deposit premium. Study [3] similarly considers the Z-score but introduces a novelty by using one more proxy, the CAMELS. With regards to the data and methodology, the author likewise uses time series data and a multivariate regression model. Nevertheless, [4] the researcher utilizes the Ordinary Least Squares and the Two Stages Least Squares methods. The methodology will be defined in more details in Chapter 3 of this thesis.

Chapter 3
Research Design, Data and Statistical Techniques

"A theory or hypothesis that is not verifiable by appeal to empirical evidence may not be admissible as part of scientific enquiry" Milton Friedman - (as cited by Damodar N. Gujarati)

This chapter introduces the methodology selected for the study, dawn from the research design (1). The chapter presents the data/variables and their sources (2), the statistical techniques employed, and the models' specifications (3).

Section 3.1 Research design

In research, there are roughly three paradigms: a scientific research paradigm, an interpretive research paradigm, and a critical research paradigm (Scotland, 2012). As per the American sociologist George Ritzer, a paradigm is a fundamental image of the subject matter within a science. A paradigm serves to define what should be studied, what questions should be asked, how they should be asked, and what rules should be followed in interpreting the answer obtained. The paradigm serves to differentiate one scientific community (or sub-community) from another. A paradigm subsumes, defines and inter-relates the exemplars, theories, methods, and instruments that exist within it (Ritzer, 1975).

Each one of the three paradigms given above is made of five constituents: ontology, epistemology, theoretical perspective, methodology, and methods.

This study is classified within the scientific research paradigm. In line with the components of a paradigm, the framework the researcher has adopted for this study is presented below and must be read from top to bottom in terms of what informs what [see (1) to (4)] (M. Crotty, 1998). The researcher's ontological view has informed the epistemology stance, which in turn informed the theoretical perspective, this then informs the methodology and finally the methods.

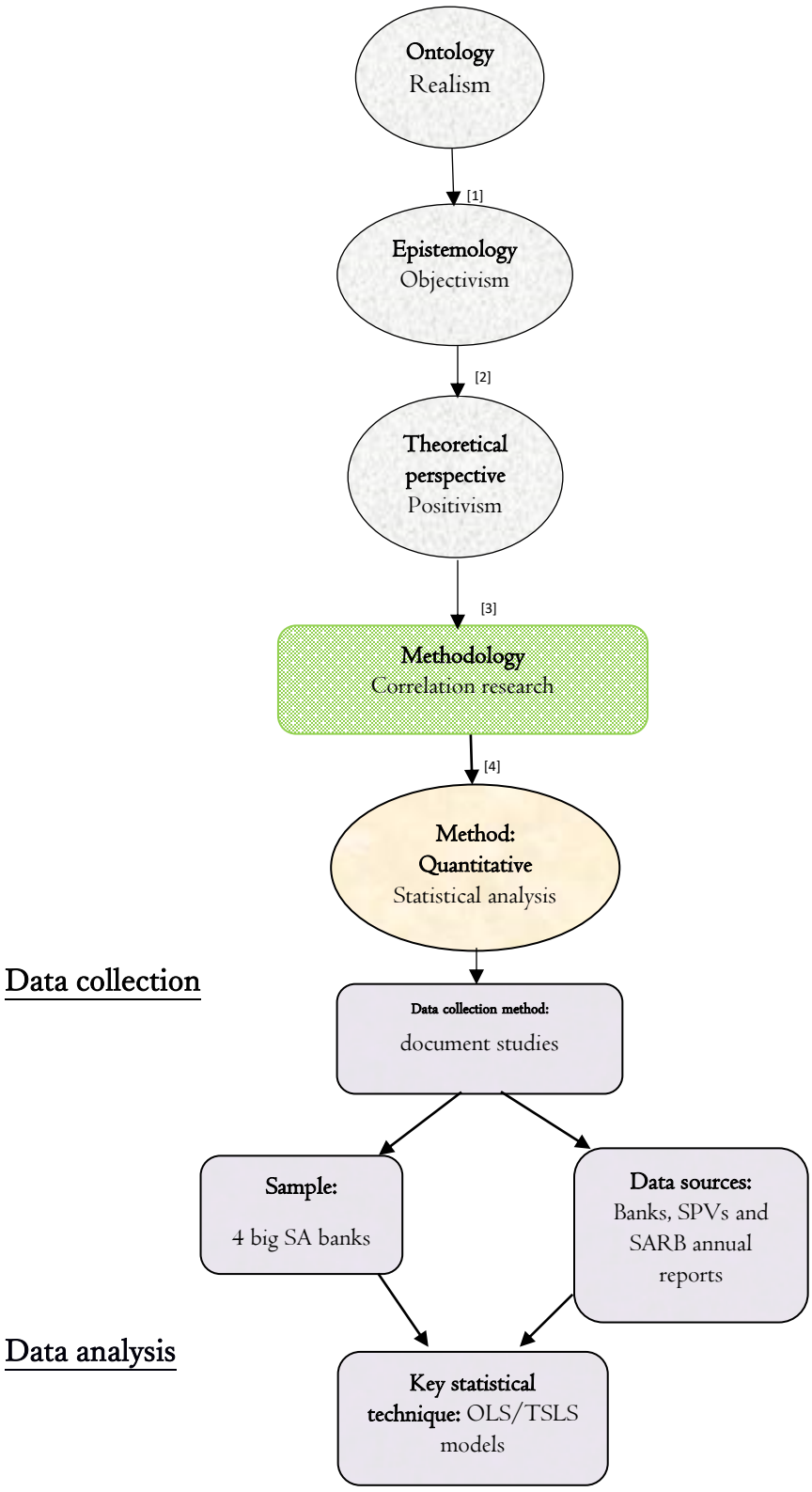


Figure 3.1 Diagrammatic Overview of the Theoretical Methodology

3.1.1 Ontology [1]: realism

Referring to the Greek philosopher and scientist Aristotle, the ontological component of a paradigm or ontology is defined as the science of the "being *qua* being", meaning the study of attributes that belong to things because of their nature, even independently of their actual existence (Guarino, Oberle, & Staab, 2009). Ontology has to do with the description of reality as it really is (Scotland, 2012). Blaikie (cited by (Mack, 2010)) defined ontology as "claims and assumptions that are made about the nature of social reality, claims about what exists, what it looks like, what units make it up and how these units interact with each other". At this level, the researcher will adopt the realism position as opposed to relativism. A realism perspective considers that the researcher's findings about a phenomenon are the absolute truth, the reflection of the reality, while relativism views the findings as the interpretation given by the researcher, so that, consequently, there can be different realities about the same phenomena depending on how it is interpreted (Crotty, 1998). Relating realism to the main topic of this research, regulatory arbitrage with its consequences is a fact that can be evidenced.

3.1.2 Epistemology [2]: objectivism

According to the Internet Encyclopaedia of Philosophy (peer reviewed), epistemology refers to the study of knowledge as translated from the Greek words "episteme"

(knowledge) and "logos" (science). Epistemology has to do with how knowledge can be created, acquired and communicated (Scotland, 2012). Epistemology refers to a picture of the way knowledge is achieved (Mack, 2010). Epistemology is concerned with the nature of knowledge and thought, in other words, what it means to know (M. Crotty, 1998). There are three main epistemological constructs: objectivism, constructionism, and subjectivism. This research project aligns with objectivism as an epistemological stance. From the objectivism point of view, reality as it exists is intrinsically meaningful regardless of the consciousness of it (M. Crotty, 1998). Vrasidas further explains that an objectivist believes that there is one true and correct reality which we can come to know following the objective methods of science (Vrasidas, 2000). Objectivism is often opposed to another paradigm which is constructionism. The latter is rooted in the idea that reality is socially constructed with the assumption that what is found in the world is the result of human social and construction acts (Harre, 2002 cited by (Leeds-Hurwitz, 2015). That is why constructivism has often served as a philosophical perspective for qualitative studies (Crotty, 1998).

3.1.3 Philosophical paradigm or theoretical perspective [3]: positivism

The purpose of the theoretical perspective is to indicate the underlying assumptions that support the researcher's stance regarding reality and understanding of human knowledge. It also informs the methodology that can be adopted. The researcher has chosen positivism

as a theoretical perspective. Positivism, credited to a French philosopher Auguste Comte, is a philosophical paradigm that regards reality (the real world) as external to the knower (Jonassen, 1991). Mack tells us that the scientific paradigm mentioned above is identical to the positivist paradigm. He further explained that positivist research is involved in proving or disproving hypotheses using the scientific method and statistical analysis while looking at generalizable findings (Mack, 2010). Positivism's other assumptions include the claim that the meaning is external to the enquirer, while thought is governed by external reality and the mind is the mirror of nature (Jonassen, 1991).

3.1.4 Methodology: regression/correlation research

The research methodology is the plan of action or process lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcome (M. Crotty, 1998). Crotty gives some examples of common methodologies and they include experimental research, survey research, ethnography, phenomenological research, grounded theory, action research, heuristic inquiry etc. A research methodology is also viewed as the science and philosophy behind all research, a kind of answer of how we know what we know (Gray, 2013).

In terms of methodology, the project is essentially a relational research. This thesis investigates the phenomenon of regulatory arbitrage. That is, whether there is a correlation between securitisation and the reduction of the banks regulatory capital

requirement on one hand, and the increase in risk taking behavior on the other hand. It also looks at the correlation between securitisation and its possible impact on bank stability. In other words, it examines whether securitisation improves or fragilizes involved banks' stability.

3.1.5 Methods: statistical analysis

Methods in research are the techniques used to gather and analyse the data related to particular research questions (Scotland, 2012). Two methods are commonly used: quantitative and qualitative. A quantitative method is based on the use of numbers as empirical tools while qualitative research utilises texts. A qualitative method is also based on the idea that realities are socially constructed (Flick, 2008). Complementing this idea, Dinzin and Lincoln qualified the qualitative method as an interpretive, naturalistic approach of the world where the study is carried out in the natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings the participants bring to the researcher. So, the method here is all about qualities of entities, processes and meaning in a value-laden framework. Quantitative method for them, in contrast, refers to the measurement of the causal relationship between variables in a value-free framework. A quantitative method uses concepts such as quantity, amounts, intensity and frequency (Denzin & Lincoln, 2006). From this characterization, a quantitative method is appropriate for this study,

Section 3.2 Data collection and variables description

This section describes the techniques used in this study to collect the data, and defines the variables.

3.2.1 Data collection

The data collection was carried out via a document studies method. The sample consists of four out of the five biggest banks (ABSA Bank Ltd, The Standard Bank of South Africa Ltd, Nedbank Ltd and Investec Bank Ltd) operating in South Africa and consistently securitising mortgage loans. The four banks selected for this research dominate the banking sector by holding not less than 70% of total assets. First Rand Bank could not be added in the sample because their securitisation programme started in 2007 and end in 2011, leaving me with only 5 years.

The study covers the period 2008 – 2015 corresponding to the publication of better regulatory frameworks for securitisation activities in South Africa. It also marks the spike (2008) of substantial growth of securitisation transactions by South African financial institutions, which was followed by their decline. In this thesis, the period is purposively chosen in order to capture the effect of the Basel Accords' evolution and implementation in South Africa, i.e. Basel II (2008 - 2012) to Basel III (2013 - current).

The main source of data were banks' annual and SPV's financial reports. Wherever necessary we requested additional data from the banks directly. Other source details are

indicated in Table 3.1 below. Regarding some issues related to our data, it is worth mentioning that the big four banks have different timelines with regards to the closure of their financial year. For example, ABSA Bank Ltd, The Standard Bank of South Africa and Nedbank Ltd end their financial year on the 31st of December. However, Investec Bank Limited ends its financial year on the 31st of March. We initially intended to group these banks according to their year-end date and analyse the data separately and then compare the results. After the data collection, the researcher realised that the volume of residential mortgage securitised were lower than expected and carrying out the analysis that way would have led to meaningless results. We decided to ignore these timing differences and proceeded with aggregate data.

Also, access of additional data was denied to the researcher on the grounds of confidentiality. The researcher was told that a huge number of securitised mortgages are not listed and details are not for the public domain.

Data were collected retrospectively, meaning that we started collecting from 2015 and proceeded back to 2008. The fact is annual reports of banks contain information of year T and year T^{-1}. So, for example the 2015 annual report roughly contains the 2014 financial results as well. But we noticed during data collection that quite often there are differences (although few) between the figures reported for example in 2014's annual report for the year 2014 and the information that was supposed to be the same for 2014 reported in 2015. The discrepancies are justified by ever-changing accounting rules and practices in the

banking sector. So, data collected retrospectively allowed us to capture all the adjustments as published by these banks at T on the T^{-1} financial statements. It will also justify the fact that sometimes, there appears an abnormal percentage change of an account between year T value and T^{-1}.

3.2.2 Variables description

The variables used, their definitions/measurements and data sources are summarised in the following table (3.1). The choice of each variable is constrained by the availability of data.

Table 3.1 Variables and Definitions

Variables	Definitions	Sources
IV – Outstanding Balance Securitisation Mortgage Loans (SEC_TA)	Annual outstanding Volume of Securitised Mortgages / Total Assets	Johannesburg Stock Exchange, Banks' and SPVs' Financial reports, Banks' staff.
DV and CV- Capital Ratio* (CAR)	Tier 1* + Tier 2* Capital / Risk-Weighted Assets*	Banks Annual Reports – Risk management sections

DV and CV- Loan Ratio (TL_TA)	Total Loans / Total Assets	Banks Annual Reports – balance sheets
CV- Retain interests / outstanding balance securitised assets (SBL_SEC)	Subordinated loans (first and 2nd loss) / Outstanding balance securitised mortgages	RMBS programmes reports
DV and CV- Liquidity	Ratio of liquid assets + cash and overnight interbank loans to Deposits and other Short-term funding (LA_DST) Total loans / Deposits and other Short-term funding(TL_DST) Liquid assets to total assets ratio(LA_TA)	Banks Annual Reports – balance sheets
DV - CAMELS (bank stability proxy)	Capital: leverage Ratio = Equity / Total Assets(TE_TA); Quality of Assets: OBS activities: ratio of	Banks Annual Reports: balance sheets, risk management sections and income statements

	off balance sheet activities to Risk-Weighted Assets(OBS_RWA); Management: cost efficiency = operating expenses to operating income ratio (cost to income ratio – OE_OI). Earnings: return on assets = results before tax to total assets ratio(ROA) or ROE (return on equity) Liquidity: ratio of liquid assets to Deposits and other Short-term funding Sensitivity: ratio of net interest income to total assets	
DV and CV- Z-score	ROAA + CAR / SDROAA (**)	Banks Annual Reports: balance sheets and income statements
CV – Interbkrate	Interbank interest rate	

CV- DST_TA	Deposits and other short-term funds to total assets ratio	Banks Annual Reports: balance sheets
CV- IE_DST	Interest expenses to Deposits and other short-term funds ratio	Banks Annual Reports: balance sheets
DV and CV - RWA_TA	Risk-weighted assets to total assets ratio	Banks Annual Reports: balance sheets
CV - Banks Size (BKSIZE)	Log Total Assets	Banks Annual Reports: balance sheets
CV - Banks Concentration (BCON)	Herfindahl–Hirschman index (HHI)	SA Reserve Bank annual reports
CV - Houses Price (HP)	Nominal House price changes	ABSA Bank
CV – GDP	Real GDP growth	SA Reserve Bank annual reports
Dum2008	Dummy for the 2008 GFC	

IV: independent variable - DV: dependent variables - CV: controlled variables (**) ROAA: Return on Average Assets – CAR: capital ratio – SDROAA: standard deviation of the ROA. [*] Capital ratio includes foreign subsidiaries figures but "Banks solo" (South Africans main bases) account for 80% to 90% of the aggregate assets.

Section 3.3 Statistical techniques and models' specifications

3.3.1 Statistical techniques

The study's statistical techniques are oriented toward inferential analysis where the focus is on a sample from the population and does not employ a descriptive analysis[30].

The core statistical models utilised in this study are the Ordinary Least Squares (OLS) and the Two Stage least squares (TSLS) regressions. According to Haldane, when the sample is small, the best way to obtain more accurate estimates is to use a simple model (Haldane, 2012).

The step by step methods of the statistical techniques employed in this study are exhibited in a diagram presented in Figure 1 (Chapter 1). This section explains these steps.

[1] The data collection process and their sources are detailed in Section 3 below.

[2] Data are partially[31] converted into ratios. In effect, all dependent and independent variables (except bank size and the macroeconomic variables) are translated into ratios as

[30] Descriptive analysis measures the characteristics of an entire population (O'Rourke, Hatcher, & Stepanski, 2005)

[31] Others are indexes.

the researcher measures the impact of the latter on the former in terms of percentage change.

[3] Natural log conversion of all data: the researcher has used time series data. As such, all variables are measured in natural logarithms because doing so aligns the data to one of the assumptions of the regression model, namely linearity. Furthermore, it facilitates the interpretation of the results. Coefficients can now be understood in terms of elasticities and not in terms of unit changes, resembling for example " Y tends to change by β percent for one percent change in X" (Koop, 2009).

[4] The examination of the data is completing the visual inspection and descriptive statistics.

Descriptive statistics talks mainly about the use of mean and standard deviation. In statistics, the mean refers to the average or the centre of a distribution. The standard deviation (SD) measures the dispersion of a distribution, meaning given two distributions, the one with the higher SD will be interpreted as more dispersed than the other (Koop, 2009).

[5] Unit root tests: this study deals with time series data. As such, it is important to insure they are stationary[32], meaning their mean, variance and covariances must remain constant

[32] Conditions of covariance stationarity: E (Y_t) = constant for all t; Var (Y_t) = constant for all t; Cov (Y_t, Y_{t+k}) = constant for all k $\neq$ 0 (Asteriou & Hall, 2011).

over time, otherwise the results after the regression analysis will be qualified as “spurious” (Asteriou & Hall, 2011).

To avoid the spurious regression problem, we have tested for the stationarity of our variables using the Augmented Dickey-Fuller test and the Philip Peron tests. The presence of a unit root attests to non-stationarity. Differencing the data eliminated the trends and rendered them stationary (Asteriou & Hall, 2011).

3.3.1.1 Ordinary Least Squares (OLS) method

This study used multiple regression models because we examined the relationship between some dependent variables and several independent variables. As presented by (Koop, 2008), this multiple regression model generally takes the following form:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_k X_{ki} + \Omega_{it}$$

, where Y_i is the dependent variable, i=1⋯N are the observations, Ω_{it} is the error term (the gap between the true regression line and a specific data point), $X_{1i}, \ldots + X_{ki}$ are the independent variables, and $\beta('s)$ are the coefficients to be estimated.

Ordinary Least Squares (OLS hereafter) is a method that allows one to estimate the coefficients by producing what is called the best-fitting line between the dependent variable and its determinants (the explanatory variables). The OLS does that by minimizing the sum of squared residuals (Koop, 2008). The residual emanates from the

fact even when a straight line is found, there is always a difference from the true regression line. The sum of squared residuals (SSR) then measure the size of all the residuals.

For a regression model with one explanatory variable: $Y_i = \beta_0 + \beta_1 X_i + \Omega_i$

the fitted regression line will be: $\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_i$

the residuals will be given by: $\hat{\Omega}_i = Y_i - \hat{\beta}_0 - \hat{\beta}_1 X_i$,

and the SSR will be equal to: $\sum_{i=1}^{N} (Y_i - \hat{\beta}_0 - \hat{\beta}_1 X_i)^2$

Koop further elucidated that the SSR is not enough because there are cases where the number of residuals is so great that it has become necessary to have one number, the R^2, that will include all the information in the residuals:

$$R^2 = 1 - \frac{SSR}{TSS}$$

where TSS is equivalent to the variance of the data. It is equal to RSS + SSR.

The RSS is in turn equal to $\sum_{i=1}^{N} (\hat{Y}_i - \bar{Y})^2$, where $\bar{Y} = \frac{\sum_{i=1}^{N} Y_i}{N}$ is the mean of Y.

R^2 indicates the percentage of the variance of Y that can be attributed to X (Koop, 2008).

The assumptions of the multiple regression model in terms of the regression errors are (Koop, 2008):

- $E(\Omega_i) = 0$ meaning that it is assumed the errors will have a mean equal to zero on average. In other words, $E(Y_i) = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_k X_{ki}$ is the proper regression model with appropriate explanatory variables.
- $Var(\Omega_i) = E(\Omega_i^2) = \sigma^2$, meaning that it is assumed that all the errors will have equal variance. This assumption is also termed homoscedasticity. The contrary would be heteroskedasticity.
- $Cov(\Omega_i, \Omega_j) = 0$ for $i \neq j$, meaning that there is no correlation between the errors.
- Ω_i is normally distributed
- X_i, the explanatory variables, are fixed and not a random variables.

Where i=1,⋯,N observations.

Under these assumptions, the OLS is considered as the best linear unbiased estimator (BLUE) from the Gauss-Markov theorem view.

The diagnostic tests for normality, the existence of serial correlation, and heteroskedasticity employed in the study are provided respectively by Jacque-Bera test, the Breusch-Godfrey test and the Breusch-Pagan test as indicated by (Kennedy, 2008).

The null hypothesis of the Jarque-Bera test is that the errors are normally distributed. The null hypothesis of the Breusch-Godfrey test is that the errors are not serially correlated and the null hypothesis of the Breusch-Pagan-Godfrey test is that the errors terms are

homoskedastic. Therefore, for all these tests, probability values of less than 5% would reject these hypotheses and thus violate the assumptions op-cited, and probability values of more than 5% would accept these hypotheses.

3.3.1.2 Two Stage Least Square (TSLS) method

While examining the relationship between securitisation and bank stability, measured by CAMELS (Capital Assets Management Earnings Liquidity Sensitivity), we were faced with a system of equations that presented the characteristics of what is called simultaneous equations.

Simultaneous equations can be viewed as a set of different equations meant to capture an economic fact where dependent variables, acting together as dependent and independent variables, are predicted at the same time (Asteriou & Hall, 2011). According to Dougherty, using the Ordinary Least Square as an estimation method for this type of equations will only yield biased and inconsistent estimates along with invalid statistical tests. He then suggested instrumental variables estimation (Dougherty, 2011). Specifically, the instrumental model has been indicated to be suitable when at least one independent variable is significantly correlated with the error term (Agung, 2009). This is because one of the assumptions of OLS that is of the distribution independence of the error term vis-a-vis independent variables is easily violated in the simultaneous equations system. The reason is that a change in the error term of one equation causes a change in the dependent

variable of that equation, which in turn causes a change in the dependent variable of the other equation where the latter is an explanatory variable and so forth. As a result, correlation between the error terms and explanatory variables seems inevitable (Asteriou & Hall, 2011).

To solve this problem, the literature recommends the TSLS. The interest in the TSLS method resides in the fact that it creates a substitute to the endogenous variable correlated to the error term which is uncorrelated, and in so doing cancels the bias (Asteriou & Hall, 2011). The properties of the TSLS are said to produce consistent and robust estimates as its properties are not particularly affected by the multicollinearity and other specification errors issues (Kennedy, 2008).

Asteriou & Hall described the two stages (hence TSLS model) that are to be considered in performing a proper estimation of simultaneous equations and we have followed these steps. The first stage consists of determining the fitted values of the endogenous variables via OLS method. The second stage entails regressing the initial equations with the sus-determined fitted values as instruments for the endogenous variables.

The choice of proper instruments is crucial for reliable estimates. Before the instruments can be used in the TSLS, they must meet a number of requirements.

The general instrumental variable regression model is presented as follows by (Stock & Watson, 2003):

$$Y_i = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_k X_{ki} + \beta_{k+1} W_{1i} + \ldots + \beta_{k+r} W_{ri} + \Omega_{it}$$

, where Y_i is the dependent variable, Ω_{it} is the error term, $X_{1i}, \ldots + X_{ki}$ are the troublesome variables (also called endogenous variables) that are presumed to be correlated with Ω_{it}, $W_{1i}, \ldots, W_{ri}$ are the other explanatory variables (also called exogenous variables) and correlated with Ω_{it}, and $\beta('s)$ are the coefficients to be determined. $Z_{1i}, \ldots, Z_{vi}$ will be the instrumental variables.

According to these authors,. $Z_{1i}, \ldots, Z_{vi}$ will be valid instruments if (1) $\text{corr}(Z_{1i}, \ldots, Z_{vi}, X_{1i}, \ldots + X_{ki}) \neq 0$, meaning the instruments are correlated with the troublesome variables (some say preferably highly correlated (Kennedy, 2008)) and (2) $\text{corr}(Z_{1i}, \ldots, Z_{vi}, \Omega_{it}) = 0$, and that means there is no correlation between the instruments and the error term Ω_{it}. As they explained, the reason behind these conditions is that, on one hand, with the correlation between the instruments and the troublesome variables, the variation of the latter will translate into the variation of the former. On the other hand, because of the exogeneity of the instruments, the troublesome variables portion that is also exogenous is in fact identified by the instruments. Thus, it is the variation of this exogenous fragment of the troublesome variables that is employed for the estimation of their coefficients.

(Dougherty, 2011)[33] broke down the requirements for good instruments in a different fashion and the researcher strives to follow that path. Any variable used as instrument for each endogenous variable (troublesome) included in our models has first been ascertained in the literature as a determinant of that variable. (i) Being a determinant that makes that

[33] In brief, a good instrument is correlated with the troublesome variable, independent from the disturbance term and is not listed among the variables already included in the structural equation(Dougherty, 2011)

instrument correlated with the troublesome variable, thus making it relevant. Also, as a determinant, the instrument is (ii) not correlated with the error term in the model because of its exogenous nature. Because there were many determinants available, we took the one with the highest coefficient of correlation with the endogenous variable as suggested by (Kennedy, 2008). Furthermore, that variable (instrument) has the particularity of (iii) not having been previously included in the structural equation of the model. Lastly, because we have multiple endogenous regressors, we have included all the explanatory variables of the system as seen in (Asteriou & Hall, 2011) and all the new instruments in the list of instruments as suggested by (Kennedy, 2008).

The preceding authors also mentioned the importance of identification. When the number of instruments is strictly equal to the number of troublesome variables in an equation, it is said that there is exact identification. More instruments than troublesome variables lead to overidentification and less, to the conclusion that there is underidentification of equation. Our models are categorized as overidentified as it can be seen in Table 3.2 below. The overidentification further explained why we are utilizing the TSLS because according to (Dougherty, 2011) it is the adequate method for that type of identification.

Identification procedure: we have followed the steps described by Asteriou and Hall (2011).

Endogenous variables (in the first column): Capital (TE/TA); Asset quality (OBS/RWA); Management efficiency (OE/OI); Earnings (ROA); Liquidity (LA/DST); Sensitivity to market risk (NII/TA)

We have 20 variables used in the CAMELS system of equations (seen in the first row).

Table 3.2 Identification of simultaneous equations models

	TE/TA	SEC/TA	TL/TA	LA/DST	TL/DST	ROE	ROA	OE/OI	OBS/RWA	IE/DST	CAR	Interbkrate	NII/TA	ZSCORE	DST/TA (-I)	BKSIZE (-I)	HP (-I)	GDP	GDP (-I)	Dum08
C	✓	✓	✓	✓	✓	✓	0	✓	0	0	0	0	0	0	0	✓	✓	0	0	✓
A	0	✓	0	0	✓	✓	✓	0	✓	0	✓	✓	0	0	0	✓	✓	✓	0	✓
M	0	✓	✓	0	✓	✓	0	✓	✓	✓	0	0	0	0	0	✓	✓	0	0	✓
E	✓	✓	✓	0	✓	✓	✓	✓	✓	0	0	0	0	0	0	✓	✓	0	0	✓
L	0	✓	0	✓	✓	0	✓	0	✓	0	0	✓	0	✓	0	✓	✓	0	0	✓
S	✓	✓	0	0	✓	0	0	0	0	0	0	✓	✓	0	✓	✓	✓	0	✓	✓

- ✓ means the variable is included in the equation and 0, means it is not.

If we call G the number of endogenous variables, G = 6 (C-A-M-E-L-S)

Let us consider N as the number of missing variables (out of the overall 20) in each of the 6 equations. The equation pertaining to Capital has N = 10; for Asset quality, N = 9; for Management efficiency, N = 10; for Earnings, N = 9; for Liquidity, N = 10; and for Sensitivity to market risk, N = 10.

For any equation, if N < G-1, then the equation will be qualified as under-identified; if N = G-1, the equation will be seen as exactly identified; if N > G-1 would mean the equation is over-identified. For the CAMELS, each of the equations has a N > G-1. This means that all the equations are over-identified. According to Asteriou and Hall, in such case these equations can be estimated with the TSLS method (Asteriou & Hall, 2011).

3.3.2 Models specification

This section specifies the models for the relationship between securitisation and regulatory arbitrage (1), then for the relationship between securitisation and bank stability measured by CAMELS (2) and then by the Z-score (3).

3.3.2.1 Securitisation and regulatory capital arbitrage

From the empirical literature survey, the researcher follows Uzun and Webb's (2007) approach for evidencing RCA (regulatory capital arbitrage) and risk retention. Similar to their study, we evidence the regulatory capital arbitrage theory of securitisation using the volume of assets securitised to total assets ratio, banks' total capital to risk-weighted assets ratio and loan ratio. However, Uzun and Webb study covers the period 2001 to 2005 while we start from 2008 through to 2015. Also, their data are quarterly panel data while for availability reason, we use annual data. Moreover, Uzun and Webb analysed different types of assets (residential mortgages, credit cards etc.) while we focus on RMBS (residential mortgage backed securities).

Our models are specified as follows:

$$\ln CAR_{it} = \Phi_0 + \Phi_1 \ln SEC\_TA_{it} + \Phi_2 \ln DST\_TA_{it} + \Phi_3 \ln TL\_DST_{it} + \Phi_4 \ln BKSIZE_{it} + Dum2013 + \delta_{it} \quad (1)$$

, where δ_{it} is the error term and i =1,...n and t=1,⋯,T

$$\ln RWA\_TA_{it} = \varphi_0 + \varphi_1 \ln SEC\_TA_{it} + \varphi_2 \ln ROE_{it} + \varphi_3 \ln TL\_TA_{it} + \varphi_4 \ln DST\_TA_{it} + \varphi_5 \ln TL\_DST_{it} + \varphi_6 \ln BKSIZE_{it} + Dum2013 + \upsilon_{it} \quad (2)$$

, where υ_{it} is the error term.

$$\ln TL\_TA_{it} = \omega_0 + \omega_1 \ln SEC\_TA_{it} + \omega_1 \ln ROE_{it} + \omega_2 \ln Interbrate_{it} + \omega_3 \ln IE\_DST_{it}(-1) + \omega_4 \ln ROA_{it} + \omega_5 \ln DST\_TA_{it} + \omega_6 \ln TL\_DST_{it} + \omega_7 \ln BKSIZE_{it} + Dum2013 + \varepsilon_{it} \quad (3)$$

, where ε_{it} is the error term.

Key variables involved in evidencing regulatory arbitrage are presented and explained as follows:

Ratio of Securitisation / total assets: securitisation here is materialised by end of financial year outstanding balance of residential mortgage-backed securities RMBS and through the period delimitated for the study.

Ratio of Total regulatory capital to risk-weighted assets. The numerator is the aggregate of Tier 1, Tier 2 and eventually Tier 3 (depending of the years it was implemented) capital as defined by the Basel Accords between 1988 and 2010. The Accords require banks to maintain this ratio at a minimum of 8% to be able to absorb unexpected losses. This ratio was useful in other different settings such as in (Calomiris & Mason, 2004), (Martín-Oliver & Saurina, 2007), (Uzun & Webb, 2007), (Dionne & Harchaoui, 2008), (Cerrato, Choudhry, Crosby, & Olukuru, 2012) and (Cardone-Riportella, Samaniego-Medina, & Trujillo-Ponce, 2010).

Total loans / total assets: total loans in this ratio includes loans and advances to customers, banks, and Groups companies. This ratio was also utilized by (Uzun & Webb, 2007), (Dionne & Harchaoui, 2008), (Agostino & Mazzuca, 2011) and (Jiangli & Pritsker, 2008).

Equation 2 is close to Salah and Fedhila's model where they defined RWA_TA as a measure of risk (Salah & Fedhila, 2012).

Size: The same study conducted by Uzun and Webb showed that banks' size is a determining factor in the decision to securitise (Uzun & Webb, 2007).

3.3.2.2 Securitisation and Bank stability

We use two popular measures of bank stability found in the literature: CAMELS and Z-Score.

3.3.2.2.1 Securitisation and CAMELS

CAMELS is an acronym which stands for Capital - Assets quality - Management - Earnings - Sensitivity to market risk. As dependent variables (or endogenous variables), they can be understood as follows (MacDonald & Koch, 2006)(Evans, Leone, Gill, & Hilbers, 2000):

Capital adequacy serves as a cushion constituted for covering the risks banks are exposed to. Its level informs third parties of how well these risks are being taken care of by the management team and how resilient they can be if their balance sheets are subjected to shocks. As for **A**ssets quality, it points out the credit risk deriving from such transactions as loans, investment portfolio and off-balance sheet businesses. **M**anagement quality is the response of the management team to the regulatory requirements as well as the handling of risks. **E**arnings entails its quantity, trend and determinants of its sustainability. **L**iquidity refers the quality of the liquidity reservoir in the short and long run. **S**ensitivity to market risk tells about how the capacity of a bank's earning can be impacted by the volatility of interest and foreign exchange rates and other commodity/ equity prices, etc.

The purpose in this section is to capture how securitisation affects SA banks' stability, here proxied by CAMELS. This measure of bank stability is considered by the International Monetary Fund (IMF) and World Bank as part of "aggregated microprudential indicators" of financial system soundness, "core financial soundness indicators", or Financial Soundness Indicators (FSIs) (Evans et al., 2000), (Gersl & Hermanek, 2006) (Sluijs, 2006). It is used in the economic literature which is indirectly close to this research project, see for example (Koetter & Poghosyan, 2010), (Mayes & Stremmel, 2012) even though these studies do not specifically refer to securitisation. After the GFC, Cole and White looked at the reasons why some small US commercial banks closed down in 2009. They employed CAMELS rating as explanatory variables and found that they remain "excellent" determinants of bank failure. They further discovered that there was an inverse relationship between CAMELS rating and real estate loans which lead to bankruptcy. As the real estate loans increased, the CAMELS rating deteriorated. However, RMBS (residential mortgage-backed securities) seemed not to have been involved in these failures (Cole & White, 2012).

The six components of CAMELS are all dependent variables but are concurrently also determinants of each other in the right side of the equations as depicted by the green arrows in the path diagram of the model below. This makes them qualified as simultaneous equations. That is why we adopt an instrument variable estimation method, particularly, the two stage least square technique (TSLS, here after). The black arrows in the path diagram show the influence of the exogenous variables on the CAMELS variables.

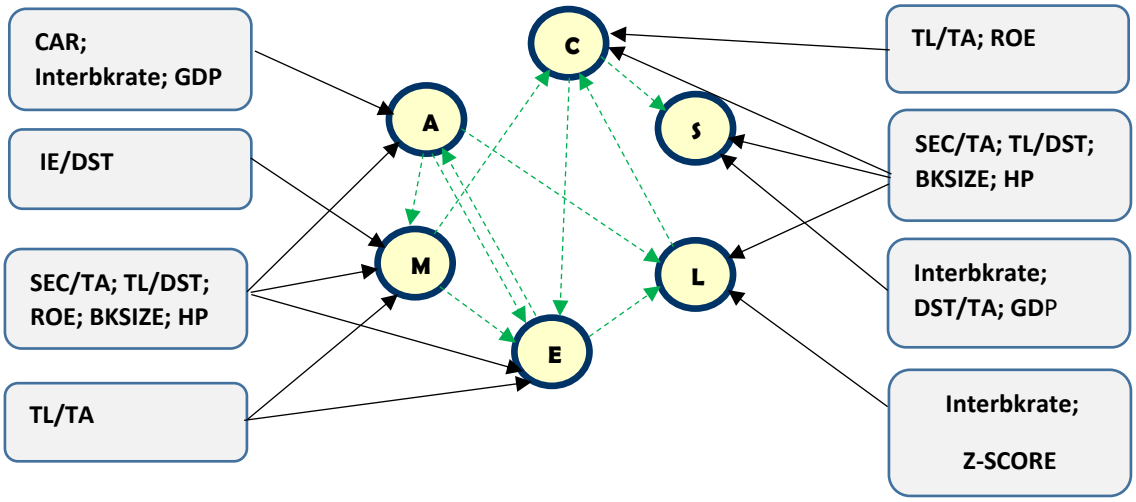


Figure 3.2: Path diagram of the CAMELS model

⇢ Indicate the simultaneous feature of the endogenous variables in the system

→ Indicate the influence of the explanatory variables in the system

The researcher will now proceed to describe the CAMELS model via each term in the acronym. The model specification of each term will then be followed by the elucidation of the independent variables and the reasons for their use.

Capital

The capital expresses the level of coverage of a bank's total risk. From the IMF point of view, this variable is measured by the ratio of capital to risk adjusted assets (Evans et al., 2000), and is the same as the one defined by the Basel Accords. It has now been empirically proven that this ratio could well not reflect the real level of risk of a particular bank (Hau,

Langfield, & Marques-ibanez, 2012). Following Mayes and Stremmel, we use the simple leverage ratio (equity to total assets) instead of regulatory capital adequacy ratio (CAR) as defined by the Basel Accords. The authors demonstrated in their 2012 study that this ratio performs better than the latter in predicting bank distress (Mayes & Stremmel, 2012). They conducted a study on the "effectiveness of capital adequacy measures in predicting bank distress". They employed the CAMELS indicators but with three different capital measures, including the risk-weighted measure of the Basel Accord, the simple leverage ratio, and the gross revenue ratio. They found that the leverage ratio illustrates bank failure in a more substantive fashion. These authors expanded on the advantage of this ratio by stating that it is also difficult to elude and to manipulate (Mayes & Stremmel, 2012). Another advocate of the simplicity and yet superiority of the leverage ratio as a good predictor is Haldane (Haldane, 2012). Additional support comes from empirical studies including (Estrella, Park, & Peristiani, 2000), (IMF, 2009) and (Demirguc-Kunt, Detragiache, & Merrouche, 2010). That is why we will be using the leverage ratio, also called the economic capital ratio (Acharya et al., 2013), instead of the risk-weighted capital adequacy ratio. The leverage ratio is defined as Equity to total assets and was also used by (Cole & White, 2012).

We drew the determinants of bank capital mainly from (Jokipii & Milne, 2008). These include the cost of capital. The ROE (return on equity) is often used even though this variable is also considered as a measure of profit. Also, the expected cost of failure. Here

the authors used non-performing loans to total loans as measure of risk. Due to lack of uniformity of data on non-performing loans in our sample's balance sheets, we will instead use the ratio of total loans to total assets. The third determinant is profit that we measured by ROA (return on assets). As needed, for all the equations we added bank size. Uzun and Webb demonstrated that bank size influenced significantly banks' decisions to securitise (Uzun & Webb, 2007) and other macroeconomic variables such as GDP growth, house price in replacement of inflation, and interbank interest rate to account for the economic pressures and shocks banks are exposed to and that could contribute to their failure (Mayes & Stremmel, 2012).

Econometric model specification

$$\ln TE\_TA_{it} = \alpha_0 + \alpha_1 \ln SEC\_TA_{it} + \alpha_2 \ln TL\_TA_{it} + \alpha_3 \ln LA\_DST_{it} + \alpha_4 \ln TL\_DST_{it} + \alpha_5 \ln ROE_{it} + \alpha_6 \ln OE\_OI_{it} + \alpha_7 \ln BKSIZE(-1)_{it} + \alpha_8 \ln HP(-1)_{it} + Dum2013 + \mu_{it} \quad (4)$$

, where μ_{it} is the error term.

TE_TA is the solvency ratio measured here by total equity to total assets. It is the first component of the CAMELS. This ratio indicates the level of preparedness of banks to absorb economic shock. Berger and Bouwman demonstrated how supportive the level of capital can be during financial crisis (Berger & Bouwman, 2013). Because securitisation

is carried out for multiple reasons (regulatory arbitrage, reputation, liquidity, diversification of funding sources etc.), the expected sign of the relationship between TE_TA and SEC_TA can be either positive or negative. SEC_TA is the ratio of the outstanding volume of mortgage securitised to total assets.

TL_TA is the ratio of total loans to total assets. It indicates the portion of assets in the balance sheet that has been transformed into loans (Cerrato et al., 2012). (Jokipii & Milne, 2008) while considering the determinants of bank capital interpreted this ratio as an indicator of a riskier profile.

LA_DST is the ratio of liquid assets to deposits and other short-term funds. The ratio measures the ability of banks to respond to their short-term commitments. Also called the deposit run off ratio, it reflects the amount of assets immediately available should customers decide to make massive withdrawals (Cerrato et al., 2012). Depending on whether liquidity definitely had a positive or negative impact on profitability, because it also has an opportunity cost (Alper & Anbar, 2011), the level of TE_TA will improve via more retained earnings or not. This liquidity ratio was also used by (Ahmad, Ariff, & Skully, 2008) when they looked at the determinants of banks capital ratios. They argued that a high level of liquidity ratio would reduce liquidity risk, thus also the cost of capital and facilitate new capital raising.

TL_DST is another measure of liquidity. Viewed as the reserve to deposits, it shows the weight of illiquid assets financed by deposits (Cerrato et al., 2012).

ROE is the ratio of the profit to total equity. ROE here is considered as the cost of equity. As such, the relationship with TE_TA is expected to be negative. It can also be found as a determinant in (Jokipii & Milne, 2008).

OE_OI is the ratio of operating expenses to operating income (interpreted as management quality). It appears to be a determinant of TE_TA in the sense that as the operating expenses diminish compared to total income, the profit increases. In the end when more profit is held as retained earnings, total equity increases as well, and we would expect the sign of the relationship to be negative. Similar to (Ahmad et al., 2008), we included management quality as determinant of bank capital ratios. However, we used a different measure (OE-OI) while they employed the ratio of net interest income to total earning assets.

BKSIZE is measured by the total assets of the sample involved in the study. Uzun and Webb evidenced that bank size has an impact on the decision to securitise (Uzun & Webb, 2007). Larger banks have a greater propensity to securitise than smaller banks because they are better equipped in terms financial resources and skills to carry out such complex transactions.

HP stands for house price. House price is the index computed by ABSA Bank, one of the banks in the sample. House price has been demonstrated by Koetter and Poghosyan and others to be a determinant of bank stability. It pushes the value of collateral upwards when it increases, assuming it does not deviate from its fundamental value. When HP increases, it enhances borrowers' net wealth and their capability to pay their debts. As a result, banks are better off in terms of their stability (Koetter & Poghosyan, 2010). The sign here is expected to be positive.

Assets quality

OBS_RWA is here the measure of assets quality as seen in (Koetter & Poghosyan, 2010). It is the ratio of Off Balance Sheet activities to Risk-Weighted Assets. Following these authors, we will infer an increase of this ratio as a decrease of asset quality. OBS here are defined by SA banks themselves as including guarantees, letters of credit, irrevocable commitments, unutilised facilities, borrowing transactions, and sometimes credit derivatives instruments. The problem here is the counterparty risk. Any underperformance of the counterparties will incur significant losses for these banks (MacDonald & Koch, 2006). In the literature, the common indicator of banks' asset quality used is non-performing loans to total loans ratio. However, as the (IMF, 2009) study showed, NPL does not truly reflect whether the assets quality has worsened.

Econometric model specification

$$\ln OBS\_RWA_{it} = \varepsilon_0 + \varepsilon_1 \ln SEC\_TA_{it} + \varepsilon_2 \ln CAR_{it} + \varepsilon_3 \ln TL\_DST_{it} + \varepsilon_4 \ln ROE_{it} + \varepsilon_5 \ln Interbkrate_{it} + \varepsilon_6 \ln ROA_{it} + \varepsilon_7 \ln BKSIZE_{it}(-1) + \varepsilon_8 \ln HP_{it}(-1) + \varepsilon_9 \ln GDP_{it} + Dum2013 + \pi_{it} \quad (5)$$

, where π_{it} is the error term.

TE_TA is the ratio of total equity to total assets. It expresses the strength of banks. From (D. M. Nachane & Ghosh, 2002)'s point of view, a positive or negative relationship will be a response, respectively, to the strength of the equity ratio on one hand and on the other hand an action (hedging), when confronted with weaker equity ratio to prevent the bank from failing. This was also deemed as determinant by (Khasawneh & Hassan, 2010) and (Cooper, 2011). Khasawneh and Hassan concluded that the relationship can be positive as an increase in capital lead to less risk and thus to less OBS. But also, it could be the case if an increase in capital as a good signal, draw more customer that are eventually in need of OBS services. Because CAR, the capital adequacy ratio performed better, we have replaced TE_TA, knowing that earlier explanations also hold for the former and are also used by (P. Calem & Rob, 1999).

TL_TA is the ratio of total loans to total assets and has been used by (D. Nachane & Ghosh, 2007) (Khasawneh & Hassan, 2010) (Elian, 2012). They explained that if this ratio increases, then interest rate risk will increase as well. Consequently, OBS will soar as banks will likely try to hedge against the risk. The former added that higher level OBS might simply result from it offered as service to customer while assessing their loans demand. We have replaced the ratio with an equal one which is TL_DST (total loans to deposit and short-term funds).

Interbank interest rate can influence assets quality because of a ripple effect caused by the rise of the ratio of total loans to total assets or deposits. Also, interest rate variation results in a variation in off balance sheet structure and volume (MacDonald & Koch, 2006).

ROE is the ratio of return on equity, looked at here more as a signal of creditworthiness (D. M. Nachane & Ghosh, 2002) (Khasawneh & Hassan, 2010) and has also been used by (Cooper, 2011).

ROA is the ratio of profit to total assets. It is a measure of profitability (IMF, 2009) from the assets perspective. ROA paints the performance of the assets of the sample. It is related to the OBS_RWA partly because of these OBS in terms of fees expenses and inherent income. We expect the sign also to be negative or positive.

SIZE: According to (D. M. Nachane & Ghosh, 2002) the relationship between bank size and OBS will be positive depending on whether the barriers to entry are or economies of scale hypothesis is accepted. A rather negative sign would result from moral hazard and/or the positioning of the banks as too-big-to-fail. This determinant is also found in (Elian, 2012).

GDP is the growth domestic product, viewed as an indicator of economic pressure with the capability of impacting banks' stability

Management efficiency

OE_OI defined as the ratio of operating expenses to operating income. Also known as the cost-to-income ratio, it is the measure of banks' management team efficiency, their ability to keep their expenses at a reasonable level. OE_OI is used in a similar way by (Petria, Capraru, & Ihnatov, 2015) and (Chiaramonte, Croci, & Poli, 2015).

Management is the third component of CAMELS. The better the ratio is contained the better the profits that will ultimately strengthen bank stability. Securitisation is a costly process that also indirectly generates a lot of profits. We expect a positive or negative sign on the relationship between OE_OI and SEC_TA as it depends on how well the management team balanced the two.

Econometric model specification

$$\ln OE\_OI_{it} = \beta_0 + \beta_1 \ln SEC\_TA_{it} + \beta_2 \ln TL\_TA_{it} + \beta_3 \ln IE\_DST_{it} + \beta_4 \ln OBS\_RWA_{it} + \beta_5 \ln TL\_DST_{it} + \beta_6 \ln ROE_{it} + \beta_7 \ln BKSIZE(-1)_{it} + \beta_8 \ln HP(-1)_{it} + Dum2013 + \Omega_{it} \quad (6)$$

, where Ω_{it} is the error term.

TL_TA is the ratio of total loans to total assets, one of the measures of bank liquidity (Munteanu, 2012)(Roman & Sargu, 2015). It is a determinant of OE_OI in that the interest income from loans is a major portion of operating income. We here expect a negative sign between the two variables.

IE_DST is the ratio of interest expenses to deposits and other short-term funds. This ratio measures the cost of short-term funds (Kasman & Yildirim, 2006)(Lozano-vivas & Pasiouras, 2010). The funding costs which are a function of the combination of the nature of the funds, the interest rate, banks' creditworthiness, and competition (Dietrich & Wanzenried, 2011).

OBS_RWA is the ratio of off balance sheet operations to risk-weighted assets. Off balance sheet activities comprise securitisation, derivatives and so forth. Total operating expenses include fees and commissions incurred during these operations. On the other hand, operating income include revenues from these activities. We expect the sign to be negative as an increase in OBS would increase income compared to expenses.

TL_DST is a ratio of total loans to deposits and other short-term funds known as the intermediation measure equally utilized by (Manlagnit, 2011). OE comprises interest paid on DST while OI is an aggregate made also of interest received from loans granted. We expect the sign of the relationship OE_OI / TL_DST to be positive or negative.

ROE is the ratio of profit to equity (other authors used ROA instead). It is considered here as the measure of bank profitability of the sample during the period investigated, from the equity perspective. It is a determinant of OE_OI as the profit is essentially the result of the difference between OE and OI. We expect the sign to be negative or positive.

BKSIZE can have a positive impact on the management efficiency as large size banks would benefit from an economy of scale.

HP (see explanation from Asset quality in (Koetter & Poghosyan, 2010)).

Earning (profitability)

ROA is the ratio profit to total assets (Yüksel & Zengin, 2016). It is a measure of profitability from the assets perspective. It reflects the performance of the assets of the sample. The relationship between SEC_TA and ROA is expected to be positive because we assume banks would engage in the securitisation transactions to generate profits.

Econometric model specification

$$\ln ROA_{it} = \varphi_0 + \varphi_1 \ln SEC\_TA_{it} + \varphi_2 \ln OE\_OI_{it} + \varphi_3 \ln TL\_TA_{it} + \varphi_4 \ln TE\_TA_{it} + \varphi_5 \ln OBS\_RWA_{it} + \varphi_6 \ln TL\_DST_{it} + \varphi_7 \ln ROE_{it} + + \varphi_8 \ln BKSIZE(-1)_{it} + \varphi_9 \ln HP(-1)_{it} + Dum2013 + \psi_{it} \quad (7)$$

, where ψ_{it} is the error term.

OE_OI is the cost efficiency measure. The ratio is the cost (operating expenses salaries, administration, general expenses, but not loans write off) to operating income (here net operating income including interest income, net fees and commission and other net income before taxation). We have also excluded all impairments and charges. The lower the ratio the better (Chiaramonte et al., 2015).

TL_TA is the ratio of total loans to total assets. This ratio could have a positive impact on the profitability thanks to the interest income they can generate, assuming the level of non-performing loans are limited.

TE_TA is the ratio of total equity to total assets, the measure of bank solvency. It reflects banks' resilience ability in the face of financial shocks. Thus the relationship between TE_TA and ROA can be expected to be positive when lessening the one-period perfect capital market assumption with symmetry information (Athanasoglou, Brissimis, & Delis, 2006), (Petria et al., 2015), (Moussa, 2015)(Petria et al., 2015). Better capitalized banks gain from the volume of customers and from the funding cost on the market because of their appreciable rating on one hand and because of their limited funding requirements on the other hand (Pasiouras & Kosmidou, 2007). From the risk-return perspective, lower TE_TA can lead to higher return (Dietrich & Wanzenried, 2011). Overall, the sign can be positive or negative.

OBS_RWA is the ratio of off balance sheet activities to risk-weighted assets. These activities generate non-interest income. An increase of the ratio via securitisation would also increase ROA. We thus expect the sign to be positive.

TL_DST is the ratio of total loan to deposits and other short-term funds, and is one of the liability liquidity measures (MacDonald & Koch, 2006). More liquidity improves ROA via economy on financing costs even though holding excessive liquidity might also cause higher opportunity cost (Petria et al., 2015). However there is a balance that needs to be observed between the level of loans financed by deposits (that generate interest income

and thus improve ROA) and the level of liquidity to be held in the case of liquidity runs (Albulescu, 2015). Overall, the sign can be either positive or negative, where a higher ratio means lower liquidity.

ROE is the return on equity, here considered as one measure of profitability. The link between the ROE and ROA is established by the equity multiplier where ROE equals ROA times the Equity Multiplier [Total assets to Equity] (MacDonald & Koch, 2006). To put it differently, we would say that ROA equals ROE divided by the equity multiplier (EM), also viewed as the level of leverage. The change in ROA now being a function of the level of ROE and EM, we expect a positive or negative sign on the relationship between ROE and ROA.

Bank Size. The impact of the size on ROA is mix according to (Athanasoglou et al., 2006) (Petria et al., 2015). Big size might mean an economy of scale but also imply actions paralyzed by heavy bureaucracy.

House Price - see explanation from Asset quality in (Koetter & Poghosyan, 2010)

Liquidity

Liquidity here is measured by the ratio of liquid assets to deposits and other Short-term funding. Liquid assets as collected for this study comprise cash and overnight interbank loans, government bonds and treasury bills. Core deposits have the characteristic of being stable and depending on it is a source of stability (Berger & Bouwman, 2013). Core deposits reflect the readiness of banks to face liquidity shocks. If securitisation is carried out to generate more liquidity, then the sign will be positive, otherwise it will be negative. Therefore, we expect a positive or negative sign. The same measures of liquidity can be found in the studies such as (Cardone-Riportella et al., 2010), (Salah & Fedhila, 2012), (López-Andión et al., 2015).

Model specification

$$\begin{aligned} \ln LA\_DST_{it} \;=\; & \Phi_0 + \Phi_1 \ln SEC\_TA_{it} + \\ & \Phi_2 \ln TL\_DST_{it} + \Phi_3 \ln Interbkrate_{it} + \Phi_4 \ln OBS\_RWA_{it} + \Phi_5 \ln ZSCORE_{it} + \\ & \Phi_6 \ln ROA_{it} + \Phi_7 \ln BKSIZE_{it}(-1) + \Phi_8 \ln HP_{it}(-1) + \; Dum2013 + \delta_{it} \end{aligned} \tag{8}$$

, where δ_{it} is the error term.

Interbkrate is the interbank short-term interest rate as applied within the SA banking system. An increase in interest rate can be an impediment for liquidity provision. Therefore, the expected sign is negative. This determinant was also used by (Munteanu, 2012).

OBS_RWA is the ratio of off balance sheet activities to risk-weighted assets. OBS was utilized by (Imbierowicz & Rauch, 2014) when they were looking at the relationship between liquidity risk and credit risk.

ROA is the ratio of return on assets. This ratio indicates how much net revenue banks have been able to make in utilizing their short-term and long-term assets (Moussa, 2015). The higher the return the higher the level of liquidity via retained earnings (Roman & Sargu, 2015).

BKSIZE is an important determinant. Roman and Sargu mentioned the crowding-in effect that is engendered when a bank is large. They meant that having more customers is synonymous with more deposits being received by the bank and that ultimately more liquidity is engendered. However, a shift may occur in favour of small banks when there is a competitive advantage in terms of interest rates offered on deposits. Overall, the relationship between bank size and liquidity can be positive or negative (Roman & Sargu, 2015).

HP (house price) - see explanation from Asset quality in (Koetter & Poghosyan, 2010)

Sensitivity to market risk (interest rate risk)

NII_TA is one measure of the sensitivity of banks to interest rate risk. The volatility that can be observed in the NII echoes the interest rate risk (MacDonald & Koch, 2006) . NII_TA is the ratio of net interest income to total assets. Net interest income is the difference between total interest income and interest expenses. When an interest rate varies (interest rate risk), it destabilizes the net interest income and the structure and volume of bank assets and liabilities (MacDonald & Koch, 2006). This ratio is also viewed as the reflection of financial intermediation effectiveness (Moussa, 2015). We examine here how securitisation of mortgage loans impacts net interest income to total assets ratio. The model specification is:

$$\begin{aligned}&\mathrm{lnNII\_TA_{it}}\\&= \lambda_0 + \lambda_1 \mathrm{lnSEC\_TA_{it}} + \lambda_2 \mathrm{lnTE\_TA_{it}} + \lambda_3 \mathrm{lnInterbkrate_{it}} + \lambda_4 \mathrm{lnTL\_DST_{it}} +\\&+ \lambda_5 \mathrm{lnDST\_TA(-1)_{it}} + \lambda_6 \mathrm{lnBKSIZE(-1)_{it}} + \lambda_7 \mathrm{lnHP(-1)_{it}} + \lambda_8 \mathrm{lnGDP(-1)_{it}} + \mathrm{Dum2013} +\\&\mathrm{n_{it}} \qquad (9)\end{aligned}$$

, where $\mathrm{n_{it}}$ is the error term.

TE_TA is the solvency ratio. A different aspect of interest rate change is its impact on the market value of stockholders' equity (MacDonald & Koch, 2006). Because change in interest rate is part of market shocks, a well-capitalized bank will be preserved from shock (Ballester, Ferrer, Gonzalez, & Soto, 2009).

Interbkrate is the interbank interest rate. The direction of the relationship with the dependent variable will indicate how much the latter changes when there is an increase of interest rate (MacDonald & Koch, 2006).

TL_DST is the ratio of total loans to deposits and other short-term funds. It indicates the portion of loans financed by deposits (Entrop, von la Hausse, & Wilkens, 2016). According to (Ballester et al., 2009), the fact that there is a maturity mismatch between loans and other assets and liabilities further exposes banks to interest rate risk when the volume of loans increases (Ballester et al., 2009).

DST_TA is the ratio of deposit and other short-term funds to total assets. Deposit and other short-term funds growth relative to total loans has a mix influence on the exposure to interest rate risk. Depending on the country, exposure to interest rate risk can increase or decrease following an increase of deposits (Racic, Stanisic, Racic, & Gmbh, 2014).

Bank size in the log of total assets. Size matters, especially regarding big banks, in terms of risk sharing, portfolio diversification in order to reduce risk, but also because a notion of too-big-to-fail can lead to incommensurate risk taking behaviour for greater return (Entrop et al., 2016)(Ballester et al., 2009). Total assets growth has a mix influence on the exposure to interest rate risk. Depending on the country, exposure to interest rate risk can increase or decrease following an increase of bank assets (Racic et al., 2014).

House Price (Koetter & Poghosyan, 2010) and Growth Domestic Product are all macroeconomic variables.

3.3.2.2.2 Securitisation and Z-score

Following (Michalak & Uhde, 2011), (Salah & Fedhila, 2012) and (López-Andión et al., 2015), we employ Z-score as a proxy of bank stability. The version used here is the banks accounting database which is different from the version called distance-to-default that relies on the banks stock price data.

Z-score is credited to (ROY, 1952), (Hannan & Hanweck, 1988) and (Boyd, Graham, & Hewitt, 1993) according to (Strobel, 2011). Z-score is known as a measure of insolvency risk. ´ It represents the number of standard deviations that a bank's rate of return on assets has to fall from the mean for the bank to become insolvent ´ (Anginer, Demirgüç-Kunt, Huizinga, & Ma, 2014), that is, for a bank to see its equity washed-out. As Delis et al. argue"it is the standard deviation between the expected values of ROA and the negative values of ROA = -EA that yield insolvency"(Delis, Hasan, & Tsionas, 2014). A higher score indicates a lower probability of failure.

The advantage of the measure is that it is relatively straightforward to calculate. It also requires little data. The evidence from Chiaramonte et al.'s study demonstrated that Z-

score and CAMELS have comparative advantage in detecting distress events during the GFC. The same study showed that Z-score performs better when it comes to sophisticated financial institutions (Chiaramonte et al., 2015). However, it does not provide an indication on the contagion relation or correlation between financial institutions (Diaconu & Oanea, 2014). (Delis et al., 2014) also argued that this measure is based on historical data and does not capture a bank's short-term risk nor the endogeneity of bank risk to other bank characteristics.

Strobel justified the use of Z-score as follows: he starts with the definition of bank insolvency as the state where $(car + roa) \leq 0$, with *car* is the bank's capital-asset ratio and the *roa*, the bank's return on assets. According to this author, if roa is a normally distributed random variable such that $roa \sim N(\mu_{roa}, \sigma^2_{roa})$, the author reported, referring to (Boyd & Graham, 1986) that, the probability of insolvency can be given as

$$P(roa \leq -car) = p\left(\frac{roa-\mu_{roa}}{\sigma_{roa}} \leq -Z\right) = \Phi(-Z),$$

where the Z-score is defined as $Z = \frac{car+\mu_{roa}}{\sigma_{roa}} > 0$

and $\Phi(.)$ is the cumulative distributive function of the standard normal distribution $N(0,1)$ (Strobel, 2011)

Salah and Fedhila put the mathematical formulation of the Z-score as it follows (Salah & Fedhila, 2012),

$$Zscore_{it} = \frac{ROAA_{it} + {E_{it}}/{A_{it}}}{\sigma(ROAA_{it})}$$

Where $ROAA_{it}$ is the return on average assets and ${E_{it}}/{A_{it}}$ the ratio of equity to total assets.

We constructed our Z-score following the steps used by (López-Andión et al., 2015). For each year, we calculate the Z-score by adding the ROAA to the ratio of equity to total assets all divided by the standard deviation of the ROAA calculated over the whole period designed for the study. The ROAA is the return on average assets before taxes.

Bank Size: in a study conducted by Uzun and Web, they demonstrated that banks' size is determinant in their decision to securitise their assets (Uzun & Webb, 2007).

Z-score (I)

$$\begin{aligned}\ln Zscore(1)_{it} = {} & \alpha_0 + \alpha_1 \ln SEC\_TA_{it} + \alpha_2 \ln RWA\_TA_{it} + \alpha_3 \ln TE\_TA_{it} + \\ & \alpha_4 \ln LA\_TA_{it} + \alpha_5 \ln TL\_DST_{it} + \alpha_6 \ln ROE_{it} + \\ & \alpha_7 \ln Interbrate_{it} + \alpha_8 \ln BKSIZE_{it} \ \alpha_9 \ln HP_{it}(-1) + \alpha_{10} \ln GDP_{it}(-1) + Dum2013 + \mu_{it}\end{aligned} \quad (10)$$

, where μ_{it} is the error term.

Z-score (II)

$$\ln Zscore(2)_{it} = \alpha_0 + \alpha_1 \ln SEC\_TA_{it} + \alpha_2 \ln SBL\_SEC_{it} + \alpha_3 \ln Interbkrate(-2)_{it} + \alpha_4 \ln TL\_DST_{it} + \alpha_5 \ln RWA\_TA_{it} + \alpha_6 \ln NII\_TA_{it} + \alpha_7 \ln BKSIZE_{it} + \alpha_8 \ln BKCON(-1)_{it} + \alpha_9 \ln HP(-1)_{it} + \alpha_{10} \ln GDP(-1)_{it} + Dum2013 + \mu_{it} \quad (11)$$

where the μ_{it} of both Z-scores are the error terms.

And where in either equation:

We use the log of the Z-score because according to (Lepetit & Strobel, 2015), under this form its distribution is not as heavily skewed as the simple one's.

RWA_TA is the ratio of risk-weighted assets to total assets and it is viewed as an indicator of credit risk (Salah & Fedhila, 2012). In their study on the impact of securitisation on credit risk and bank stability, Salah and Fedhila used this ratio as a dependent variable along with the Z-score which they all see as measures of risk. We utilised the RWA_TA ratio instead as one of our independent variables for bank stability with the understanding that it can contribute to the contraction of the distance from insolvency that defined the Z-score.

TE_TA is the ratio of total equity to total assets. This was used as well in the literature as a determinant of bank stability measure by Z-score (Salah & Fedhila, 2012).

SBL_SEC (Sarkisyan & Casu, 2013) is the ratio of Retain interests (specifically Subordinated loans) to Outstanding securitised assets: retain interests in the securitisations programmes are credit enhancements and other guarantees meant to protect investors from potential losses. A 2013 study showed that they can have a negative impact on banks' insolvency risk, in particular the provision of subordinated (first loss) facilities (Sarkisyan & Casu, 2013). The 2008 Financial Crisis revealed that securitisations were carried out for regulatory arbitrage purposes via the setting up of conduits provided with explicit guarantees that in the end prevented risk transfer (as it should) to investors (Acharya et al., 2013). Building on these two papers, we introduced the variable subordinated loans (first and second loss) to the securitised assets ratio. Other liquidity and redraw facilities could be added but they have not been used on a consistent basis in our sample.

LA_TA is the ratio liquid assets to total assets which indicate the level of bank liquidity. It can be found in several studies as determinant of bank stability, for example (Salah & Fedhila, 2012)(López-Andión et al., 2015)(Sarkisyan & Casu, 2013)

TL_DST is the ratio of total loans to deposit and other short-term funds. This ratio is another indicator of liquidity level as it tells how the level of short-term funds remaining available after a share has been allocated to loans.

ROE is a return on equity, an indicator of bank performance. Following Salah and Fedhila, then Jiangli and Pritsker, we considered this ratio as another useful independent variable (Salah & Fedhila, 2012)(Jiangli & Pritsker, 2008).

NII_TA is the ratio of net interest income to total assets. It was employed by López-Andión et al in their study on the solvency of financial institutions where they drew lessons from securitisation. They viewed this ratio as a measure of bank profitability (López-Andión et al., 2015)

Bank size is measured by the logarithm of total assets. Salah and Fedhila posited that large banks has more opportunities to diversify their activities and thus would have a negative relation with credit risk (Jiangli & Pritsker, 2008).

We included some macroeconomic variables:

From Mayes and Stremmel's point of view, interbank interest rate, inflation, and GDP (Gross Domestic Product) are indicators in which economic burdens become apparent. Their deterioration is able to fragilize the banking stability (Mayes & Stremmel, 2012).

Interest rate is equally utilised as determinant by (Salah & Fedhila, 2012)(López-Andión et al., 2015)

We have replaced inflation with house price. Koetter and Poghosyan, looking at the relationship between real estate markets and banks'distress in Germany, demonstrated in their study that house price deviations from their fundamental values are contributing factors to bank instability (Koetter & Poghosyan, 2010).

Bank concentration is measured by HHI. It is defined as the sum of the squares of banks' market shares (Petria et al., 2015). We have added this variable as seen in the study by Salah and Fedhila, and López-Andión et al where is it surmised (from the literature) that the higher the level of concentration the higher the exposure of banks to risk. At the same time, it seems that too much competition would not be desirable either (Salah & Fedhila, 2012)(López-Andión et al., 2015).

3.4 Conclusion

We conclude this chapter on the key assumptions that underpinned this study. (1) The researcher has assumed that the financial information available in the banks' annual reports are reliable since they are referred to most of the time as audited by well-known audit firms. Also, financial reports are available to investors and other third parties for them to make informed decisions. (2) The researcher has also assumed that the four big

banks chosen in this study are representative of the banking population in South Africa since they hold a monopolistic position in the South African banking system.

(3) The data regarding the volume of RMBS are assumed accurate as we collected them from different sources (the Johannesburg Stock Exchange, the respective banks and looked on the South African Banking Association website) and found that the volume securitised matched approximately year by year (specifically the last two sources).

(4) Other assumptions are drawn from the theories underpinning this study: i.e. agency and institutional theories. They are indicated in chapter 2.

Chapter 4
Empirical Results

"All parameters associated with economic behaviour are local approximations applying to a specific time and place"
(Kennedy, 2008) – (recalling John Maynard Keynes' description of econometrics)

This chapter presents the estimation process and the interpretation of the research findings. The data were analysed with the support of Eviews 9.5 software version.

The common features regarding the handling of all the data are the following: first, all the variables were log-transformed to ensure their linearity. Second, challenged with the limited number of observations needed to achieve models stability and perform other tests[34], we converted the data from a lower frequency (annually data) to higher frequency (quarterly data). We opted for the constant-match average conversion method, among others proposed in Eviews software, where the annual outstanding balances of our variables were reported identically in each quarter. We justify this choice by the fact that, as equally explained in the software, the values remained constant each quarter during the year and seems not to have significantly changed the standard deviations and the quarterly data variations from one year to another. However, because of this transformation, some of the log variables (three out of twenty-four) that were originally normally distributed

[34] For example, a minimum of 20 observations were required by the software for the ADF and PP tests, while we only had 8 years of data. The conversion then increased the number to 32 quarterly observations.

now appeared non-normally distributed at less than 1% significance level[35]. However, a sample size (understood as the number of observations) of more than 30 or 40 can still yield good parametric inferences even though the normality assumption is violated (Ghasemi & Zahediasl, 2012). In this study, we have 32 observations from our time series data. Furthermore, McDonald argued that after transformation, if the data remained non-normally distributed, parametric tests can nevertheless be used because they are not so easily responsive to non-normality (McDonald, 2014). The third common feature is that all our variables were first-differenced to avoid spurious regression because as shown in Table 4.5 in the appendix, they were all found to have unit roots. Units roots tests were performed employing the Augmented-Dicker Fuller and Phillips-Peron unit roots tests. Fourth, all the baseline specifications included a dummy variable that accounts for the 2008 global financial crisis with 1-(one) throughout 2008 and 0-(zero) elsewhere. Fifth, another dummy variable was added each time needed to capture some few outliers. Sixth, some variables were incorporated in the models with a one period lag aiming at mitigating the unpredictable effects of multicollinearity. Seventh, the results are interpreted ceteris paribus (meaning, holding all other explanatory variables constant (Koop, 2008)).

The research questions of this study, in a nutshell, were knowing why SA banks securitise mortgage loans – with a special focus on regulatory capital arbitrage - and how these

[35] Please see annotations on Table 4.1 in Appendix (a Jarque-Bera probability value of more than 5% indicates normal distribution)

activities affect their soundness. The ultimate objective of this chapter is to answer these questions by estimating a model of mortgage loans securitisation impact on Total Regulatory Capital Ratio, Loan Ratio, Risk and Bank Stability. The chapter splits the analysis and the results into two parts. The first section focuses on the relationship between securitisation of mortgage loans and regulatory capital arbitrage. The second section examines the relation between securitisation of mortgage loans and bank stability.

Section 4.1 Securitisation of mortgage loans and regulatory capital arbitrage.

This section presents the results pertaining to the acceptance or rejection of the first hypothesis formulated in chapter one. The null hypothesis tested stipulated that South African (SA) banks do not securitise mortgage loans for regulatory arbitrage. This was done through the following steps: descriptive statistics, correlation matrix, models specification, model estimation and results analysis, diagnostic and stability tests, robustness check and conclusion.

4.1.1 Descriptive statistics and correlation matrix

Graphs of all the variables

The year 2008 and 2013 marked the dates where Basel II and Basel III regulations respectively were implemented in South Africa. Our data starts in 2008 and ends in 2015.

They capture the impact of both regulations. 2008 specifically corresponds to the pick of the securitisation of mortgages activities in South Africa. It also coincides with the period where the financial crisis started, caused among other reasons by the careless use of securitisation. So, the graphs (in Appendix – Figure 4.1) provide a glimpse of how four of the main SA banks responded as the crisis was hitting and after. For example, it can be noticed that the volume of mortgage securitisation has continued decreasing since 2008, as well as total loans after a spike in 2009. The ratios of profitability have decreased similarly while expenses have increased.

Other descriptive statistics and correlation matrix are equally attached in Appendix (Tables 4.1 and 4.2).

Model specification

The purpose of this section is to answer the question of whether SA banks securitise for regulatory arbitrage or alternatively for funding reasons. In the literature, RCA (regulatory capital arbitrage) is clearly mentioned as one of the reasons why banks securitise their mortgage loans. The hypothesis tested here is that [H0], as risk averse agents[36], SA banks do not securitise mortgage loans for RCA purpose. Consequently, Mortgage loans securitization is expected to not negatively affect SA banks' risk-based capital ratio [CAR], nor positively influence the level of risk [RWA_TA], nor positively affect their loan ratio

[36] consideration derived from the agency theory (AT) presented in the theoretical framework in chapter 2.

[*Loans*]. Instead[H1], as risk averse agents, it is assumed that SA banks securitise mortgage loans mostly for funding purpose. Thus, Mortgage loans securitisation is expected to positively affect South African banks' liquidity ratios [*DST_TA; TL_DST*]. We proceed the statistical analysis starting with the OLS (ordinary least squares) regression, then adjusted the results with the Generalized linear technique. The variables are defined in Chapter 3.

Our models specified in Chapter 3 as it follows:

$$\ln CAR_{it} = \Phi_0 + \Phi_1 \ln SEC\_TA_{it} + \Phi_2 \ln DST\_TA_{it} + \Phi_3 \ln TL\_DST_{it} + \Phi_4 \ln BKSIZE_{it} + Dum2013 + \delta_{it} \quad (1)$$

, where δ_{it} is the error term and i =1,...n and t=1,⋯,T

$$\ln RWA\_TA_{it} = \varphi_0 + \varphi_1 \ln SEC\_TA_{it} + \varphi_2 \ln ROE_{it} + \varphi_3 \ln TL\_TA_{it} + \varphi_4 \ln DST\_TA_{it} + \varphi_5 \ln TL\_DST_{it} + \varphi_6 \ln BKSIZE_{it} + Dum2013 + \upsilon_{it} \quad (2)$$

, where υ_{it} is the error term.

$$\ln TL\_TA_{it} = \omega_0 + \omega_1 \ln SEC\_TA_{it} + \omega_1 \ln ROE_{it} + \omega_2 \ln Interbrate_{it} + \omega_3 \ln IE\_DST_{it}(-1) + \omega_4 \ln ROA_{it} + \omega_5 \ln DST\_TA_{it} + \omega_6 \ln TL\_DST_{it} + \omega_7 \ln BKSIZE_{it} + Dum2013 + \varepsilon_{it} \quad (3)$$

, where ε_{it} is the error term.

Model (I) specification is close to Uzun and Webb's study where the regulatory arbitrage theory of securitisation was tested (Uzun & Webb, 2007). Just as these authors, we included the following variables: Capital ratio (here as the dependent variable), and as independent variables, securitisation ratio and bank size. Because the purpose here is to test our null hypothesis (Ho) that SA banks do not securitise for capital arbitrage motive, we accordingly expected the signs to be respectively [+] and [+]. Unlike Uzun and Webb, we added two liquidity measures in our model specification. We used Deposits and other short-term funds to Total Assets ratio, and Total Loans to Deposits and other short-term funds. The expected signs for both measures are respectively [+] and [-].

Model (II) is similar to (Dionne & Harchaoui, 2008). The purpose here is to complement (I) with a clear answer to the second aspect of RCA definition in the literature which states that RCA reduces the regulatory capital while increasing risks. These authors as well as (Acharya et al., 2013) approximated this risk with the ratio Risk-weighted assets to Total Assets. The idea here was to see how securitisation affects this ratio. In the same way as argued by these authors, a positive relationship would imply higher risks taken by SA banks through securitisation and would go against the hypothesis from the agency theory that they are risk averse. So, we expect a negative sign [-] based on this hypothesis. As for the covariates, the cost of fund would be positive [+] as an increase create incentives to take more risk to compensate, Total Loans to Total assets [+] because an increase would push overall risk level upward, Deposits and other short-term funds to Total assets [+/-] will

all depend on how much is utilised, and Total loans to Deposits and other short-term funds [+] as a rise in this ratio can only be indicative of increased risk.

Model (III) is meant to evidence whether securitisers in SA expand their loans level via securitisation of mortgage loans. (P. Calem & Rob, 1999) demonstrated in their study that well-capitalised banks take even more risk when the regulatory capital required increases. (Jokipii & Milne, 2008) while considering the determinants of bank capital, interpreted total loans to total assets ratio as an indicator of a riskier profile. Total loans to assets ratio is the dependent variable. It is joined by SEC_TA and other covariates that potentially can have an influence such as the cost of fund (ROE, Interest Expenses(IE_DST)), liquidity measures (LA_DST, TL_DST, DST_TA), the cost of short-term interbank fund (Interbank interest rate). Again, because of the assumption from the agency theory that these banks are risk averse, we expect the signs to be respectively [-] for securitisation, then [-] for the cost of funds as an increase would reverberate on loan pricing and slow down loans extension by discouraging potential borrowers, and [+] for all liquidity measures as used to fund loans.

4.1.2 RCA models estimation

Table 4.5 Estimated results RCA

Dependent variables / Independent Variables	CAR (I)	RWA_TA (II)	TL_TA (III)
SEC_TA	-1.011 (0.168) *	0.867 (0.050) *	0.475 (0.203) **
ROA			-0.502 (0.214) **
TL_TA		-0.680(0.031) *	
ROE		-0.411(0.010) *	0.158(0.147)
IE_DST			-0.004(0.005)
Interbrate			-0.020 (0.012)
TL_DST	0.972 (0.536) ***	0.128(0.069) ***	0.315(0.344)
DST_TA	0.820 (0.283) *	1.177(0.038) *	1.537(0.540) **
BKSIZE	-1.177(0.204) *	1.410(0.063) *	0.964(0.431) **
Dum2013	-0.006(0.004)	-0.001 (0.001)	0.003(0.003)
Constant	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Standard error regression	0.006	0.001	0.006
N	30	30	30

(*) significance at 1% level. (**) significance at 5% level. (***) significance at 10% level

Because TL_TA appears as an independent variable in the RWA_TA equation, II and III were also estimated as simultaneous equations with the two stage least squares method (results - in Appendix Table 6 - and do not show major differences).
CAR, RWA_TA and TL_TA are analysed with the OLS technique and then adjusted with the generalized least squares model (specifically the white heteroskedasticity-consistent standard errors and covariance). RWA_TA and TL_TA are also analysed with the two stages least square because TL_TA as endogenous variable appears in both equations (results are in Appendix).
SEC_TA: ratio outstanding volume mortgages securitized to total assets; CAR: capital adequacy ratio (Tier1 + Tier2/RWA); ROE: return on equity; ROA: return on assets; Interbkrate: interbank short-term interest rate; RWA_TA: ratio Risk-weighted assets to Total Assets. TL_TA: ratio total loans to total assets; IE_DST: ratio Interest expenses to deposits and other short-term funds; TL_DST: ratio total loans to deposits and other short-term funds; DST_TA: ratio deposits and other short-term funds to total assets; BKSIZE is aggregate total assets; Dum2008: dummy accounting for 2008 global financial crisis.

Models performance: all the models performed well with an R-squared correspondingly 92%, 99%, and 88% for (I), (II) and (III) when we used OLS regression method. This means that the models were properly specified and moreover that the variance of the regulatory capital (CAR), RWA_TA and Total Loans (TL_TA) are between 88% to 99% explained by all our regressors.

Looking at the overall model's significance, the F-statistic test is one of the measures. The null hypothesis here is that the regressors included in this model are not effective. The P-value of the F-statistic is significant at 1% level for the three models, meaning that the Ho hypothesis is rejected. Indeed, the explanatory variables performed well, making the overall models statistically significant.

4.1.3 Results analysis

In (I), SEC_TA is the ratio of the outstanding volume of mortgage securitised to total assets. This variable depicts the level of SA banks involvement in the securitisation

transactions. The coefficient is negative and significant at 1% level. This reflects an inverse relationship between securitisation activities and regulatory capital. This suggests that securitisation has a negative impact on the level of regulatory capital. This result falls in line with (Dionne & Harchaoui, 2008) where they found that the securitisation of Assets-Backed securities, including Mortgage-Backed Securities (RMBS) by Canadian banks reduces their regulatory capital. Similarly, (Uzun & Webb, 2007) found, with the USA data, that there is also an inverse relationship between regulatory capital and the securitisation of other ABS(credit cards) but a positive statistical significance relation with the RMBS. While at this stage, Dionne and Harchaoui were cautious in drawing any conclusion about regulatory arbitrage because they intended to evidence the risk-taking aspect, Uzun and Webb suggested based on their analysis that the result with the ABS(credit cards) already implies a practice of regulatory arbitrage. (Ambrose et al., 2005) found with USA data that RMBS were also used as regulatory capital arbitrage medium based on the evidence that higher risk loans were retained and lower risk portion securitised and not via capital adequacy ratios. (Martín-Oliver & Saurina, 2007) in Spain reached a different conclusion according to which RMBS were securitised only to meet liquidity needs. (Cardone-Riportella et al., 2010) in another study in Spain did not find any evidence of RCA either by Spanish banks with all type of assets, including RMBS. Both studies in Spain used the CAR ratio. (Agostino & Mazzuca, 2011) findings in Italy support our results that RMBS minimise CAR and would mean RCA.

Model (II) highlights in a more straightforward way the relation between securitisation and risk, approximated by RWA_TA. Let's recall that RCA reduces the CAR with no or little curve of risks (Jones, 2000). This model is close to the one used by (Dionne & Harchaoui, 2008) and (Salah & Fedhila, 2012). The key point here is that the coefficient of the relation between RWA_TA and SEC_TA is positive and significant at 1% level. This infers that securitisation increases risks and thus confirms the outcome found by (Dionne & Harchaoui, 2008) and (Salah & Fedhila, 2012). Furthermore, having the same interest as (Acharya et al., 2013), we reverse the dependent variable ratio and replace RWA_TA by TA_RWA and found a negative and highly significant coefficient (results in Appendix). As securitisation volume grows, the ratio of TA to RWA decreases.

Model (III) looked at the impact of SEC_TA on the expansion of total loans (TL_TA). SEC_TA has a positive and significant coefficient. 1% increase in securitisation of mortgages leads to 47% change in total loans. This might indicate that SA banks use securitisation to expand their loans portfolio. It possibly also implies that, if SA banks are not risk-adverse as the previous outcome seems to indicate, then as argued by (Blum, 1999) expecting more equity tomorrow would mean taking higher risks today, if SA banks, like banks in general, perceive regulatory requirements as equity-costly, via cost-benefit analysis (Jones, 2000). This result, as far as the researcher is aware of, is a novelty. Previous studies evolved around model (I) and (II). Apart from (Uzun & Webb, 2007), (Cardone-Riportella et al., 2010), this variable (TL_TA) was also used by (Dionne & Harchaoui, 2008), however only as an independent variable.

Other costs of fund and two out of three liquidity variables have expected signs. Costs of fund have negative coefficient and not significant. As for the two liquidity variables, the coefficients are positive and one is significant at 5%, demonstrating perhaps how decidedly they contributed in loans growth.

BKSIZE in the three models (I, II, III) is measured by total assets. This variable has a negative coefficient and is significant at 1% level in (I). This shows a negative relationship between bank size and regulatory capital. It means that when total assets increase, the level of regulatory capital diminishes probably due to securitisation. However, in (II) and (III) the coefficient is positive when it comes to bank size and risk-weighted assets ratio to total assets on one hand, and total loans on the other hand. Our overall view is that for SA banks, the extent of securitisation depends more on the level of loans than total assets. Moreover, the increase of assets is accompanied by an increase of the level of risk.

The dummy variable accounting for the year 2013 implementation of Basel III with 1 that year and 0 otherwise is not significant in the three models.

In summary, regarding our null hypothesis (Ho), the direction of the key relationships among the related variables is contrary to the anticipated signs. All Three models corroborated the definition of RCA. Capital ratio and securitisation have inverse relationships while there is a positive relation between securitisation and risk approximated by risk-weighted assets to total assets. Moreover, there is a positive and significant association as well between loan ratio and securitisation. These results are thus

highly suggestive that SA banks do securitise motivated by capital arbitrage. Consequently, this means that our null hypothesis against capital arbitrage is rejected.

4.1.4 Diagnostic and stability tests

We started the analysis employing the OLS technique. There are three common diagnostic tests for the OLS method for a good model. They include the fact that the errors terms must be normally distributed, there must be no serial correlations among the independent variables and no heteroscedasticity. Eviews software offers the Jarque-Bera test for the first diagnostic test. The null hypothesis is that the error terms are normally distributed. Model I, II and III exhibited probability values of respectively 28%, 28% and 14 %, which are all more than 5% level of significance. This means that the null hypothesis of normality of residuals is accepted. Consequently, it can be concluded that our model's predictions are not biased.

The second test for serial correlation employed the Breug-Godfrey serial correlation test. The null hypothesis is no serial correlation. Tests for the three models showed that the Obs*R-squared of the tests had probability values of 20%, 16% and 96%. These outcomes accept the null hypothesis that there no serial correlation in our model's specifications.

The third test looks at whether there is heteroscedasticity (no constancy) in the variance of the error terms. The Breug-Pagan-Godfrey heteroscedasticity test's null hypothesis is that there is homoscedasticity. Our three models generated a probability values which were significant at 1% level, thus rejecting the homoscedasticity hypothesis. To solve this

problem, (Asteriou & Hall, 2011) suggest using the generalised linear method. This method encompasses different procedures including the White's heteroscedasticity-consistent estimation method. The latter is appropriate when it is difficult to identify the variable causing the problem. We thus followed the steps as described by these authors and believe that we have obtained, as they predict, the estimates that are consistent and the estimators that are efficient.

The stability tests were carried out with the CUSUM test. The graph shows that all the three models are stable.

4.1.5 Robustness check

Model (I) robustness check was inspired by the work of (Acharya et al., 2013) where they evidenced how Assets Backed Commercial Paper (ABCP) conduits were used by banks before the GFC for regulatory arbitrage purpose and how the setting up of these structures negatively affected their balance sheets during the GFC. In their study, ABCP exposures are the dependent variable. This is also analogous to (Dionne & Harchaoui, 2008)'s paper where securitisation is the dependent variable. Here then, we have reversed the position of the two main variables by employing SEC_TA as the dependant variable as well. Unlike model (I), we supplemented this new specification with the ratio liquid assets to deposits and other short-term funds as needed to improve its goodness. This ratio shows the level

of liquid assets available. The target was the relationship between CAR and SEC_TA. Leaning on the assumption that SA is risk-averse agents (AT), the expected sign is [+].

The outcomes (reported in Appendix – Table 7) showed an inverse relationship between CAR and SEC_TA where the coefficient is significant at 1% level. This confirms the statistical result in model (I). Similar results were reached by (Acharya et al., 2013) when studying ABCP conduits. In the same interpretive manner as Acharya et al in the same study on ABCP, we look at the trend of the ratio total assets to risk-weighted assets, assuming that if the securitisation of mortgage loans has decreased during the period studied as it indeed has, then we will see this ratio decreasing also. What we observed is that in 2008 this ratio was 2 and has remained roughly the same throughout the period until 2015 at 1.9. Which leads us to the conclusion that securitisation with RCA motive reduces the level of regulatory capital with no or little reduction of risk as argued by Jones (2000).

Furthermore, surprisingly an increase in total assets as a measure of bank size had an inverse and strong relation with securitisation. This suggests that the increase in the level of securitisation was more determined by the level of loans issued than total assets.

TL_TA's coefficient was positive but not significant. Significance would have been interpreted as total loans increasing together with securitisation activities.

LA_DST is the ratio of liquidity to deposits and other short-term funding, in the same way as in (Cardone-Riportella et al., 2010), (Agostino & Mazzuca, 2011). The coefficient is

also positive but not significant. Significance would have indicated that liquidity fosters securitisation possibly as a source of securitisation costs funding.

TL_DST is another measure of liquidity used in this model, from (Martín-Oliver & Saurina, 2007). The statistical results confirms the previous liquidity measure's above in exhibiting a positive coefficient with no statistical significance.

Further robustness check was done by conducting similar regression analyses with natural data. The results confirm our first findings (see Table 4.10 in Appendix).

Section 4.2 Securitisation of mortgage loans and bank stability

In this section, the point of focus is whether securitisation of mortgage loans affects negatively or positively SA banks' stability. The hypothesis tested here is originated from the agency theory and formulated as follows: If SA banks do not engage in regulatory arbitrage (because they are risk-averse) and random effects (i.e. macroeconomics factors) are favorable, then mortgage loans securitisation do not negatively affect SA banks 'stability(Ho). In other words, the hypothesis tested stipulates that in good time, securitisation of mortgage loans positively affects SA banks stability and in a bad time, it does the reverse, if there no RCA. This task was done through the following steps: descriptive statistics, correlation matrix, models specification, model estimation and results analysis, diagnostic and stability tests, robustness check and conclusion. Here we utilised two measures of bank stability named CAMELS and Z-score.

4.2.1 Securitisation and CAMELS

CAMELS stands for Capital, Asset quality, Management efficiency, Earnings or Profitability, Liquidity and Sensitivity to market risk, specifically in this study, sensitivity to interest risk.

4.2.1.1 Descriptive statistics and correlation matrix

Details of descriptive statistics and correlation matrix can be found in the appendix (Table 4.3).

Model specification (seen in Chapter 3)

Securitisation and CAMELS relation is analysed with the two stage least square method. All the variables were defined and their inclusion in the regressions justified in Chapter 3. Our model's specifications are as follows:

Securitisation and capital

$$\begin{aligned}&\ln TE\_TA_{it}\\&= \alpha_0 + \alpha_1 \ln SEC\_TA_{it}\\&+ \alpha_2 \ln TL\_TA_{it} + \alpha_3 \ln LA\_DST_{it} + \alpha_4 \ln TL\_DST_{it} + \alpha_5 \ln ROE_{it} + \alpha_6 \ln OE\_OI_{it} + \alpha_7 \ln BKSIZE(-1)_{it}\\&+ \alpha_8 \ln HP(-1)_{it} + Dum2013 + \mu_{it} \qquad (4)\end{aligned}$$

, where μ_{it} is the error term.

Instruments for the endogenous regressors LA_DST and OE_OI are respectively Z-SCORE and GDP. The latter are determinants but not included in the specification.

Securitisation and asset quality

$$\begin{aligned}&\ln OBS\_RWA_{it}\\&= \varepsilon_0 + \varepsilon_1 \ln SEC\_TA_{it}\\&+ \quad \varepsilon_2 \ln CAR_{it} + \varepsilon_3 \ln TL\_DST_{it} + \varepsilon_4 \ln ROE_{it} + \varepsilon_5 \ln Interbkrate_{it} + \varepsilon_6 \ln ROA_{it} + \varepsilon_7 \ln BKSIZE_{it}(-1)\\&+ \varepsilon_8 \ln HP_{it}(-1) + \varepsilon_9 \ln GDP_{it} + Dum2013 + \pi_{it} \qquad (5)\end{aligned}$$

, where π_{it} is the error term.

Instrumental variable for the endogenous regressor ROA is TL_TA. The latter is a determinant of ROA but not included in the specification.

Securitisation and management efficiency

$$\begin{aligned}&\ln OE\_OI_{it}\\&= \beta_0 + \beta_1 \ln SEC\_TA_{it}\\&+ \beta_2 \ln TL\_TA_{it} + \beta_3 \ln IE\_DST_{it} + \beta_4 \ln OBS\_RWA_{it} + \beta_5 \ln TL\_DST_{it} + \beta_6 \ln ROE_{it} + \beta_7 \ln BKSIZE(-1)_{it}\\&+ \beta_8 \ln HP(-1)_{it} + Dum2013 + \Omega_{it} \qquad (6)\end{aligned}$$

, where Ω_{it} is the error term.

Instrumental variable for the endogenous regressor OBS_RWA is BKCON. The latter is a determinant of OBS_RWA but not included in the specification.

Securitisation and profitability

$$\ln ROA_{it} = \varphi_0 + \varphi_1 \ln SEC\_TA_{it} + \varphi_2 \ln OE\_OI_{it} + \varphi_3 \ln TL\_TA_{it} + \varphi_4 \ln TE\_TA_{it} + \varphi_5 \ln OBS\_RWA_{it} + \varphi_6 \ln TL\_DST_{it} + \varphi_7 \ln ROE_{it} + \varphi_8 \ln BKSIZE(-1)_{it} + \varphi_9 \ln HP(-1)_{it} + Dum2013 + \psi_{it} \quad (7$$

, where ψ_{it} is the error term.

Instrumental variables for the endogenous regressors OE_OI, TE_TA and OBS_RWA are respectively IE_DST, DST_TA and GDP. These instruments are also the determinants but not included in the specification.

Securitisation and liquidity

$$\ln LA\_DST_{it} = \Phi_0 + \Phi_1 \ln SEC\_TA_{it} + \Phi_2 \ln TL\_DST_{it} + \Phi_3 \ln Interbkrate_{it} + \Phi_4 \ln OBS\_RWA_{it} + \Phi_5 \ln Z - SCORE_{it} + \Phi_6 \ln ROA_{it} + \Phi_7 \ln BKSIZE_{it}(-1) + \Phi_8 \ln HP_{it}(-1) + Dum2013 + \delta_{it} \quad (8)$$

, where δ_{it} is the error term.

Instrumental variables for the endogenous regressors OBS_RWA and ROA are respectively GDP and ROE. The latter are the determinants as well but not included in the specification.

Securitisation and sensitivity to market risk (interest risk)

$$\begin{aligned} &\ln NII\_TA_{it} \\ &= \lambda_0 + \lambda_1 \ln SEC\_TA_{it} + \lambda_2 \ln TE\_TA_{it} + \lambda_3 \ln Interbkrate_{it} + \lambda_4 \ln TL\_DST_{it} + \\ &+ \lambda_5 \ln DST\_TA(-1)_{it} + \lambda_6 \ln BKSIZE(-1)_{it} + \lambda_7 \ln HP(-1)_{it} + \\ &\lambda_8 \ln GDP(-1)_{it} + Dum2013 + n_{it} \end{aligned} \quad (9)$$

, where n_{it} is the error term.

Instrumental variable for the endogenous regressor TE_TA is BKCON. The latter is a determinant but not included in the specification. BKCON is the level of concentration of SA banks measured by the HHI (Herfindahl–Hirschman index).

Instrument variables for all specifications[37]: lnsec_ta; lntl_ta; lnz-score; lntl_dst lnroe lnCAR; lnie_dst; lnie_dst(-1); lndst_ta(-1); lndst_ta; lnbcon; dlnbksize(-1); lninterbkrate lnhp; lnhp(-1); lngdp1; lngdp(-1); Dum2013

For each specification, one or two lags were added to the exogenous variables of that equation to improve the overall relevance and exogeneity of the instruments of the specification. For example, specification number one (dlnte_ta) had the following instruments: dlnsec_ta(-2) dlntl_ta(-2) dlnz-score dlntl_dst(-1) dlnroe(-2) dlnCAR

[37] This list includes instruments for robustness check specifications.

dlnie_dst dlnie_dst(-1) dlndst_ta dlndst_ta(-1) dlnbcon(-1) dlnbksize(-2) dlninterbkrate dlnhp(-2) dlngdp(-1) dlngdp(-2) Dum2013

4.2.1.2 Models estimation

Table 4.8 presents the summary of the results for both measures of bank stability employed in this study (CAMELS and Z-score).

Table 4.8 Estimated results securitisation and bank stability

	CAMELS						Z-SCORES	
Dependent variables / Independent variables	Capital	Asset Quality	Management Efficiency	Earnings	Liquidity	Sensitivity to market risk	Z-score (1)	Z-score (2)
SEC_TA	-0.277 (0.005) *	0.148 (0.075) ***	2.022 (0.250) *	0.023 (0.004) *	0.684 (0.014) *	0.328 (0.051) *	-1.195 (0.135) *	-0.243 (0.077) *
CAR		3.078 (0.339) *						
TE_TA				0.819 (0.007) *		0.273 (0.036) *	1.146 (0.048) *	
TL_TA	-0.018		-15.27	-1.229				

	(0.014)		(1.936) *	(0.044) *				
RWA_TA							1.231 (0.159) *	0.499 (0.100) *
NII_TA								0.790 (0.150) *
LA_DST	0.530 (0.002) *							
TL_DST	0.293 (0.056) *	-8.916 (1.429) *	-4662 (0.823) *	0.349 (0.063) *	-1.037 (0.171) *	-6.786 (0.611) *	-1.016 (0224) *	-0.086 (0.167)
LA_TA							-0.394 (0.063) *	
ROE	-0.282 (0.003) *	1.256 (0.223) *	-0.878 (0.087) *	0.839 (0.004) *			0.736 (0.067) *	
ROA		-1.335 (0.223) *			0.092 (0.008) *			
SBL_SEC								0.035 (0.012) *
OE_OI	-0.230 (0.007) *			-0.217 (0.008) *				
IE_DST			0.647 (0.101) *					
Interbkrate		-0.010			0.001	0.029	-0.009	-0.017

		(0.038)			(0.004)	(0.016) ***	(0.004)	(0.013)
Z-SCORE					1.876 (0.018) *			
OBS_RWA			3.061 (0.400) *	0.179 (0.008) *	0.060 (0.008) *			
DST_TA						0.513 (0.136) *		
BCON								0.216 (0.425)
BKSIZE	-0.006 (0.003) (-1)	0.223 (0.119) (-1)	0.107 (0.059) (-1)	-0.008 (0.004) (-1)	0.022 (0.014) (-1)	0.238 (0.056) * (-1)	-2.108 (0246) *	-0.316 (0.105)
HP	-0.024 (0.006) * (-1)	0.697 (0.195) * (-1)	0.375 (0.108) * (-1)	-0.028 (0.008) * (-1)	0.084 (0.022) * (-1)	0.530 (0.080) * (-1)	0.100 (0.028) * (-1)	0.021 (0.047) (-1)
GDP		-0.054 (0.006) *				-0.005 (0.002) ** (-1)	-0.001 (0.001) (-1)	-0.000 (0.000) (-1)
Dum2013	-0.001 (0.000)	0.012 (0.008)	0.005 (0.004)	0.001 (0.001)	0.001 (0.001)	0.003 (0.003)	0.000 (0.001)	0.003 (0.002)
Constant	-0.000 (0.000)	0.001 (0.004)	0.001 (0.001)	-0.001 (0.001)	0.000 (0.000)	0.000 (0.001)	-0.001 (0.001)	-0.001 (0.000)

F. Stat	11602	52.53	28.22	25640	3015	31.06	276	83.70
Standard Error regression	0.000	0.014	0.007	0.001	0.001	0.005	0.001	0.004
N (after software adjustments)	**29**	**29**	**29**	**29**	**29**	**29**	**30**	**29**

(*) significance at 1% level. (**) significance at 5% level. (***) significance at 10% level

CAMELS is analysed with the Two stage least squares instrumental variable method. Z-scores are analysed with the OLS technique and then adjusted with the generalized least squares method (the heteroscedasticity-consistent standard errors). SEC_TA: ratio outstanding volume mortgages securitized to total assets; CAR: capital adequacy ratio (Tier1 + Tier2/RWA); TE_TA: ratio equity to total assets; TL_TA: ratio total loans to total assets; LA_DST: ratio liquid assets to deposits and other short-term funds; TL_DST: ratio total loans to deposits and other short-term funds; ROE: ratio return on equity; ROA: ratio return on assets; SBL_SEC: ratio subordinated loans provided to SPVs to outstanding securitized mortgages; OE_OI: cost-to-income ratio: operating expenses to operating income; Z-score: ratio return on average assets + (ratio equity to total assets) to standard deviation return on average assets. IE_DST: ratio interest expenses to deposits and other short-term funds; Interbkrate is interbank interest rate; RWA_TA: ratio risk-weighted assets to total assets; NII_TA: ratio net interest income to total assets; OBS_RWA: ratio off-balance sheet activities to risk-weighted assets; DST_TA: ratio deposits and other short-term funds to total assets; BKSIZE is aggregate total assets; HP is house price index; GDP is gross domestic product; Dum2008: dummy accounting for 2008 global financial crisis.

Models performance: all the models performed well. CAMELS's R-squared are respectively 99%, 96%, 94%, 99%, 99% and 94%. The two Z-scores' are at 99% and 98%. This means that the models were properly specified and moreover that the variance of the different regressants is adequately explained by all our regressors.

Looking at the overall model's significance, the F-statistic test is one of the measures. The null hypothesis here is that the regressors included in this model are not effective. The P-values of the F-statistic is significant at 1% level for all the models, meaning that the Ho

hypothesis is rejected. Indeed, the explanatory variables performed well, making the overall models statistically significant.

4.1.2.3 Results analysis

Securitisation and Capital

With regards to the dependent variable Capital, securitisation has a negative and significant coefficient. This suggests that an increase of the level of securitisation erodes the level of equity ratio. This result is consistent with the outcome of the first part of this study that was focused on testing the regulatory arbitrage hypothesis. It is worth noticing that the elasticity of the securitisation influence seems more pronounced when capital is defined according to the Basel Accord risk-weighted-based measure. For a percentage change of securitisation, capital change is more than 90% with the capital adequacy ratio against 27% for the simple equity to assets ratio. A strong capital level is one that can preserve the stability of banks' balance sheets should they be subjected to shocks. This subsequently means that a downward movement at the capital level could be an indicator of a growth of the financial institution' risk exposure (Evans et al., 2000). Let's remember that under Basel II as implemented in South Africa in 2008, mortgage loans securitised are assigned 35% risk-weight (and more, depending on the risk) for the determination of the risk-weighted assets. According to the Bank Supervision Department 2014 report, the lessening of SA banks' capital adequacy in 2013 is partly the result of the surge in the credit

risk-weighted exposures (South African Reserve Bank, 2014). This clearly indicates an increased risk taking. Because there an inverse relationship between securitisation and equity capital, we can suggest that SA banks securitise for RCA motive. This outcome confirms of our early results in Section I.

Securitisation and Asset quality

On the assets quality front, securitisation has a positive relationship with the ratio OBS to risk-weighted assets as a measure of assets quality, and the coefficient is significant at 10% level. We expected the sign to be positive because when a securitisation transaction takes place, assets securitised are moved from the balance sheet to securitised off-balance sheet debt. In the regulatory arbitrage framework, banks cherry-pick good assets, thus sending a signal to investors that their investment will be safe. Although off-balance sheet operations are still risky, in this case, the credit risk part will be significantly reduced. If securitised assets are mortgages granted with lax in the screening process, then off-balance sheet credit risk is important because additionally, banks would have to support the operations with more credit enhancements facilities given the prospect of a higher probability of default. Accordingly, as part of OBS activities, SEC and OBS move in the same direction. When we looked at the trends depicted by the graphs of these two variables earlier, there was a downward swing of the volume mortgage securitised since 2008 and an upward swing of OBS activities from that same time. We do not see causality between these two observations but attribute the connection between the two variables, as said earlier, to the fact that securitisation is part of the OBS activities. There are two other

plausible explanations for the inverse trends: a) one is the impact of the GFC where the misuses of mortgage securitisation are pointed in the literature as the main cause. South African banks, just as most countries that were engaged in the MBS, have pushed back their involvement in the MBS transactions since the crisis. B) Second, the upward trend of OBS is not a compensatory measure undertaken by SA banks to offset the decrease of SEC_TA, but instead the result of the enforcement in April 2010 of a new regulatory reporting requirement requesting that SA banks should incorporate "revocable facilities" in the off-balance sheets portfolio, which have since become the biggest portion of the OBSs, followed by undrawn facilities and guarantees (South African Reserve Bank, 2011).

Not seeing the way to use Non-Performing Loans as another measure of assets quality, we alternatively conducted a robustness check by looking at the impact of securitisation on non-interest income as a percentage of net operating revenue. The non-interest income encapsulates fees service from securitised mortgages (Stiroh, 2004) and fees from all other OBS transactions. The coefficient was equally positive and significant at 1% level (see Table 8 in Appendix). A percentage change in securitisation translates into 20% change in the ratio. This implies that securitisation of mortgage loans generate substantial fees for SA banks. The result corroborates with the positive relation between OBS_RWA and SEC_TA found earlier.

Securitisation and Management Efficiency

When it comes to the cost-to-income ratio as the measure of management efficiency or even bank performance, securitisation has a positive and significant coefficient. This would indicate that securitisation increases the level of cost relative to income. According to (Evans et al., 2000), if this ratio rises instead, the reason is likely to be the fact that the institution lack efficiency in the way it operates. This result contrast with the findings in the studies of (Hänsel & Bannier, 2008), (Cardone-Riportella et al., 2010) were securitisation enhances bank performance when approximated by cost-to-income ratio. For example, Hänsel and Bannier found that even though the cost of setting up a securitisation programme can be dissuasive, large banks, as well as small banks in the Europe, could overcome this barrier and engage in securitisation activities. So, SA banks probably need to review their operating costs as they engage in securitisation activities. Saayman and Styger interviewed South Africans financial operators about the difficulties hindering the development of securitisation in SA. Among the issues mentioned, was the fact that setting up securitisation program in SA is lengthy (about a year) and highly costly (Saayman & Styger, 2000) even though there was a hope that the trend will change overtime as the actors get fully skilled.

Securitisation and Earning

Concerning the return on assets as a measure of bank profitability, securitisation has a positive and significant coefficient. This outcome may indicate that securitisation enhances SA banks' profitability. It is worth noticing however that the percentage change in ROA is small (2%).This seems to be a logical consequence of the increase in the cost-to-income ratio observed earlier. When there is a rise of this ratio, a negative impact can be equally expected on profitability (Evans et al., 2000). The positive results is consistent with the outcomes found in the studies carried by (Cerrato et al., 2012), (Jiangli & Pritsker, 2008), (Salah & Fedhila, 2012), (Cardone-Riportella et al., 2010) and (Hänsel & Bannier, 2008), securitisation is a profitable enterprise. An uncommon case of a negative outcome was evidenced by (Michalak & Uhde, 2011) and they suggested that the cause may come from the accounting practice.

Another explanatory factor of the tightened impact could be the decrease in the ratio of equity to total assets, the solvency ratio, due to securitisation. It might have been negatively perceived as a signal of increasing risks (Evans et al., 2000) and trigger a swelling funding cost mechanism. Another explanation may come from the taxation aspect in South Africa (Saayman & Styger, 2000).

When we conducted a robustness check by replacing the return on assets with the return on equity (ROE) which is another measure of profitability, securitisation positively and significantly influences the ROE (see Table 8 in Appendix). The statistical impact is much larger here at 13.6%. Our understanding is that, as securitisation has reduced the equity ratio in point 1, the decrease might have gone lower enough to keep a positive return.

There are different ways of extracting profits from securitisation transactions. These include transaction fees, swaps, avoiding double taxation by distributing the beneficial receivables to the originator and SPV, and dividends paid to the originator (Deacon, 2004). SA banks' main method of extracting profits from securitisation is to directly hold preference shares in the capital of their SPV (Boshohh & Krisch, 2016) and transaction fees (as shown in the SPVs annual reports). From the securitisation programmes reports, we could notice that indeed servicers' profits are recorded as preference dividends (from time to time) and servicers' transaction fees. This means, over the period studied, originators received transactions fees and eventually some dividends. In brief, the profits may not yet be fully channeled in South African banks' balance sheets but ROA loses a bit because of the increase of the operating expenses and ROE gains from the decrease of the equity ratio or inversely from the increases of the equity multiplier. ROE is the product of ROA and the Equity multiplier which is Total Assets/Equity (MacDonald & Koch, 2006). Lastly, the positive relationship between SEC and ROE can also be explained by the renowned risk/return positive relationship.

Securitisation and liquidity

Looking at the relationship between securitisation and the ratio liquid assets to deposits and other short-term funds, where this ratio is one measure of bank liquidity, the securitisation coefficient is positive and significant. This appears to indicate that

securitisation improves the level of liquidity. Which might also mean that SA banks securitise mortgage loans for funding purpose. A higher liquidity level can only be a positive indicator of the readiness of (SA) banks to face a crisis such as sudden runs (Evans et al., 2000). This outcome is consistent with several other related studies. In particular, (Agostino & Mazzuca, 2011) found that Italians banks securitise residential mortgages for funding purposes. In others cases, the same results were reached but for different types of assets: covered bonds and assets backed securities by Spanish banks (Martín-Oliver & Saurina, 2007), assets and liabilities of Spanish banks (Cardone-Riportella et al., 2010), CLO by European banks (Hänsel & Bannier, 2008) and ABS by UK banks (Cerrato et al., 2012). When we conducted a robust check by replacing LA/DST by LA/TA, the ratio liquid assets to total assets, we obtained similar results. The coefficient of the relation between SEC and LA/TA is positive and significant at 1% level (see Table 8 in Appendix).

Securitisation and market sensitivity (interest rate risk)

With regards to the net interest income (NII) as a measure of bank sensitivity to market risk, specifically interest risk, securitisation has a positive and significant coefficient. This would reflect the fact that securitisation has a positive impact on the net interest income to assets ratio. NII is the difference between interest income and interest expenses. Knowing that mortgage loans (long term maturity) are financed by deposits (short-term maturity), if interest rate declines, mortgages with fixed-interest rate will not be impacted, only the deposits. This causes a greater spread between the interest rate on deposits and

the interest rate on mortgages loans with the expansion of the NII subsequently (MacDonald & Koch, 2006). Furthermore, evidence has demonstrated that the drop in short-term interest rate results in a lax on the lending standards of mortgage loans in relation to securitisation and supervisory requirements (Maddaloni & Peydró, 2011). The fact is South African short-term interest rate has sharply lowered between 2008 and 2015, going gradually from 10.17% in 2008 to 4.67% in 2015. Moreover, when we looked at the ratings of the RMBS programmes involved in this study, the major portion is rated AAA, then from A to BB in conformity with Basel II regulation. Only a negligible part is indicated as unrated. This suggests that SA banks hold the riskiest share of mortgage loans securitised on their balance sheets. Therefore, the statistical inference above might imply that because of lower interest rate during the period studied, more liabilities (deposits) were repriced at a lower rate than assets (retained part of mortgages securitised), interest income had then contracted but at a smaller magnitude than interest expenses, leading to a higher net interest income (MacDonald & Koch, 2006).

Dum2013: regarding the dummy entered in the specification to account for the implementation of Basel III in South Africa, this variable is globally not statistically significant.

In conclusion, CAMELS is a valid instrument of bank vulnerability measure as evidenced by (Cole & White, 2012) on the year 2009, a period covering the latest financial crisis. We agree with these authors that lower capital, worse asset quality, lower earnings, worse liquidity increase the probability of failure (Cole & White, 2012).

4.2.1.4 Diagnostic and stability tests

The two stage least square is basically the OLS technique in two steps, with the introduction of instrument variables. Again, there are three common diagnostic tests for the OLS method for a good model and they include the fact that the errors terms must be normally distributed, there must be no serial correlations among the independent variables and no heteroscedasticity. Eviews software offers the Jarque-Bera test for the first diagnostic test. The null hypothesis is that the error terms are normally distributed. CAMELS specifications exhibited probability values of respectively 20%, 41%, 50.6%, 51%, 48% and 41%. These probability values are all at more than 5% level of significance. This means that the null hypothesis of normality of residuals is accepted. Consequently, it can be concluded that our model's predictions are not biased.

The second test for serial correlation employed the Breug-Godfrey serial correlation test. The null hypothesis is no serial correlation. Tests for the CAMELS models showed that the Obs*R-squared have probability values of respectively 42%, 15%, 50.7%, 28%, 38% and 17%. These outcomes accept the null hypothesis that there no serial correlation in our model's specifications.

The third test looked at whether there is heteroscedasticity (no constancy) in the variance of the error terms. The Breug-Pagan-Godfrey heteroscedasticity test's null hypothesis is that there is homoscedasticity. Our CAMELS models generated probability values of

respectively 14%, 13%, 25%, 24%, 22% and 26%. These outcomes thus accept the homoscedasticity hypothesis.

4.2.1.5 Instruments tests

Weak instrument tests: As pointed out by (Kennedy, 2008), weak instruments lead to meaningless results. F-statistics provided an indication of the strength of our instruments. (Staiger & Stock, 1997) posited that an F-statistics of more than 10 from the first-stage regression when there is only one endogenous regressor on the right side of the equation implies the instruments are strong. In the CAMELS system, the specifications of Asset quality (OBS_RWA), Management(OE_OI) and Sensitivity to market risk(NII_TA) have one endogenous variable each which are respectively ROA, OBS_RWA and TE_TA. When we regressed the instruments chosen to substitute the latter on the total instruments in each equation as explained by (Kennedy, 2008), we obtained F-statistics of respectively, 34.7, 21.4 and 66.8. This suggests that our instruments are strong.

As for Capital (TE_TA), Earnings(ROA) and Liquidity(LA_DST), they have more than one endogenous variable in their right-hand equations, which are respectively [LA_DST, OE_OI]; [OE_OI, TE_TA, OBS_RWA] and [OBS_RWA, ROA]. To test the strength of the instruments for multiple endogenous variables, (Stock & Yogo, 2005) provided critical values.

The validity of instruments: an instrument is valid if its relevance and exogeneity conditions are met (Stock & Watson, 2003). An instrument that is correlated with the dependent variable but not correlated with the error term is relevant and exogenous. The statistical test for the latest is the J-statistic. The null hypothesis is exogenous variable.

(Kennedy, 2008) recognized the difficulty to have both conditions met. For each equation of the CAMELS, we have ensured that each instrument is a determinant, thus correlated to the dependent variable, and was not previously included in the equation, thus ensuring its exogeneity. The P-values of the J-statistics of all the specifications are 15.7%. These outcomes thus implied that our instruments were relevant and accepted the null hypothesis of exogeneity.

4.2.2 Securitisation and Z-score

This section conducts the analysis of the relation between securitisation and bank stability using the second measure which is the Z-score. Z-score 1 includes the data of four banks while Z-score 2, only three banks for the reasons explained later in this section.

4.2.2.1 Descriptive statistics: Z-score (1) and Z-score (2)

Descriptive statistics and correlation matrix are counted in Appendix (Table 4.3)

Model specification (as seen in Chapter 3)

Z-score (I)

$$\begin{aligned}\ln Z-\text{score}(1)_{it} = {} & \alpha_0+\alpha_1 \ln SEC\_TA_{it}+\alpha_2 \ln RWA\_TA_{it}+\alpha_3 \ln TE\_TA_{it}+ \\ & \alpha_4 \ln LA\_TA_{it}+\alpha_5 \ln TL\_DST_{it}+\alpha_6 \ln ROE_{it}+ \\ & \alpha_7 \ln Interbkrate_{it}(-2)+\alpha_8 \ln BKSIZE_{it}+\alpha_9 \ln HP_{it}(-1)+ \\ & \alpha_{10} \ln GDP_{it}(-1)+Dum2013+\mu_{it}\end{aligned} \quad (10)$$

where μ_{it} is the error term.

Z-score (II)

$$\begin{aligned}\ln Z-\text{score}(2)_{it} = {} & \psi_0+\psi_1 \ln SBL\_SEC_{it}+\psi_2 \ln SEC\_TA_{it}+\psi_3 \ln Interbkrate(-2)_{it}+ \\ & +\psi_4 \ln TL\_DST_{it}+\psi_5 \ln RWA\_TA_{it}+\psi_6 \ln NII\_TA_{it}+ \\ & \psi_7 \ln BKSIZE_{it}+\psi_8 \ln BKCON_{it}(-1)+\psi_9 \ln HP(-1)_{it}+\psi_{10} \ln GDP(-1)_{it}+ \\ & Dum2013+\pi_{it}\end{aligned} \quad (11)$$

, where π_{it} is the error term.

4.2.2.2 Models estimation

The estimations are all summarised in Table 4.8 above.

4.2.2.3 Results analysis

Z-score (I)

Z-score has become a common measure of bank stability. It is composed of the average return on assets, the equity to assets ratio and standard deviation of the average return on assets. As indicated in Chapter 3, the higher the score, the greater the distance from default.

We have undertaken the analysis of the relation between securitisation of mortgage loans and Z-score utilising the OLS regression. The results indicate a negative and significant coefficient at 1% level. This means securitisation of mortgage loans increases the probability of default or insolvency risk of SA banks. This outcome is consistent with those found by (Michalak & Uhde, 2011) in the European Union and Switzerland from 1997 to 2007, (López-Andión et al., 2015) from 1998 to 2006 in Spain, where they attributed the negative impact to regulatory arbitrage. Because we have previously seen that securitisation of RMBS undermined SA banks' capital ratio due to RCA, we would adopt the same conclusion. By contrast, other studies found that RMBS contribute in strengthening banks stability'. We saw that in (López-Andión et al., 2015) from 2007 to 2012 in Spain, (Salah & Fedhila, 2012) from 2001 to 2008 in the USA for RMBS but not for non-RMBS. What is noticeable is that, RCA seems to have occurred in the former countries when only Basel I was implemented. Let's recall that RCA is precisely one of the key reason why Basel I have since been replaced by Basel II, implemented in 2007 and the latter by Basel III following the GFC. This study covers the period 2008 to 2015 where

banks were subjected to new regulations and yet RCA, apparently, is still likely to occur as shown by SA results and mentioned in the theoretical literature.

Z-score (2)

The analysis with Z-score (2) looked at how credit enhancements, which most of the time accompany securitisation, affect banks' stability. This point was originally meant to be an integral part of Z-score (1). The entire study is based on the data of the four majors SA banks. Because of the unavailability of data on retained interest for one of the 4 banks, we had 3 banks left and decided to conduct the analysis separately. The credit enhancement in question here is the subordinated debt granted to SPVs by SA banks when they securitise mortgage loans. This variable was added in the Z-score regression for the 3 banks. The results demonstrated interestingly that the coefficient of subordinated debt is positive and significant at 1% level, indicating that this type of retained interest does not affect bank stability. This is contrary to our expectation because, in effect, in (Acharya et al., 2013)'s study on "securitisation without risk transfer", the authors evidenced how setting up ABCP conduits and supporting these structures with liquidity guarantees did not really transfer risk to investors as it should normally be the case. Subsequently, banks involved suffered major losses during the GFC. However, our result is not singular but accords with (Sarkisyan & Casu, 2013) on "retained interest in securitisations and implications for bank solvency" where they found that subordinated debts reduce the risk

for small scale securitisers. It is also worth noticing that securitisation of mortgage loans as control variable maintained a negative and significant coefficient at 5% as seen with Z-score (1). It thus seems that securitisation, even supported by subordinated debt, still has a negative impact on bank stability.

4.2.2.4 Diagnostic and stability tests

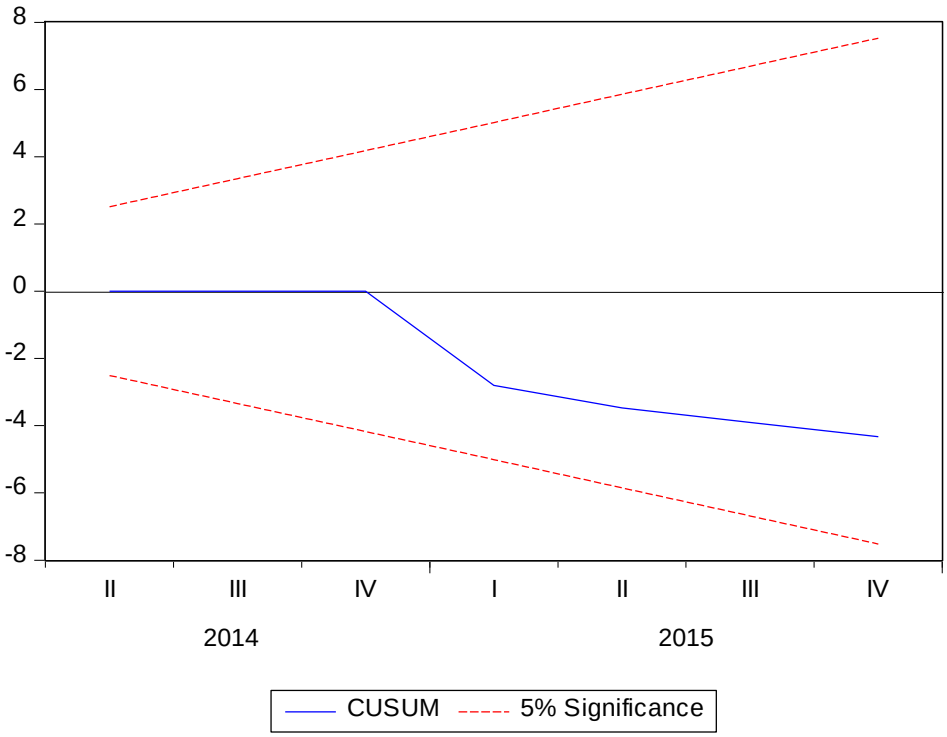
We started the analysis employing the OLS technique. There are three common diagnostic tests for the OLS method for a good model and they include the fact that the errors terms must be normally distributed, there must be no serial correlations among the independent variables and no heteroscedasticity. Eviews software offers the Jarque-Bera test for the first diagnostic test. The null hypothesis is that the error terms are normally distributed. Z-score I and Z-score II exhibited probability values of respectively 11% and 61 %, which are all more than 5% level of significance. This means that the null hypothesis of normality of residuals is accepted. Consequently, it can be concluded that our model's predictions are not biased.

The second test for serial correlation employed the Breug-Godfrey serial correlation test. The null hypothesis is no serial correlation. Tests for the three models showed that the Obs*R-squared of the tests had probability values of 98% and 94%, which is far more than 5%. These outcomes accept the null hypothesis that there no serial correlation in our model's specifications.

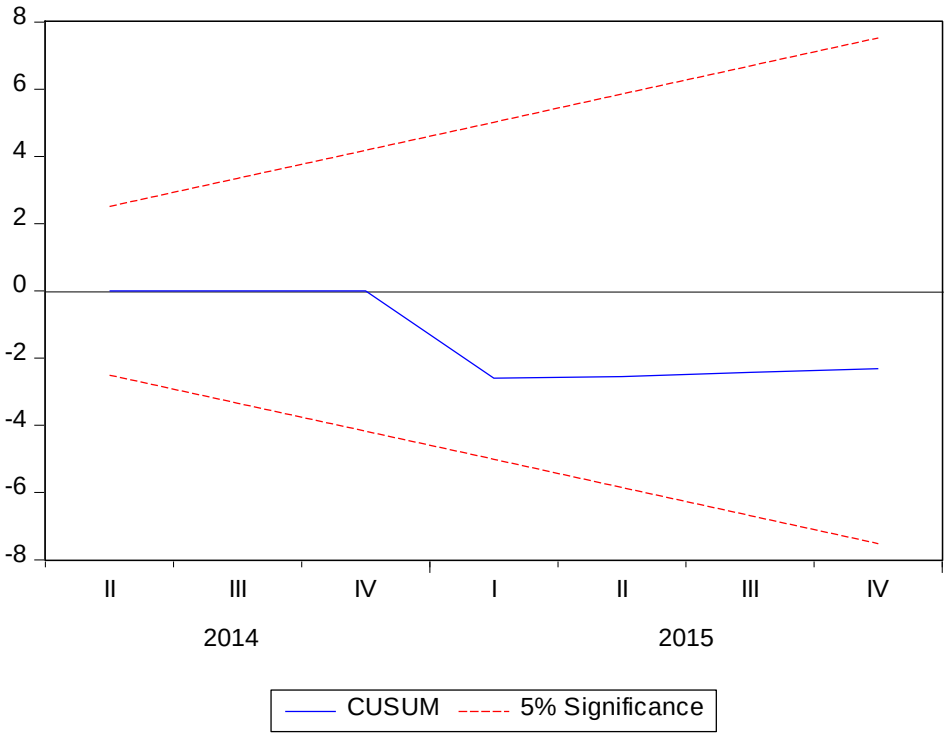
The third test looked at whether there is heteroscedasticity (no constancy) in the variance of the error terms. The Breug-Pagan-Godfrey heteroscedasticity test's null hypothesis is that there is homoscedasticity. Z-score (1) model generated a probability values of 33%, thus accepting the homoscedasticity hypothesis, while Z-score (2)'s was significant at 1% level, thus rejecting the homoscedasticity hypothesis. To solve this problem, (Asteriou & Hall, 2011) suggest using the generalised linear method. This method encompasses different procedures including the White's heteroscedasticity-consistent estimation method. The latter is appropriate when it is difficult to identify the variable causing the problem. We thus followed the steps as described by these authors and believe that we have obtained, as they predict, the estimates that are consistent and the estimators that are efficient for Z-score (2).

The stability tests were carried out with the CUSUM test. The graphs showed that both models are stable:

Z-score1(stability test)



Z-score2 (stability test)



4.3 Conclusion

The conclusion of this section answers the second null hypothesis of this study drawn from agency theory which states that, if there is no RCA and random effects are favourable, then mortgage loans securitisation does not negatively affect banks' stability. The results have exhibited an inverse relationship between Capital and Securitisation of mortgage loans, inferring RCA. Moreover, we have observed that during the period studied, GDP in SA went from a 3.7% growth in 2008 to 1.3% in 2015. Interest rate decreased from 10% in 2008 to 4.75% in 2015 and house price index had increased from 356.3 in 2008 to 498.2 in 2015. These macroeconomics indicators illustrate the erosion of the SA economic conditions. Under these circumstances, we have seen that our analysis generated more negative than positive inferences for bank stability. Therefore, our second null hypothesis can be accepted. However, this conclusion must be qualified. The analysis with the CAMELS measure for bank stability revealed that in the short run, securitisation of mortgage loans improves the liquidity, net interest income and earnings of SA banks. The implication is that liquidity (DST_TA in model (1) of the first section and LA_DST in CAMELS) is positively and significantly related to SA banks' capital ratios. With regards to earnings, it is assumed that part of it has been put back as retained earnings in the balance sheets. Overall, from the CAMELS analysis, it can be said that securitisation of mortgage loans has reduced SA banks' capital but has generated liquidity and earnings reinvested to strengthen that capital. Now the question is, has there been a perfect trade-off. Bank stability measured with Z-score, which is composed of the equity ratio and the

return on average assets (divided by its standard deviation), answers negatively even when securitisation of mortgage loans is supported by retained interests (specifically subordinated debts). Further robustness check was done by conducting similar regression analyses with natural data. The results confirm our first findings except for securitisation and assets quality (see Tables 4.10 and 4.11 in Appendix).

Chapter 5
Conclusion and policy implications

"Regulatory arbitrage as a business model is a dangerous undertaking" (*Acharya & Schnabl, 2009)*

This chapter recalls what this research was all about, summarises the research results and theoretical interpretation. It also suggests some policy implications and formulates some recommendations using a framework (Figure 5.1). Lastly, it provides direction for future research.

Section 5.1. Research Summary

SA banks are featured by the SARB as safe, sound and well-capitalised because their capital adequacy ratio is above the minimum required by the Basel Accords, as seen in Chapter 2. The problem with well-capitalised banks that are involved in the securitisation transactions is that their true level of insolvency probability can be masked if securitisation is carried out for regulatory arbitrage purpose. The amount of capital published may well be above the regulatory minimum required but in reality, remains below the level needed to cover the overall risks taken. This thesis has thus investigated whether the major well-capitalised SA banks securitise mortgage loans for regulatory arbitrage reasons, in which case their well-capitalised standing would be undermined. The thesis has furthermore considered the impact of this type of securitisation and motives on these SA banks'

insolvency probability, in other words, on their stability. Finally, the theoretical aspect has shed important light on the contributing factors that lead to securitisation.

The six hypotheses, formulated in light of the agency and institutional theories' perspectives, where SA banks are considered as acting on the behalf of the regulators and in constant quest of legitimacy for their survival, stipulate that: If SA banks are risk-averse agents, then they do not securitise mortgage loans for regulatory arbitrage motives (Ho). Alternatively, they securitise mortgage loans to meet their liquidity needs (H1).

The third and fourth hypotheses assume that, from the Agency Theory lens, the implications of the securitisation of mortgage loans for SA banks' stability, no matter the motive, would be uncertain (outcome uncertainty) because even though they depend on banks' behaviour, they also rely on unpredictable factors such as the economic conditions. Therefore, the researcher assumes that, if SA banks do not engage in regulatory arbitrage, because they are risk-averse, and random effects such as economic conditions are favourable, then mortgage loans securitisation will positively affect SA banks' stability (Ho). If, by contrast, SA banks engage in regulatory arbitrage and random effects are unfavourable, then mortgage loans securitisation will negatively impact SA banks' stability (H1).

The last hypothesis, from Institutional Theory (IT), leans on the concept of legitimacy. It is articulated around the idea that SA banks are keen to preserve their well-capitalised reputation, which confers legitimacy. Legitimacy coming from complying with legal requirements per IT, the researcher hypothesizes that if SA banks want to preserve their legitimacy, thus their well-capitalised position, then they will not securitise mortgage loans driven by regulatory arbitrage (Ho). Alternatively, if regulatory arbitrage is one of their guiding aims, then it will wear down their legitimacy (H1).

Section 5.2. Key research findings

Recapping that this study's focus was exploring the correlation between the main variables and thus, did not test their directional influences (causality), the main outcomes are as follows:

5.2.1. Securitisation of mortgage loans and regulatory capital arbitrage

According to several authors, regulatory capital arbitrage will be manifested in that securitising mortgage loans will cause the reduction of regulatory capital level with little or no reduction of risks. Banks would securitise the less risky portion of their portfolio, retain the riskier part, extend their loans portfolio with lax criteria and the average level of risk of the loans portfolio will hence increase. The researcher looked at the relationship

between the volume of securitisation and regulatory capital as defined by the Basel Accords, the relationship between the volume of securitisation and total risk and the relationship between the volume of securitisation and total loans.

The empirical results, recapitulated in a framework further down, are:

A1(a).[38] The relationship between the outstanding volume of mortgage loans securitized and the regulatory capital is negative. So, securitized mortgage loans reduce the level of regulatory capital. This result suggests that SA banks securitise mortgage loans for regulatory capital arbitrage. They might have found the regulatory capital required higher, and thus costlier, than the economic capital they deemed sufficient to hold for the portion of loans securitised, and resolved it is more profitably to remove these assets from their balance sheets.

A2. The relationship between the outstanding volume of mortgage loans securitized and the measure of risks is positive. This result indicates that securitising mortgage loans increases the overall level of SA banks' risk. As explained in the literature, banks usually retain the junior tranches, namely the riskiest share of loans securitised. The purpose is saving their reputation vis-a-vis the investors, but more importantly, freeing more capital as they can be strategically

[38] References of the framework in Figure 5.1

included in the portfolio with the knowledge that the required regulatory capital for the level of risk these tranches carry is ultimately less than the appropriate economiccapital.

A3. The relationship between the outstanding volume of mortgage loans securitized and the volume of the loans portfolio is equally positive. This implies that SA banks use the proceed of mortgage loans securitization to expand their loans portfolio. This would have been perceived as the normal step forward after securitization if the increasing risk suggested by the previous results did not occur. The researcher interprets this outcome as a signal that confirms the assumption that most banks that securitise their loans get more lax in their credits valuations and in so doing, accumulate more risk.

5.2.2 Securitisation and Bank Stability

The second part of the study focused on the impact of the securitisation of mortgage loans on SA banks' stability. The results on bank stability measured by CAMELS are as follows:

A1(b). Capital (the economic capital, not the regulatory capital): The relationship between the outstanding volume of mortgage loans securitized and capital, proxied with the simple leverage ratio, is negative. We observe that the effect of mortgage loans securitisation is identical on the regulatory capital and the economic capital.

This also confirms our previous suggestion that regulatory capital arbitrage is one of the potential reason why SA banks use these innovative activities.

A4. Asset quality: The relationship between the outstanding volume of mortgage loans securitized and asset quality, proxied by the volume of off-balance sheets activities and risk weighted assets ratio is positive, indicating a deterioration of asset quality via an increase of risks.

A5. Management efficiency: The relationship between the outstanding volume of mortgage loans securitized and management efficiency, proxied by cost-to-income ratio is positive, showing that these mortgage loans securitisation transactions increase the cost level of SA banks involved.

A9. Earnings: The relationship between the outstanding volume of mortgage loans securitized and bank profitability, proxied by the return on asset ratio is positive. These results suggest that despite an increase in costs, securitisation of mortgage loans remains profitable for SA banks.

A8. Liquidity: The relationship between the outstanding volume of mortgage loans securitized and the liquidity measure is positive as well. This prompts the comment

that SA banks securitise mortgage loans not only for regulatory capital arbitrage, but also for funding purposes.

A10. Sensitivity to market risk: The relationship between the outstanding volume of mortgage loans securitized and SA banks' sensitivity to market interest risk is positive. The net interest income to total assets ratio remains positively related to the securitisation of mortgage loans. This indicates that even when interest rate varied the securitisation of mortgage loans was used productively perhaps by charging upfront higher interest rate to riskier loans.

Impact of economic variables on CAMELS: results suggest that House prices (B2) increase over the period studied had a negative effect on SA banks' capital, it has contributed in the deterioration of assets quality, pushed upward SA banks operating costs relative to operating income, had a tightening effect on banks' earnings. However, it has improved SA banks' liquidity and net interest income relative to total assets.

B1 - With regards to GDP, results have established an inverse relationship with asset quality where Off-balance sheet activities relative to risk weighted assets has increased with a declining SA GDP. A negative relationship was also found between GDP and net interest income to total assets ratio implying that under a liquidity

constrained environment due to slow economy, SA banks might have increased their intermediation costs to preserve their margin.

In brief, the CAMELS measure of bank stability reveals that securitising mortgage loans may be a good thing in the short term but it harms SA banks' resilience capacity should they be faced with serious economic conditions.

The results with bank stability when measured by **Z-score** are:

A6. The relationship between the outstanding volume of mortgage loans securitized and Z-score is negative. This result shows and confirms that for SA banks, an increase of mortgage loans securitisation might represent a threat for their stability. It reduces their distance to insolvability.

A7. The relationship between the volume of mortgage loans securitized and Z-score when the researcher includes part of the retained interest in the form of subordinated loans in the baseline model, is equally negative. However, the relationship between subordinated debt and Z-score is positive. The finding is contrary to what transpired from the GFC but could be explained by the fact that the size of subordinated loans provided by SA banks to special purpose vehicles (SPVs) remains inconsequential.

A8. Bank size in previous studies favors large banks with regards to the decision to securitise. Large size also facilitates portfolio diversification to reduce risk. However, large size creates the too-big-to-fail belief that exacerbate the risk taking behaviour. In this study, bank size is significant in explaining the contraction of SA banks' capital ratio, the increase of risk and loans, and the reduction of the distance of insolvability.

B2. Impact of economic variables on Z-score: House price exhibited a positive relationship with Z-score, meaning that the increase of house prices during the period studied might have enhanced SA banks' stability. However, **B1.** GDP did not have any statistical significance in explaining the changes of the Z-score.

Section 5.3. Theoretical Interpretation of the Results

The theoretical lenses through which the results are explained are Agency Theory (AT) and Institutional theory (IT).

5.3.1 Agency Theory

The researcher uses some of the key concepts developed in the AT and IT to tentatively enlighten why SA banks securitise mortgage loans and the effect on their stability. In other

words, here the researcher tries to clarify whether SA banks' managers securitised mortgage loans with the interests of the regulators in mind and the repercussions of their decisions. The main concepts from AT to do so are *goal conflict,* approximated by the regulatory capital arbitrage indicators; *asymmetry of information,* proxied by securitisation volume; *risk,* proxied by the ratios total loans and risk weighted assets to total assets; and *outcome uncertainty,* proxied by the measures of bank stability. The concepts are employed under the AT assumptions that banks are *self-interested* but *risk-averse* and regulators are *self-interested* but *risk-neutral.* From IT, we focus on the concept of *legitimacy,* approximated by effective compliance to regulation, meaning no RCA.

In Chapter 2, regulatory capital arbitrage, in the context of this study, and its consequences are presented as originating from the friction in the relationship between regulators and banks due to conflicting goals. This goal conflict is reflected in the difference between the regulatory capital required by the regulator and the economic capital, which is the banks' internal desired level of capital. We have found the features of that relationship consistent with the characteristics of the *implicit administered contracts*, which has provided us with a bridge to AT.

The core of AT's simple model is a metaphoric contractual relationship between a principal and an agent where the agent acts on behalf of the principal. However, this

relationship has problems of asymmetry of information, because the agent hides its behaviour from the principal, and risk sharing, because the principal is assumed risk-neutral and the agent risk-averse. In the end, conflicting goals and conflicting risk preferences arise together with monitoring costs. In the literature, the researcher has located a rare interesting instance where banks as "regulatee"-agents would act in place of the regulator (the principal), because they have been given the latitude to choose among the provisions of a regulation, and the options that best match the features of their activities. One would expect banks to simply comply with the regulations as subordinates and not as substitutes of the regulators. This uncommon case permitted the researcher to reflect the assumptions of AT on the relationship between the SA Reserve Bank (the regulator implementing the Basel Accords) and SA banks, and to formulate the hypotheses. In the AT framework, banks are assumed risk averse while regulators are assumed risk neutral, which causes conflicting risk preferences. To solve the agency problems, AT's simple model suggests a behaviour-oriented or an outcome-oriented contract, which are however respectively subject to outcome uncertainty due to random effects and transfer of risk to the agent.

In the context of this study, regulators' goals are to preserve the safety, the soundness and the stability of the whole banking system from potential systemic crisis. However, banks are in pursuit of profits. Competition has narrowed their margins and innovative but risky

products, such as securitisation, provide them with extra revenues. Opacity surrounding these products create asymmetry of information between banks and regulators.

Regulations are thus inadequately tailored to reach the regulators' goals. Banks then use the loopholes in these regulations to not comply or to partially comply, which is called regulatory arbitrage. Regulators with the Basel Accords have thus given banks the latitude to choose, within the dispositions provided, those that align with the goals of securing the banking system better. Unfortunately, this has only opened a free way for more delinquencies even though the control systems via tightened provisions have improved.

From the assumptions of AT then, we recall the hypotheses and then interpret the results as follows:

Null hypothesis (1) stated that, if SA banks are risk-averse agents (AT), then they do not securitise mortgage loans for regulatory capital arbitrage (RCA) because it is risky, it increases the insolvency probability of banks and do not align with the regulators' (the principal's) aims to safeguard the banking system. In other words, statistically, Mortgage loans securitization does not negatively affect Total risk-based capital ratio of securitising SA banks, nor positively affect their risk and loan ratios.The results have suggested otherwise. They seem to indicate instead that RCA has taken place during the period studied and thus reject the null hypothesis. These results tell us that banks' managers are indeed rational self-interested agents as predicted by the AT theory because their decision

to securitise mortgage loans to uphold less capital, ignores the regulators' purpose. However, engaging in RCA contradicts the risk-averse profile these banks are supposed to have, according to the simple model of the AT. However, from a more progressive aspect of AT, where the risk-averse assumption is relaxed, agents are less risk-averse and the risk-reward trade-offs substitute to the pejorative way to interpret risk (Eisenhardt, 1988).

An alternatively Hypothesis (1) expected that if SA banks are risk-averse agents (AT), then they would securitise mortgage loans for funding purposes or simply securitise to transfer risk to the investors. Consequently, mortgage loans securitisation would positively affect South African banks' liquidity ratios.

Remarkably, the results from the CAMELS analysis accept this hypothesis and has shown that in addition to regulatory capital arbitrage, SA banks also securitise mortgage loans for liquidity needs. From the AT perspective, if we consider the relax assumption where banks are less risk-averse, this would mean once again that SA banks are positioned in the risk/reward type of decision making process when it comes to securitisation.

Null Hypothesis (2) is related to the concept of outcome uncertainty (SA banks' stability), which depends on SA banks' behaviour as well as the economic conditions (random effects). If SA banks do not engage in regulatory arbitrage because they are risk-averse and random effects are favorable, then mortgage loans' securitisation do not negatively affect SA banks' stability (Ho).

This hypothesis is rejected by the empirical results and the alternative hypothesis that stipulated that the contrary is accepted. This implies that SA banks have shown themselves less risk-averse (here, consistent with the relax of the simple model's assumptions) and regulatory capital arbitrage together with SA's slow economy, led to a negative effect of securitization of mortgage loans on SA banks' stability. A less risk averse agent engaging in RCA and good economic conditions may yield the same results but with less concern as with some increased profits from securitisation, banks would eventually retain more earnings to strengthen their capital.

5.3.2. Institutional Theory

According to the IT, legitimacy derives from complying with the legal or quasi-legal requirements. The researcher hypothesizes that if SA banks want to preserve their well-capitalised reputation, which confers legitimacy, then they will not securitise mortgage loans for regulatory arbitrage (Ho). Alternatively, regulatory arbitrage will erode their legitimacy (H1).The results are interpreted in accordance with this definition of legitimacy. Using securitisation of mortgage loans as a source of funding by SA banks will be construed as conforming to legal requirements and RCA as non-conformity.

Therefore, results reject the null hypothesis and accept the alternative.

Section 5.4. Policy Implications and Recommendations

Over the period studied (2008-2015), where Basel II and Basel III were enforced, the researcher observes that the regulators searched for more transparency in the way banks report their activities in their balance sheets. For example, they require that banks disclose details of their capital components and if these components are presented in the form of ratios, the calculation method used must be clearly indicated. Drawing the parallel with Agency Theory, higher level of capital and more robust information systems seem to have been found by the regulator as the optimal way to curb the agency problem. However, the results from this study are suggesting that setting up an information system to control the banks' behaviour is not enough. The recommendations are as follows:

The researcher agrees with the advocates of simplicity (C1) in the formulation of regulations and suggest (C3) tighter regulation on activities that have higher likelihood to propagate systemic risk and lax regulation, or not all, on others, or even forward-looking loan loss provisioning. This would render banks more responsible for their individual fate and reduce moral hazard.

AT also assumes that the principal (the regulators) is self-interested. The literature mentions cases of revolving-door goals and regulations being purposefully complexified

(Krueger & Duncan, 1994; Heyes, 2000). We recommend regulators to be genuinely risk-averse (C2) as the extended simple model of AT assumes they are, and less self-interested.

Through training, regulators should be more knowledgeable (C2) about banks' activities and processes. This would reduce asymmetry of information and thus loopholes in the regulations.

The introduction of incentives (C4) such as compensation and rewards such as rebates on costs, discount on interest rate among others, if compliance is proved effective and efficient. These incentives are justified as it will always be a challenge for the regulators to know exactly what banks are doing, given the pace at which banks' activities evolve. This will also reduce the perception that the regulation requirements are costly.

(C5). A combination of behavior-based (behavior control: information system) and outcome based contract (outcome required: bank stability) between banks and regulators where proper behavior occurs, should lead to adequate compliance.

A positive impact of securitisation on banks' stability is viewed in the literature as the result of a closed monitoring of securitised assets (C6). The same policy is recommended for SA banks.

See Figure 5.1. below for a framework on securitisation of mortgage loans' influence on banks' capital, risk, stability and recommendations.

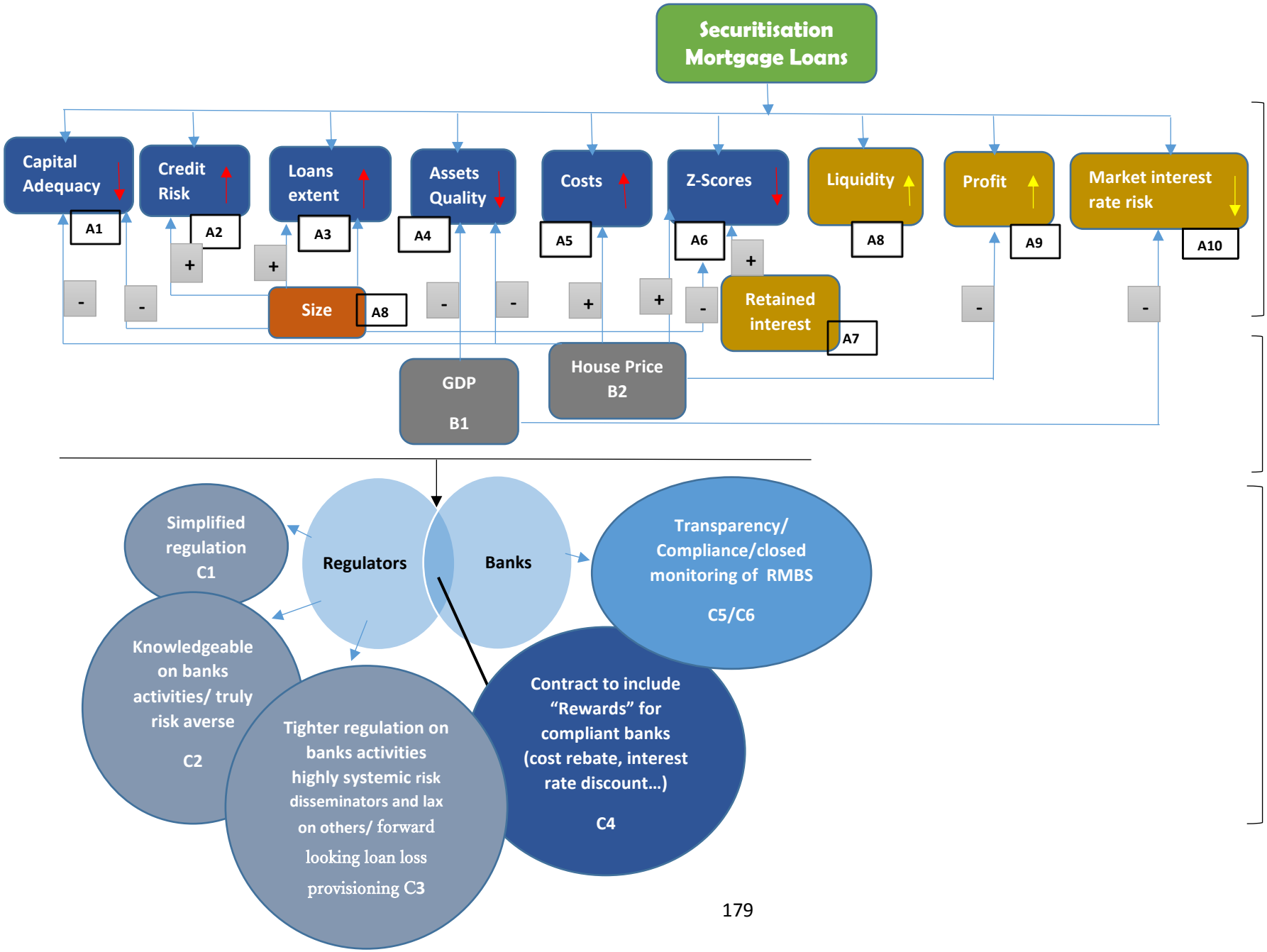

Securitisation Mortgage Loans
Capital Adequacy
Credit Risk
Loans extent
Assets Quality
Costs
Z-Scores
Liquidity
Profit
Market interest rate risk
A1
A2
A3
A4
A5
A6
A8
A9
A10
Size
A8
Retained interest
A7
GDP
B1
House Price
B2
Impact on SA Banks' specifics
(A)
Macroeconomic influence
(B)
Simplified regulation
C1
Regulators
Banks
Transparency/ Compliance/closed monitoring of RMBS
C5/C6
Knowledgeable on banks activities/ truly risk averse
C2
Tighter regulation on banks activities highly systemic risk disseminators and lax on others/ forward looking loan loss provisioning C3
Contract to include "Rewards" for compliant banks (cost rebate, interest rate discount…)
C4
Policy Recommendations
(C)

Figure 5.1. Framework on Securitisation of Mortgage Loans' Influence on Banks' Capital, Risk, Stability and Recommendations.

Section 5.5 Suggestions for Future Research

5.5.1. So far, this study focused on the banks' side of the agency relationship. Further studies could look at the regulators' side by examining how their profile impact the efficiency of regulations.

5.5.2. Others could research the effect of securitisation under the Basel III securitisation framework effective from 2018 on banks' capital adequacy ratio and on other bank stability measures such as non-performing loans and Expected Default Frequency.

5.5.3. Looking at whether the determinants including credit risk transfer, reputation, performance and specialisation justify securitisation transactions in South Africa may equally yield interesting outcomes.

5.5.4. Further study may also examine the impact of other assets securitised than mortgage loans, such as credit cards receivables, auto loans and commercial mortgages on the banking and shadow banking's stability.

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Appendices

A) Appendix of Chapter 2

Table 2.1: Survey of the studies related to this thesis

Study	Model	Period	Country	Key variables	Findings
RCA and securitisation (in chronological order)					
[1] (Calomiris & Mason, 2004)	OLS Probit Tobit	1996	USA	Tier 1 + Tier 2/on-balance sheet Assets Tier 1 + Tier 2/managed Assets Cash + Government securities/ on-balance sheet Assets Insured deposit/Total deposits Managed credit cards portfolio securitised Min 90 days past due loans/Total loans Min 90 days past due loans/Total assets	Efficient contracting RCA (+) Credit Cards Safety net abuse RCA (-) Credit Cards
[2] (Ambrose et al., 2005)	Model prepayment – default probabilities OLS Logit	1995 -1997	USA	Loan-to-value ratio Effective yield-10 years Treasury rate Credit score borrower	RCA (+) RMBS Reputation (+)
[3] (Martín-Oliver & Saurina, 2007)	Probit Tobit	1999–2006	Spain	Solvency ratio (Capital/RWA) Liquidity ratio	RCA (-) / Liquidity (+) for

				(loan/deposit) Risk profile (Non-performing loans ratio) Funding cost	Covered bonds and ABS Transfer of risk (-) RCA (+) for SMEs loans
[4] (Uzun & Webb, 2007)	Matched sample approach Fixed-effects Logit	2001 – 2005	USA	Tier 1 leverage ratio Tier 1 capital ratio Total risk-based capital ratio Loan ratio	RCA (+) (Credit Cards) RCA (-) RMBS and other assets
[5] (Dionne & Harchaoui, 2008)	Instrumental variable model	1988 – 1998	Canada	Tier 1 leverage ratio Total risk based capital ratio Loan ratio ROE-ROA Cost of capital Securitisation ratio	RCA (+) Risk taking (+)
[6] (Hänsel & Bannier, 2008)	Logit	1997-2004	EU	Tier 1 ratio Equity share Credit risk provision/net interest income ROE Cost/ income ratio Credit default probability Rating downgrades to upgrades ratio S.T & L.T interest rates Yield diversified stock index	RCA (+/-) CLO Credit risk transfer (+) CLO Funding (+) CLO Access to capital market based businesses + fee income (+) (performance) “Reverse” RCA (+)

[7] (Cardone-Riportella et al., 2010)	Logit	2000 – 2007	Spain	Total risk-based capital ratio Equity/Total Assets Interbank loans ratio Liquid assets/Deposits + S.T funding NPL/Gross loans ROE - ROA	Credit Risk Transfer (-) RCA (-) Liquidity (+) Performance (+)
[8] (Agostino & Mazzuca, 2011)	Probit	1999 – 2006	Italy	Tier 1 ratio Loans to assets ratio Interbank ratio Liquidity ratio Historical cost Leverage Market funding ratio ROA- Interest ratio	RCA and Funding (+) (RMBS) Funding and Specialisation (+) (NPL)
[9] (Cerrato et al., 2012)	Logit / Probit Bank fixed-effect model	2000 – 2010	UK	Tier 1 ratio Total risk-based capital ratio Capital funds and Equity ratios Interbank ratio Other liquidity ratios NPL/gross loans RROA (rate of return on operating assets)	Funding (+) globally RCA and credit risk transfer (+) (ABS) RCA and Funding (+) (CDO) OTD (+) for ABS/CDOs' high default rate Profitability (+)
Securitisation and Impact on bank stability					

[10] (Jiangli & Pritsker, 2008)	Semi-parametric Instrumental variable analysis OLS	2001 – 2007	USA	Time deposits premium Leverage ratio ROE Cost of funding Share of loans/Assets Nonaccrual + charge off / Loans	Insolvency risk (-) (MBS) Profitability (+) (MBS) Leverage ratios (+) (MBS)
[11](Michalak & Uhde, 2011)	Instrumental variable	1997 – 2007	EU / Switzerland	Securitisation/total assets Securitisation/net loans Z-Score (accounting based: (ROAA+Equity capital/Total Assets)/SdROAA) + Z-Score (market based: Distance to Default, Expected default Frequency, Banks' stock return volatility) Tier 1	Financial Soundness (-) due to RCA Profitability (-) capital environment (-) Return's volatility (+)
[12] (Salah & Fedhila, 2012)	Generalized Least Square Method	2001 – 2008	USA	Mortgage Securitised /Total Assets Non-mortgage securitised Assets/Total Assets RWA/Total Assets Z-Score (ROAA+Equity capital/Total Assets)/SdROAA) Total capital/Total Assets ROE	Degradation portfolio (+) Credit risk (+) Profitability (+) Stability (+) (MBS) Stability (-) (non-MBS)

				Liquid Assets/Total Assets Real Interest Rate	
[13] (López-Andión et al., 2015)	Dynamic panel data model Forward orthogonal deviations generalized method of moment model (GMM)	1998 – 2012	Spain	Total securitisation Cost-income ratio Impaired loans to gross loans Net interest margin S.T interest rates Liquid assets to Total assets Z-score	Stability (-) (MBS + ABS) from 1998 to 2006 due to RCA Stability (+) from 2007 – 2012 Stability (no effect) (covered bonds – liabilities securitisations)

B) Appendix of Chapter 4

Table 4.1 Descriptive statistics of all the variables used in this study (quarterly detailed)

	LNSEC_TA	LNTL_TA	LNLA_DST	LNTL_DST	LNROE	LNOE_OI
Mean	-4.723117	-0.327375	-2.080014	-0.009208	-1.933409	-0.618855
Median	-4.725696	-0.326815	-1.977650	-0.012952	-1.965310	-0.591830
Maximum	-4.342951	-0.288430	-1.878611	0.040357	-1.620448	-0.556925
Minimum	-5.233914	-0.354749	-2.435612	-0.041880	-2.066802	-0.735134
Std. Dev.	0.298332	0.019260	0.200797	0.026156	0.128737	0.061710
Skewness	-0.236711	0.616639	-0.719676	0.536606	1.686794	-0.923327
Kurtosis	1.938608	2.870005	1.906133	2.269361	4.838571	2.307136
Jarque-Bera	1.800909	2.050495	4.357707	2.247491	19.68191	5.186925
Probability	0.406385	0.358708	0.113171	0.325060	0.000053**(*)**	0.074761
Sum	-151.1398	-10.47599	-66.56045	-0.294660	-61.86908	-19.80335
Sum Sq. Dev.	2.759057	0.011500	1.249902	0.021209	0.513773	0.118052
Observations	32	32	32	32	32	32

(*) annual probability 0.08

	LNCAR	LNINTERBKRATE	LNROA	LNIE_DST	LNOBS_RWA	LNTE_TA
Mean	-1.911440	1.586649	-4.624895	-2.859638	-1.359665	-2.685003
Median	-1.905429	1.446919	-4.615272	-3.029315	-1.382425	-2.677174
Maximum	-1.849055	2.319442	-4.491842	-2.302585	-1.198896	-2.598160
Minimum	-2.022774	1.252763	-4.767689	-3.130407	-1.641768	-2.870427
Std. Dev.	0.049462	0.347383	0.080109	0.301083	0.142057	0.084261
Skewness	-1.146524	1.125516	-0.257533	0.954818	-0.582503	-1.098289
Kurtosis	3.830930	2.956491	2.556876	2.227153	2.589482	3.449446
Jarque-Bera	7.931355	6.758719	0.615536	5.658668	2.034350	6.702611
Probability	0.018955**(*)**	0.034069**(**)**	0.735086	0.059052	0.361615	0.035039**(***)**
Sum	-61.16608	50.77278	-147.9966	-91.50841	-43.50929	-85.92010
Sum Sq. Dev.	0.075842	3.740924	0.198940	2.810184	0.625590	0.220098
Observations	32	32	32	32	32	32

(*), (**) and (***) are significant at 1% level, others are at 5% level. (*) annual probability 0.37; (**) annual probability non-log 0.003; (***) annual probability 0.43

	LNZSCORE	LNDST_TA	LNNII_TA	LNNII_NOR	LNLA_TA	LNRWA_TA
Mean	3.992617	-0.319456	-3.625408	-0.840614	-2.403644	-0.660903
Median	4.007145	-0.316128	-3.634391	-0.846034	-2.282782	-0.655881
Maximum	4.063198	-0.293030	-3.571986	-0.811404	-2.171557	-0.623621
Minimum	3.872450	-0.371064	-3.665163	-0.867303	-2.813411	-0.733969
Std. Dev.	0.066476	0.024273	0.030141	0.017304	0.225087	0.031222
Skewness	-0.547984	-0.951991	0.538637	0.307269	-0.752148	-1.402431
Kurtosis	1.998968	3.048313	2.064392	2.131388	1.998459	4.296161
Jarque-Bera	2.937615	4.836638	2.714507	1.509524	4.354652	12.72971
Probability	0.230200	0.089071	0.257367	0.470122	0.113344	0.001721(*)
Sum	127.7638	-10.22259	-116.0131	-26.89965	-76.91661	-21.14891
Sum Sq. Dev.	0.136990	0.018264	0.028162	0.009282	1.570586	0.030219
Observations	32	32	32	32	32	32

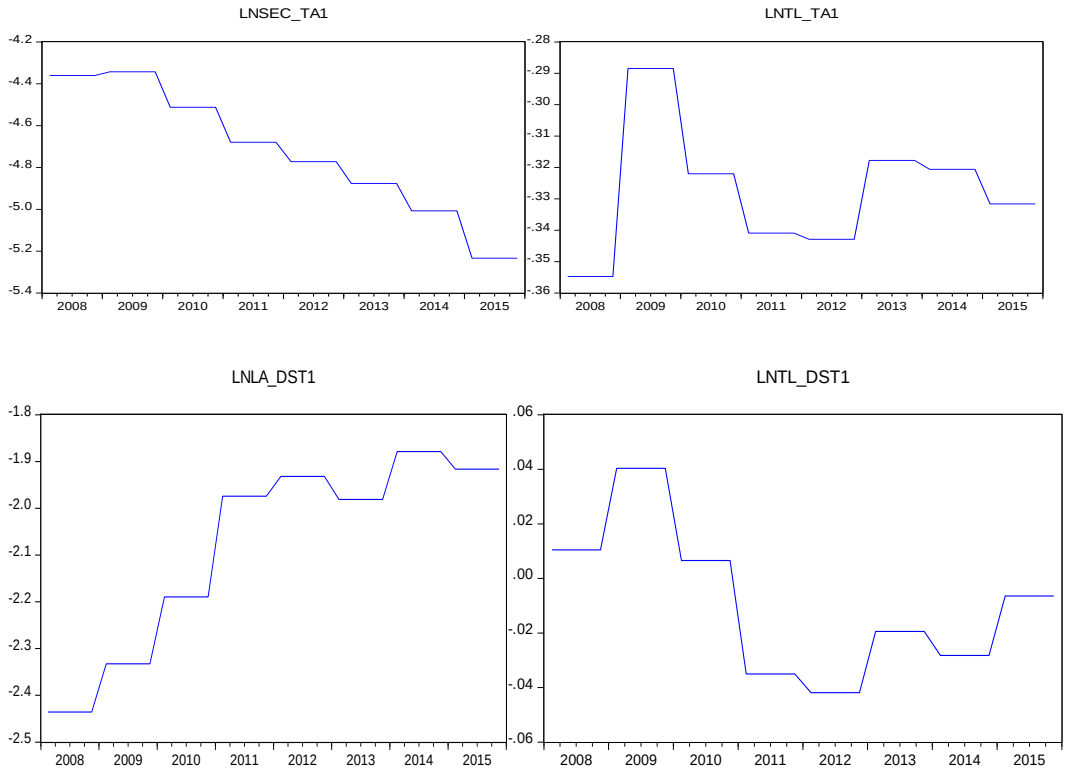
(*) annual probability 0.20

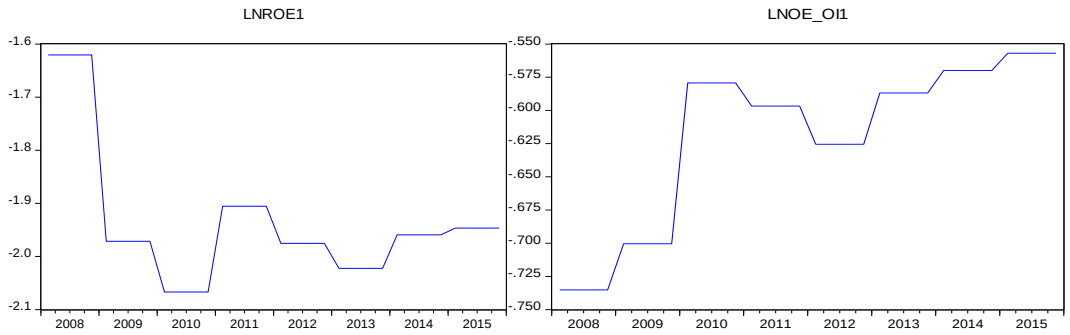
	LNTA_RWA	LNSBL_SEC	LNBKSIZE	LNBCON	LNHP	LNGDP
Mean	0.660144	-3.403126	14.76796	-1.683476	6.005711	0.663155
Median	0.655157	-2.995652	14.75174	-1.679328	5.964474	0.852374
Maximum	0.732849	-2.680922	15.03210	-1.666008	6.211002	1.308333
Minimum	0.621651	-4.615221	14.58448	-1.709258	5.872118	-0.693147

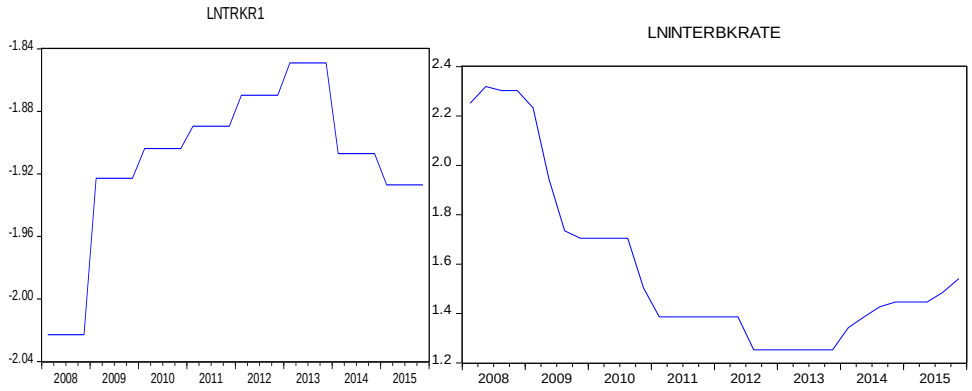
Std. Dev.	0.031273	0.721624	0.143515	0.015943	0.118462	0.629543
Skewness	1.351195	-0.590935	0.492706	-0.436781	0.550766	-1.061382
Kurtosis	4.225223	1.635308	2.155672	1.708152	1.937979	3.170301
Jarque-Bera	11.73877	4.345599	2.245237	3.242644	3.121679	6.046844
Probability	0.002825(*)	0.113858	0.325427	0.197637	0.209960	0.048635(**)
Sum	21.12460	-108.9000	472.5746	-53.87125	192.1827	21.22095
Sum Sq. Dev.	0.030319	16.14299	0.638490	0.007880	0.435032	12.28604
Observations	32	32	32	32	32	32

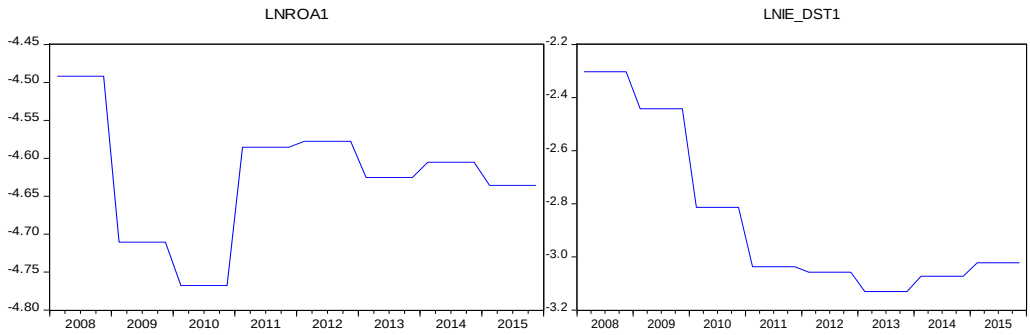
(*) Annual probability 0.23; (**) is significant at 1% level and annual probability was 0.46

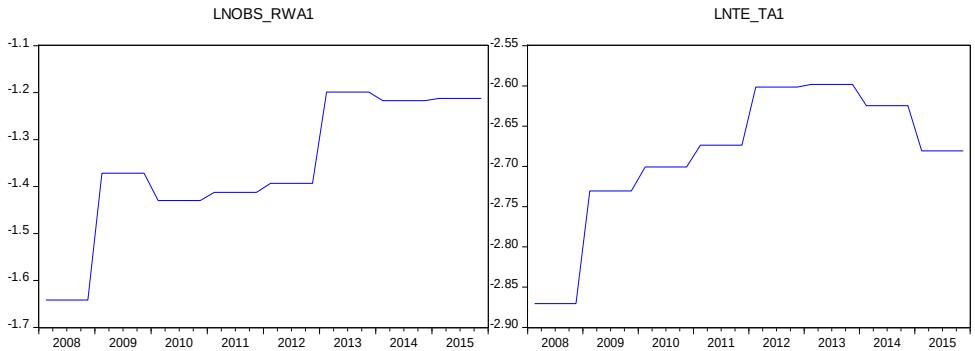
Figure 4.1 Graphs of all the variables

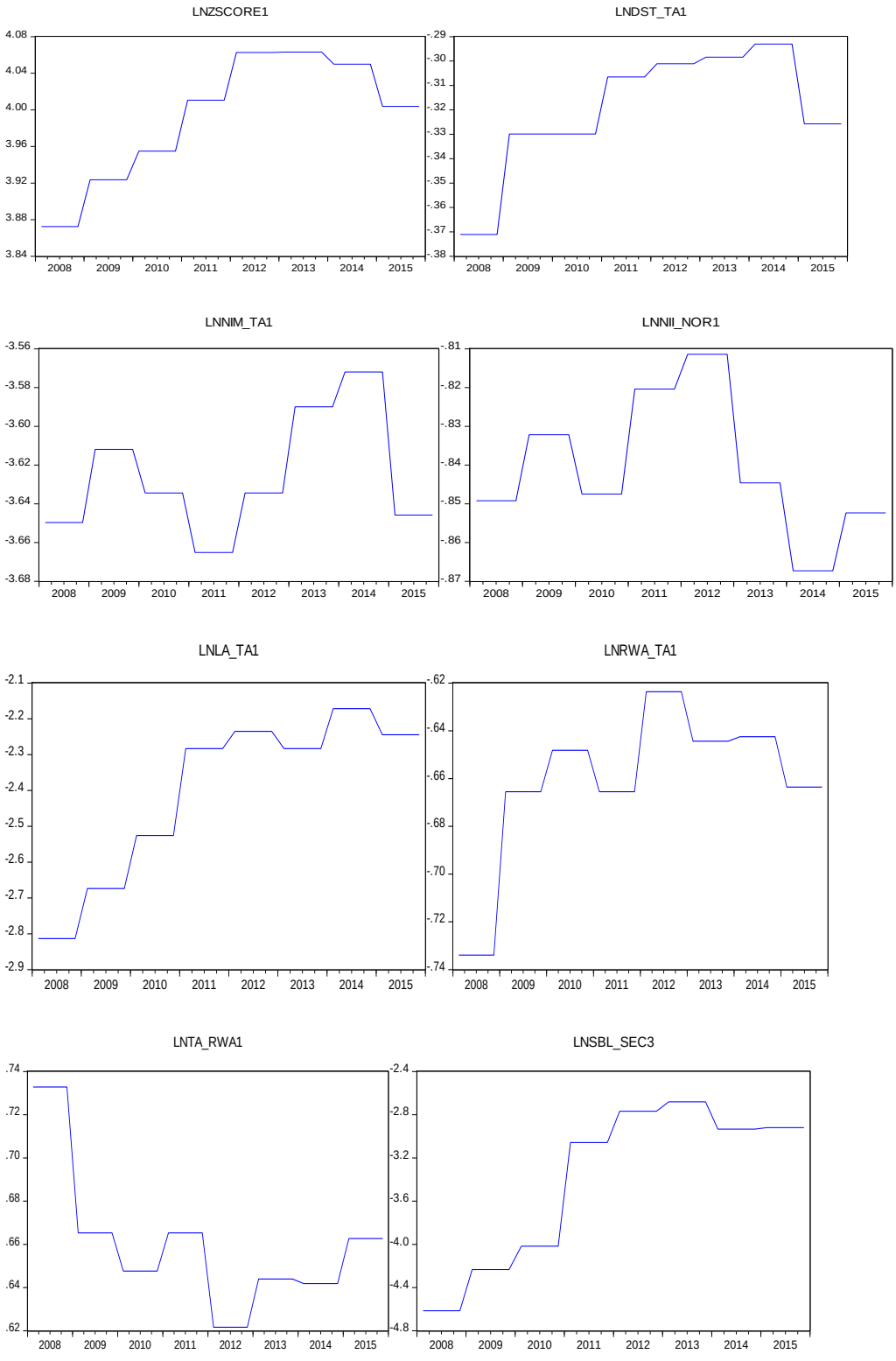



LNROE1
-1.6
-1.7
-1.8
-1.9
-2.0
-2.1
2008
2009
2010
2011
2012
2013
2014
2015
LNOE_OI1
-.550
-.575
-.600
-.625
-.650
-.675
-.700
-.725
-.750
2008
2009
2010
2011
2012
2013
2014
2015


LNTRKR1
-1.84
-1.88
-1.92
-1.96
-2.00
-2.04
2008
2009
2010
2011
2012
2013
2014
2015
LNINTERBKRATE
2.4
2.2
2.0
1.8
1.6
1.4
1.2
2008
2009
2010
2011
2012
2013
2014
2015


LNROA1
-4.45
-4.50
-4.55
-4.60
-4.65
-4.70
-4.75
-4.80
2008
2009
2010
2011
2012
2013
2014
2015
LNIE_DST1
-2.2
-2.4
-2.6
-2.8
-3.0
-3.2
2008
2009
2010
2011
2012
2013
2014
2015


LNOBS_RWA1
-1.1
-1.2
-1.3
-1.4
-1.5
-1.6
-1.7
2008
2009
2010
2011
2012
2013
2014
2015
LNTE_TA1
-2.55
-2.60
-2.65
-2.70
-2.75
-2.80
-2.85
-2.90
2008
2009
2010
2011
2012
2013
2014
2015


LNZSCORE1
LNDST_TA1
LNNIM_TA1
LNNII_NOR1
LNLA_TA1
LNRWA_TA1
LNTA_RWA1
LNSBL_SEC3

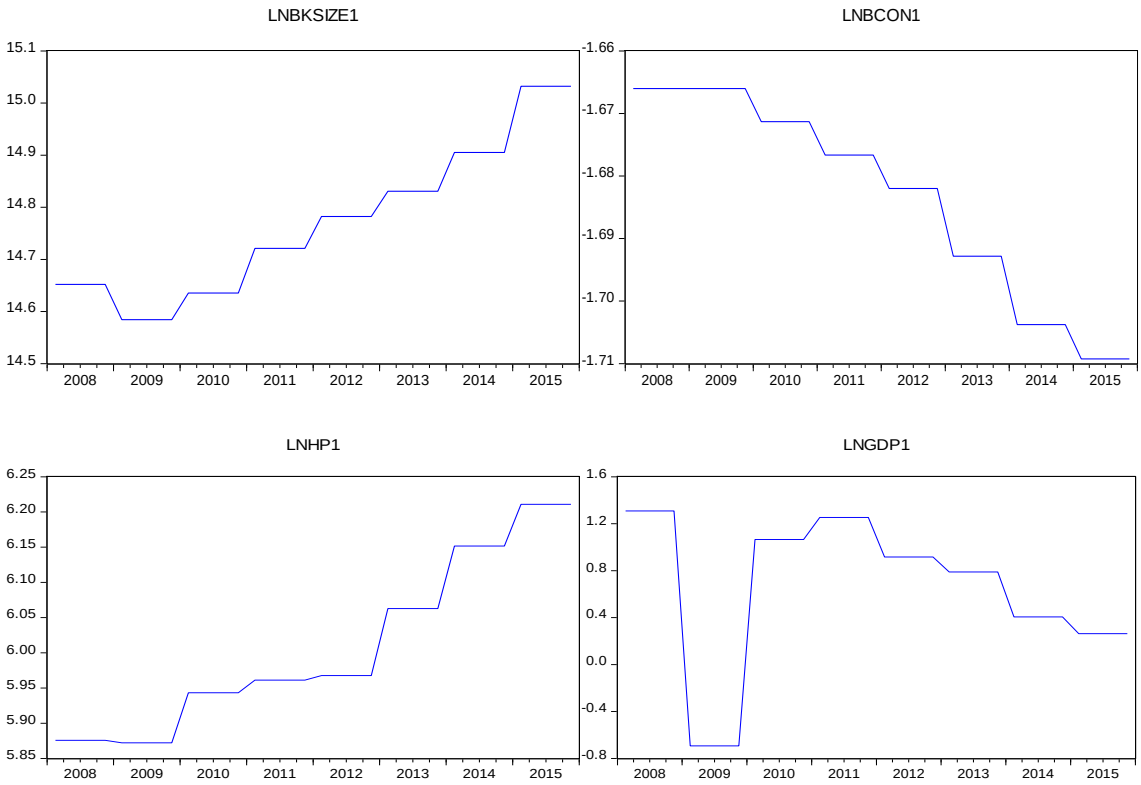


Table 4.2 Descriptive statistics and correlation matrix Securitisation and regulatory arbitrage

Table 4.3a Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNCAR	-1.91	0.04	-2.02	-1.84	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNTL_TA	-0.32	0.01	-0.35	-0.29	32
LNROE	-1.93	0.12	-2.06	-1.62	32
LNROA	-4.62	0.08	-4.76	-4.49	32
LNINTERATE	1.58	0.34	1.25	2.31	32
LNIE_DST	-2.85	0.30	-3.13	-2.30	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNDST_TA	-0.31	0.02	-0.37	-0.29	32
LNBSIZE	14.76	0.14	14.58	15.03	32
LNRWA_TA	-0.66	0.03	-0.73	-0.62	32

All variables are normally distributed except CAR, ROE, INTERBKRATE, RWA_TA.

Table 4.3b: Correlation Matrix

	LNCAR	LNSEC_TA	LNDST_TA	LNTL_DST	LNROE	LNROA	LNTL_TA	LNINTBKRATE	LNIE_DST	LNBKSIZE	LNRWA_TA
LNCAR	1.00										
LNSEC_TA	-0.41	1.00									
LNDST_TA	0.89	-0.58	1.00								
LNTL_DST	-0.53	0.58	-0.68	1.00							
LNROE	-0.85	0.34	-0.71	0.16	1.00						
LNROA	-0.38	-0.08	-0.16	-0.42	0.78	1.00					
LNTL_TA	0.32	0.11	0.24	0.53	-0.59	-0.73	1.00				
LNINTBKRATE	-0.88	0.68	-0.90	0.72	0.69	0.15	-0.07	1.00			
LNIE_DST	-0.81	0.80	-0.87	0.81	0.62	0.06	0.07	0.94	1.00		
LNBKSIZE	0.25	-0.98	0.45	-0.52	-0.18	0.20	-0.17	-0.56	-0.69	1.00	
LNRWA_TA	0.91	-0.47	0.87	-0.48	-0.89	-0.47	0.35	-0.83	-0.77	0.32	1.00

	LNRWA_TA	LNSEC_TA	LNROE	LNTL_TA	LNDST_TA	LNTL_DST	LNBKSIZE		
LNRWA_TA	1.00								
LNSEC_TA	-0.47	1.00							
LNROE	-0.89	0.34	1.00						
LNTL_TA	0.35	0.11	-0.59	1.00					
LNDST_TA	0.87	-0.58	-0.71	0.24	1.00				
LNTL_DST	-0.48	0.58	0.16	0.53	-0.68	1.00			
LNBKSIZE	0.32	-0.98	-0.18	-0.17	0.45	-0.52	1.00		

	LNTL_TA	LNSEC_TA	LNROE	LNINTERBKRATE	LNIE_DST	LNROA	LNDST_TA	LNTL_DST	LNBKSIZE
LNTL_TA	1.00								
LNSEC_TA	0.11	1.00							
LNROE	-0.59	0.34	1.00						
LNINTERBKRATE	-0.07	0.68	0.69	1.00					
LNIE_DST	0.07	0.80	0.62	0.94	1.00				
LNROA	-0.73	-0.08	0.78	0.15	0.06	1.00			
LNDST_TA	0.24	-0.58	-0.71	-0.90	-0.87	-0.16	1.00		
LNTL_DST	0.53	0.58	0.16	0.72	0.81	-0.42	-0.68	1.00	
LNBKSIZE	-0.17	-0.98	-0.18	-0.56	-0.69	0.20	0.45	-0.52	1.00

Table 4.3 Descriptive statistics and correlation matrix Securitisation and bank stability

Securitisation and Capital

Table 4.4a Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNTE_TA	-2.68	0.08	-2.87	-2.59	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNTL_TA	-0.32	0.01	-0.35	-0.29	32
LNLA_DST	-2.08	0.20	-2.43	-1.87	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNROE	-1.93	0.12	-2.06	-1.62	32
LNOE_OI	-0.61	0.06	-0.73	-0.55	32
LNBKSIZE	14.76	0.14	14.58	15.03	32
LNHP	6.00	0.11	5.87	6.21	32

The composition of our variables is essentially made of ratios. As such, the mean is more appropriate as the measure of central tendency, unlike of the mode or the median (Gay, Mills, & Airasian, 2006). Except perhaps the variable *LNOE_OI*, all the other variables pertaining to the determination of the relationship between *LNSEC_TA* and *LNTE_TA* are huddled around their respective mean and quite close together. Likewise, their respective standard deviations, which is the measure of variance, are all less that one. This is an indication that our data are less spread out, meaning that they are not too far from the mean.

Table 4.4b Correlation matrix

	LNTE_TA	LNSEC_TA	LNTL_TA	LNLA_DST	LNTL_DST	LNROE	LNOE_OI	LNBKSIZE	LNHP
LNTE_TA	1.00								
LNSEC_TA	-0.63	1.00							
LNTL_TA	0.23	0.11	1.00						
LNLA_DST	0.87	-0.87	-0.09	1.00					
LNTL_DST	-0.65	0.58	0.53	-0.81	1.00				
LNROE	-0.79	0.34	-0.59	-0.53	0.16	1.00			
LNOE_OI	0.75	-0.79	0.04	0.85	-0.57	-0.69	1.00		
LNBKSIZE	0.50	-0.98	-0.17	0.78	-0.52	-0.18	0.68	1.00	
LNHP	0.54	-0.97	-0.01	0.78	-0.43	-0.32	0.78	0.96	1.00

Securitisation and Asset quality

Table 4.4c Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNOBS_RWA	-1.35	0.14	-1.64	-1.19	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNCAR	-1.91	0.04	-2.02	-1.84	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNROE	-1.93	0.12	-2.06	-1.62	32
LNROA	-4.62	0.08	-4.76	-4.49	32
LNINTERBRATE	1.58	0.34	1.25	2.31	32
LNBKSIZE	14.76	0.14	14.58	15.03	32
LNHP	6.00	0.11	5.87	6.21	32
LNGDP	0.66	0.62	-0.69	1.30	32

All variables are throng together around the mean.

Table 4.4d Correlation matrix

	LNOBS/RWA	LNSEC_TA	LNCAR	LNTL_DST	LNTL_TA	LNINTBKRATE	LNROE	LNROA	LNBKSIZE	LNHP	LNGDP
LNOBS_RWA	1.00										
LNSEC_TA	-0.79	1.00									
LNCAR	0.67	-0.41	1.00								
LNTL_DST	-0.30	0.58	-0.53	1.00							
LNTL_TA	0.47	0.11	0.32	0.53	1.00						
LNINTERBKRATE	-0.74	0.68	-0.88	0.72	-0.07	1.00					
LNROE	-0.69	0.34	-0.85	0.16	-0.59	0.69	1.00				
LNROA	-0.32	-0.08	-0.38	-0.42	-0.73	0.15	0.78	1.00			
LNBKSIZE	0.72	-0.98	0.25	-0.52	-0.17	-0.56	-0.18	0.20	1.00		
LNHP	0.81	-0.97	0.30	-0.43	-0.00	-0.58	-0.32	0.00	0.96	1.00	
LNGDP	-0.44	0.05	-0.07	-0.54	-0.84	-0.05	0.32	0.45	-0.05	-0.13	1.00

All independent variables are suitably correlated except *LNSEC/LNHP; LNSEC/LNBKSIZE* and *LNBKSIZE/LNHP*. We have employed them with one period lag.

Securitisation and Management efficiency

Table 4.4e Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNOE_OI	-0.61	0.06	-0.73	-0.55	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNTL_TA	-0.32	0.01	-0.35	-0.28	32
LNIE_DST	-2.85	0.30	-3.13	-2.30	32
LNOBS_RWA	-1.35	0.14	-1.64	-1.19	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNROE	-1.93	0.12	-2.06	-1.62	32
LNBKSIZE	14.76	0.14	14.58	15.03	32
LNHP	6.00	0.11	5.87	6.21	32

All variables are clustered around the mean.

Table 4.4f Correlation matrix

	LNOE_OI	LNSEC_TA	LNTL_TA	LNIE_DST	LNOBS_RWA	LNTL_DST	LNROE	LNBKSIZE	LNHP
LNOE_OI	1.00								
LNSEC_TA	-0.79	1.00							
LNTL_TA	0.04	0.11	1.00						
LNIE_DST	-0.89	0.80	0.07	1.00					
LNOBS_RWA	0.75	-0.79	0.47	-0.74	1.00				
LNTL_DST	-0.57	0.58	0.53	0.81	-0.30	1.00			
LNROE	-0.69	0.34	-0.59	0.62	-0.69	0.16	1.00		
LNBKSIZE	0.68	-0.98	-0.17	-0.69	0.72	-0.52	-0.18	1.00	
LNHP	0.78	-0.97	-0.01	-0.70	0.81	-0.43	-0.32	0.96	1.00

Except *LNBKSIZE*, all independent variables are reasonably correlated.

Securitisation and Profitability

Table 4.4g Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNROA	-4.62	0.08	-4.76	-4.49	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNTL_TA	-0.32	0.01	-0.35	-0.28	32
LNOE_OI	-0.61	0.06	-0.73	-0.55	32
LNTE_TA	-2.68	0.08	-2.87	-2.59	32
LNOBS_RWA	-1.35	0.14	-1.64	-1.19	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNROE	-1.93	0.12	-2.06	-1.62	32
LNBKSIZE	14.76	0.14	14.58	15.03	32
LNHP	6.00	0.11	5.87	6.21	32

Here also, all the variables are grouped around the mean.

Table 4.4h Correlation matrix

	LNSEC_TA	LNOE_OI	LNTL_TA	LNTE_TA	LNOBS_RWA	LNTL_DST	LNROE	LNBKSIZE	LNHP	LNROA
LNSEC_TA	1.00									
LNOE_OI	-0.79	1.00								
LNTL_TA	0.11	0.04	1.00							
LNTE_TA	-0.63	0.75	0.23	1.00						
LNOBS_RWA	-0.79	0.75	0.47	0.79	1.00					
LNTL_DST	0.58	-0.57	0.53	-0.65	-0.30	1.00				
LNROE	0.34	-0.69	-0.59	-0.79	-0.69	0.16	1.00			
LNBKSIZE	-0.98	0.68	-0.17	0.50	0.72	-0.52	-0.18	1.00		
LNHP	-0.97	0.78	-0.01	0.54	0.81	-0.43	-0.32	0.96	1.00	
LNROA	-0.08	-0.34	-0.73	-0.24	-0.32	-0.42	0.78	0.20	0.01	1.00

All the variables are properly correlated except *LNSEC/LNHP; LNSEC/LNBKSIZE* and *LNBKSIZE/LNHP*. We included them with one period lag also.

	LNROA	LNSEC_TA	LNOE_OI	LNTL_TA	LNTE_TA	LNOBS_RWA	LNTL_DST	LNROE	LNBKSIZE	LNHP1
LNROA	1.00									
LNSEC_TA	-0.08	1.00								
LNOE_OI	-0.34	-0.79	1.00							
LNTL_TA	-0.73	0.11	0.04	1.00						
LNTE_TA	-0.24	-0.63	0.75	0.23	1.00					
LNOBS_RWA	-0.32	-0.79	0.75	0.47	0.79	1.00				
LNTL_DST	-0.42	0.58	-0.57	0.53	-0.65	-0.30	1.00			
LNROE	0.78	0.34	-0.69	-0.59	-0.79	-0.69	0.16	1.00		
LNBKSIZE	0.20	-0.98	0.68	-0.17	0.50	0.72	-0.52	-0.18	1.00	
LNHP	0.01	-0.97	0.78	-0.01	0.54	0.81	-0.43	-0.32	0.96	1.00

All the variables are properly correlated except *LNSEC/LNHP; LNSEC/LNBKSIZE* and *LNBKSIZE/LNHP*. We included them with one period lag also.

Securitisation and Liquidity

Table 4.4i Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNLA_DST	-2.08	0.20	-2.43	-1.87	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNOBS_RWA	-1.35	0.14	-1.64	-1.19	32
LNZSCORE	3.99	0.06	3.87	4.06	32
LNROA	-4.62	0.08	-4.76	-4.49	32
LNINTERATE	1.58	0.34	1.25	2.31	32
LNBSIZE	14.76	0.14	14.58	15.03	32
LNHP	6.00	0.11	5.87	6.21	32

All variables are normally distributed except *Lninterbankrate*

Table 4.4j Correlation matrix

	LNLA_DST	LNSEC_TA	LNTL_DST	LNZSCORE	LNINTBKRATE	LNOBS_RWA	LNROA	LNBKSIZE	LNHP
LNLA_DST	1.00								
LNSEC_TA	-0.87	1.00							
LNTL_DST	-0.81	0.58	1.00						
LNZSCORE	0.93	-0.73	-0.81	1.00					
LNINTBKRATE	-0.90	0.68	0.72	-0.93	1.00				
LNOBS_RWA	0.76	-0.79	-0.30	0.75	-0.74	1.00			
LNROA	0.02	-0.08	-0.42	0.01	0.15	-0.32	1.00		
LNBKSIZE	0.78	-0.98	-0.52	0.63	-0.56	0.72	0.20	1.00	
LNHP	0.78	-0.97	-0.43	0.62	-0.58	0.81	0.01	0.96	1.00

All independent variables are appropriately correlated except *LNINTBKRATE/LNZSCORE* and *LNBKSIZE/LNHP*. The latter were included with one period lag as well.

Securitisation and Sensitivity to market risk

Table 4.4k Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNNIM_TA	-3.62	0.03	-3.66	-3.57	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNTE_TA	-2.68	0.08	-2.87	-2.59	32
LNDST_TA	-0.31	0.02	-0.37	-0.29	32
LNINTERATE	1.58	0.34	1.25	2.31	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNBKSIZE	14.76	0.14	14.58	15.03	32
LNHP	6.00	0.11	5.87	6.21	32
LNGDP	0.66	0.62	-0.69	1.30	32

Variables here, are also closed to their mean. All variables are normally distributed except *LNTE_TA, LNINTERBKRATE* and *LNGDP*.

Table 4.4l Correlation matrix

	LNNIM_TA	LNSEC_TA	LNTE_TA	LNDST_TA	LNINTBKRATE	LNTL_DST	LNBKSIZE	LNHP	LNGDP
LNNIM_TA	1.00								
LNSEC_TA	-0.24	1.00							
LNTE_TA	0.45	-0.63	1.00						
LNDST_TA	0.49	-0.58	0.96	1.00					
LNINTBKRATE	-0.27	0.68	-0.93	-0.90	1.00				
LNTL_DST	-0.01	0.58	-0.65	-0.68	0.72	1.00			
LNBKSIZE	0.22	-0.98	0.50	0.45	-0.56	-0.52	1.00		
LNHP	0.34	-0.97	0.54	0.50	-0.58	-0.43	0.96	1.00	
LNGDP	-0.43	0.05	-0.10	-0.10	-0.05	-0.54	-0.05	-0.13	1.00

All the variables are suitably correlated except *LNSEC/LNHP; LNSEC/LNBKSIZE; LNTE_TA/LNINTERBKRATE* and *LNBKSIZE/LNHP*. Likewise, they were used with one period lag to correct perfect multicollinearity.

Securitisation and Z-score (1)

Table 4.4m Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNZSCORE					
LNTE_TA	-2.68	0.08	-2.87	-2.59	32
LNSEC_TA	-4.72	0.29	-5.23	-4.34	32
LNLA_TA	-2.40	0.22	-2.81	-2.17	32
LNRWA_TA	-0.66	0.03	-0.73	-0.62	32
LNTL_DST	-0.01	0.02	-0.04	0.04	32
LNROE	-1.93	0.12	-2.06	-1.62	32
LNINTERBRATE	1.58	0.34	1.25	2.31	32
LNBKSIZE	14.76	0.14	14.58	15.03	32
LNHP	6.00	0.11	5.87	6.21	32
LNGDP	0.66	0.62	-0.69	1.30	32

Table 4.4n Correlation matrix

	LNZSCORE	LNSEC_TA	LNRWA_TA	LNTE_TA	LNLA_TA	LNTL_DST	LNROE	LNINTBKRATE	LNBKSIZE	LNHP	LNGDP
LNZSCORE	1.00										
LNSEC_TA	-0.73	1.00									
LNRWA_TA	0.82	-0.47	1.00								
LNTE_TA	0.96	-0.63	0.93	1.00							
LNLA_TA	0.94	-0.85	0.75	0.89	1.00						
LNTL_DST	-0.81	0.58	-0.48	-0.65	-0.81	1.00					
LNROE	-0.60	0.34	-0.89	-0.79	-0.55	0.16	1.00				
LNINTBKRATE	-0.93	0.68	-0.83	-0.93	-0.91	0.72	0.69	1.00			
LNBKSIZE	0.63	-0.98	0.32	0.50	0.76	-0.52	-0.18	-0.56	1.00		
LNHP	0.62	-0.97	0.39	0.54	0.76	-0.43	-0.32	-0.58	0.96	1.00	
LNGDP	0.05	0.05	-0.20	-0.10	0.05	-0.54	0.32	-0.05	-0.05	-0.13	1.00

Securitisation and Z-score (2)

Table 4.4o Descriptive statistics

Variable Name	Mean	Std. Dev.	Min	Max	Obs
LNZ-SCORE	4.18	0.08	4.03	4.29	32
LNSEC_TA	-4.56	0.34	-5.09	-4.09	32
LNSBL_SEC	-3.40	0.72	-4.61	-2.68	32
LNINTERBKRATE	1.58	0.34	1.25	2.31	32
LNTL_DST	-0.07	0.02	-0.10	-0.04	32
LNRWA_TA	-0.66	0.04	-0.74	-0.59	32
LNNII_TA	-3.68	0.03	-3.72	-3.64	32
LNBKSIZE	14.42	0.16	14.21	14.70	32
LNHP	6.00	0.11	5.87	6.21	32
LNGDP	0.66	0.62	-0.69	1.30	32
LNBCON	-1.68	0.01	-1.70	-1.66	32

Table 4.4p Correlation matrix

	LNZSCORE2	LNSEC_TA	LNSBL_SEC	LNINTERBKRATE	LNTL_DST	LNRWA_TA	LNNIM_TA	LNBKSIZE	LNBCON	LNHP	LNGDP
LNZ-SCORE2	1.00										
LNSEC_TA	-0.84	1.00									
LNSBL_SEC	0.95	-0.87	1.00								
LNINTERBKRATE	-0.88	0.75	-0.91	1.00							
LNTL_DST	0.57	-0.64	0.45	-0.35	1.00						
LNRWA_TA	0.87	-0.59	0.84	-0.83	0.27	1.00					
LNNII_TA	0.36	-0.12	0.14	-0.02	0.61	0.19	1.00				
LNBKSIZE	0.76	-0.96	0.76	-0.58	0.71	0.45	0.23	1.00			
LNBKCON	-0.79	0.96	-0.76	0.61	-0.77	-0.46	-0.31	-0.98	1.00		
LNHP	0.73	-0.95	0.71	-0.58	0.77	0.39	0.24	0.97	-0.99	1.00	
LNGDP	-0.10	-0.01	0.06	-0.05	-0.61	-0.07	-0.63	-0.05	0.14	-0.13	1.00

Table 4.4 Unit root tests of all the variables

		Augmented Dickey-Fuller test (*)	Phillips-Perron test (*)	
		T-values (lags) /P-values	T-values(bandwidth) /P-values	
	Model specification	5% significance	5% significance	**Conclusion**
LnBKCON	Intercept	-0,416(4) / 0,89	0,658(13) / 0,98	Non-stationary
	Trend and Intercept	-2,265(4) / 0,43	-3,266(30) / 0,09	
	None	1,880(4) / 0,98	3,510(14) / 0,99	
LnBKSIZE	Intercept	0,544(4) / 0,98	1,677(30) / 0,99	Non-stationary
	Trend and Intercept	-2,265(4) / 0,43	-3,595(26) / 0,04	
	None	2,360(4) / 0,99	2,470(14) / 0,99	
LnGDP	Intercept	-2,381(0) / 0,15	-2,470(1) / 0,13	Non-stationary
	Trend and Intercept	-3,502(3) / 0,05	-2,428(1) / 0,35	
	None	-1,879(0) / 0,05	-1,90(1) / 0,055	
LnHP	Intercept	0,109(0) / 0,96	1,344(30) / 0,99	Non-stationary
	Trend and Intercept	-2,537(0) / 0,31	-2,442(8) / 0,352	
	None	1,868(4) / 0,98	4,519(30) / 0,99	
LnLA-DST	Intercept	-1,641(0) / 0,45	-2,264(20) / 0,18	Non-stationary
	Trend and Intercept	-1,319(0) / 0,86	-1,088(7) / 0,91	
	None	-1,912(0) / 0,05	-2,348(11) / 0,02	
LnNII-NOR	Intercept	-1,624(0) / 0,45	-1,730(2) / 0,40	Non-stationary
	Trend and Intercept	-1,869(0) / 0,64	-1,909(1) / 0,62	
	None	0,022(0) / 0,68	0,02(0) / 0,68	
LnOBS-RWA	Intercept	-1,877(0) / 0,33	-1,843(4) / 0,35	Non-stationary
	Trend and Intercept	-2,572(0) / 0,29	-2,560(3) / 0,29	
	None	-1,467(0) / 0,13	-1,709(4) / 0,08	
LnOE-OI	Intercept	-1,747(0) / 0,39	-1,719(4) / 0,41	Non-stationary
	Trend and Intercept	-15,12(7) / 0,00	-2,024(2) / 0,56	
	None	-1,479(0) / 0,12	-1,637(4) / 0,09	
LnROAA	Intercept	-2,540(0) / 0,11	-2,562(2) / 0,11	Non-stationary
	Trend and Intercept	-11,85(7) / 0,00	-2,244(7) / 0,44	
	None	0,318(0) / 0,77	0,318(0) / 0,77	
LnSEC-TA	Intercept	0,530(4) / 0,98	1,165(14) / 0,99	Non-stationary
	Trend and Intercept	-2,475(4) / 0,33	-5,039(30) / 0,00	
	None	2,193(4) / 0,99	5,65(14) / 0,99	
LnTE-TA	Intercept	-2,374(0) / 0,15	-2,755(15) / 0,07	Non-stationary
	Trend and Intercept	-1,283(0) / 0,87	-0,148(30) / 0,99	
	None	-1,165(0) / 0,21	-1,249(3) / 0,18	
LnTL-LA	Intercept	-2,515(0) / 0,12	-2,515(0) / 0,12	Non-stationary
	Trend and Intercept	-2,469(0) / 0,33	-2,521(1) / 0,31	
	None	-0,415(0) / 0,52	-0,415(0) / 0,52	
LnCAR	Intercept	-2,412(0) / 0,14	-2,452(7) / 0,13	Non-stationary
	Trend and Intercept	-1,562(0) / 0,78	-1,073(23) / 0,91	
	None	-0,832(0) / 0,34	-0,840(1) / 0,34	

LnZSCORE	Intercept	-1,460(0) / 0,54	-1,497(1) / 0,52	Non-stationary
	Trend and Intercept	-2,262(0) / 0,29	-2,673(1) / 0,25	
	None	0,648(0) / 0,85	0,653(1) / 0,85	
LnDST-TA	Intercept	-2,263(0) / 0,18	-2,311(5) / 0,17	Non-stationary
	Trend and Intercept	-1,274(0) / 0,87	-0,673(7) / 0,96	
	None	-0,937(0) / 0,30	-0,947(1) / 0,29	
LnTL-DST	Intercept	-1,441(0) /0,54	-1,469(1) / 0,53	Non-stationary
	Trend and Intercept	-1,354(0) / 0,85	-1,470(2) / 0,81	
	None	-1,287(0) / 0,17	-1,315(1) / 0,17	
LnROE	Intercept	-9,208(7) / 0,00	-3,222(9) / 0,02	Non-stationary
	Trend and Intercept	-9,371(7) / 0,00	-2,306(10) / 0,41	
	None	-0,616(0) / 0,84	0,623(1) / 0,84	
LnInterbkrate	Intercept	-2,828(1) /0,06	-2,048(3) / 0,26	Non-stationary
	Trend and Intercept	-1,733(4) / 0,70	0,229(10) / 0,99	
	None	-1,520(1) / 0,11	-1,973(0) / 0,04	
LnIE-DST	Intercept	-2,484(4) / 0,13	-2,533(21) /0,11	Non-stationary
	Trend and Intercept	-0,292(3) / 0,98	0.033(22) / 0,99	
	None	0,090(4) / 0,70	1,376(4) / 0,95	
LnROA	Intercept	-2,352(0) / 0,16	-2,352(0) /0.16	Non-stationary
	Trend and Intercept	-5,109(7) / 0,00	-2,345(2) /0,39	
	None	0.440(0) / 0,80	0,440(0) / 0.80	
LnRWA-TA	Intercept	-2,587(0) / 0,10	-2,829(7) /0,06	Non-stationary
	Trend and Intercept	-1,960(0) / 0,59	-1,559(8) / 0,78	
	None	-0,899(0) / 0,31	-0,909(1) / 0,31	
LnNII-TA	Intercept	-1,869(0) / 0,34	-1,988(2) /0,29	Non-stationary
	Trend and Intercept	-6,100(7) / 0,00	-1,837(2) /0,66	
	None	-0,049(0) / 0,65	-0,049(0) / 0,65	
LnLA-TA	Intercept	-1,765(0) / 0,39	-2,447(20) / 0,13	Non-stationary
	Trend and Intercept	-1,219(0) / 0,88	-0,888(8) / 0,94	
	None	-1,837(0) / 0,06	-2,108(9) / 0,03	
LnSBL-SEC	Intercept	-1.590(0) / 0,47	-1.620(9) / 0,46	Non-stationary
	Trend and Intercept	-1,080(0) / 0,91	-1.005(5) / 0,92	
	None	-1.854(0) / 0,06	-2.030(7) / 0,04	
LnTA-RWA	Intercept	-2,573(0) / 0,10	-2,803(7) / 0,06	Non-stationary
	Trend and Intercept	-1,960(0) / 0,59	-1,573(7) / 0,78	
	None	-0,891(0) / 0,32	-0.900(1) / 0,31	

(*) Ho: the variable has unit root

Table 4.6 RCA - Estimated results with the Two Stage Least Squares method

Dependent variables / Independent variables	RWA_TA	TL_TA
SEC_TA	0.897(0.044) *	0.483(0.204) **
ROA		-0.520(0.222) **
TL_TA	-0.755(0.050) *	
ROE	-0.425(0.010) *	0.169(0.153)
IE_DST		-0.004(0.005)
Interbrate		-0.019 (0.012)
TL_DST	0.100(0.063)	0.342(0.329)
DST_TA	1.221(0.059) *	1.573(0.557) **
BKSIZE	1.456(0.071) *	0.987(0.435) **
Dum2008	0.001 (0.001) ***	0.001(0.001)
Constant	-0.001 (0.001) ***	-0.001 (0.001)
N	30	30

(*) significance at 1% level. (**) significance at 5% level. (***) significance at 10% level

Instruments variables: lnsec_ta1 lnroe1 lnie_dst1(-1) lninterbkrate lnroa1 lndst_ta1 lntl_dst1 lnbksize1 Dum2008

Table 4.7 Securitisation and RCA - Robustness check - Estimated results

Dependent variables / Independent variables	SEC_TA	TA_RWA
CAR	-0.929 (0.171) *	
SEC_TA		-0.867(0.05) *
TL_TA	0.655(0.618)	-0.680(0.031) *
LA_DST	0.481(0.345)	
ROE		-0.411(0.010) *
TL_DST	0.721 (0.426)	-0.128(0.069) ***
DST_TA	-1.433(1.562)	-1.177(0.03) *
BKSIZE	-1.157(0.143) *	-1.410(0.063) *
Dum2013	-0.002(0.003)	-0.008 (0.001)
Constant	-0.001 (0.001) ***	0.000 (0.000) ***
Std error regression	0.005	0.001
N	30	30

(*) significance at 1% level. (**) significance at 5% level. (***) significance at 10% level

Table 4.9 Securitisation and Bank stability - Robustness check - Estimated results

Dependent variables / Independent variables	ROE	NII_NOR	LA_TA
SEC_TA	0.136(0.021) *	0.206(0.05) *	0.917(0.026) *
TL_TA	0.261(0.113) **	-4.069(0.44) *	
IE_DST	-0.000(0.004) (-1)		
TE_TA	-0.996(0.015) *		
OBS_RWA	-0.004(0.025)	0.516(0.060) *	0.135(0.015) *
TL_DST	-1.131(1.187) *	1.822(0.373) *	-1.928(0.319) *
ROA	1.051(0.001) *		0.126(0.015) *
DST_TA		-0.074(0.061) (-1)	
Interbkrate			0.001(0.008)
Z-SCORE			2.265(0.03) *
ROE		-0.095(0.018) *	
BKSIZE	0.025(0.014) *** (-1)		0.042(0.026) (-1)
HP	0.091(0.026) * (-1)	-0.192(0.047) * (-1)	0.157(0.041) *
GDP		-0.055(0.004) *	
Dum2013	0.001(0.001)	0.001 (0.002)	0.001(0.001)
Constant	0.00(0.00)	-0.001 (0.001)	0.001(0.001)

Std error regression	0.001	0.003	0.003
N	**29**	**29**	**29**

(*) significance at 1% level. (**) significance at 5% level. (***) significance at 10% level

Table 4.10 Estimated results RCA with original data

Dependent variables / Independent Variables	CAR (I)	RWA_TA (II)	TL_TA (III)
SEC_TA	-5.042 (1.767) *	21.19 (1.74) *	19.02 (2.16) *

(*) significance at 1% level – Other control variables are intentionally not reported

Table 4.11 Estimated results Securitisation and Bank stability with original data

	CAMELS						Z-SCORES	
Dependent variables / Independent variables	**Capital**	**Asset Quality**	**Management Efficiency**	**Earnings**	**Liquidity**	**Sensitivity to market risk**	**Z-score (1)**	**Z-score (2)**
SEC_TA	-2.37 (0.061) *	-9.20 (2.41) *	43.19 (17.92) * *	0.461 (0.001) *	9.47 (1.10) *	0.383 (0.159) * *	-667 (6.17) *	-1262 (23.58) *
SBL_SEC								53.77 (2.02) *

(*) significance at 1% level. (**) significance at 5% level - Other control variables are intentionally not reported