Credit Risk and Securitisation in the South African Banking Sector

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Abstract: This paper investigates the relationship between credit risk and securitisation in the South African banking sector. Panel data analysis was used to analyse the annual observations from four major South African banks for a sample period from 2005 to 2014. Results indicate that the basis for securitisation variation in South African banks stems from capital, bank size and the economic growth of the country. A positive impact of securitisation on credit risk was discovered. The paper revealed that, contrary to previous findings, the global financial crisis of 2007–2009 had no effect on the securitisation in the South African banking sector. This paper also found that size has a significant influence on capitalisation. Compared to small banks, large banks tend to securitise more and take on further credit risk. Therefore, banks should increase or maintain an acceptable capital amount to hedge against any unexpected risks. Proper systems should be established and adopted to encourage repayment of loans by borrowers.

Keywords: Bank stability; solvency risk; cointegration, bank performance; South Africa

JEL Classification: G21; G32

1. Introduction

Banks are at the heart of every economy. Healthy and successful banks are vital for economic development, especially in a country such as South Africa. Nevertheless, there are a number of risks faced by banks, including credit risk (risk of repayment), market risk, operational risk, trade union risk, liquidity risk, interest risk, portfolio risk and legal risk. The most important of these risks is credit risk. Credit risk is one of the most significant risks for every bank. Credit risk is the inability of the borrower to repay the loan, combined with the bank's poor supervision over the credit granted. Credit risk is one of the causes of the 2007–2009 global financial crisis and

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consequent economic meltdown (Charles & Kenneth, 2013). Moreover, Chijoriga (1997) contends that the influence of credit risk is far greater, and capable of collapsing a whole bank, compared to the other risks faced by banks. As an attempt to hedge against credit risk and the future financial instability, most banks have increased their securitisation activities. Securitisation is the process that starts when an individual or a company approaches a bank for a loan, and the bank approves the loan, but incurs the cost and risk of non-payment by the borrower (Shenker & Colletta, 1991). In mitigation, banks group a number of loans together according to their different characteristics, and then pool these loans into different securities that can be sold on the open market (Shenker & Colletta, 1991). This securitisation is implemented to transfer the risk associated with these loans, and to protect the bank liquidity and profitability (Shenker & Colletta, 1991).

The engagement of banks in the securitisation process lies in the three benefits associated with this process. The first benefit is the efficient source of funding by removing certain stocks (loans) from the bank's books and thereby realising more capital, reducing financing costs and improving capital requirements (Griffin,1997). The second one is the improved banks' Statement of Financial Position, in which risky assets, including loans are removed from the banks' statement of financial position (Liaw & Eastwood, 2000). This process tends to improve the financial, economic, and capital measures of the bank (Liaw & Eastwood, 2000). The third benefit of securitisation is related to the use of securitisation as a risk management tool (Davis, 2000). Among the risks faced by banks, credit risk is one of the risks directly related to the banks' performance and profitability, and for this reason, banks take advantage of securitisation to provide the additional funding required to cover credit risk.

The South African securitisation market has increased substantially since its first transaction in 1989. Due to misunderstanding of this new concept and lack of appreciation by banks, for a period of 12 years (1989–2001), certain restrictions were imposed by regulatory bodies to slow down the rapid development of securitisation in South Africa (Moyo & Firrer, 2008). Following the newly amended securitisation regulation in 2001, the securitisation market in South Africa started to grow significantly again. However, there is limited research on securitisation and credit risk in South Africa. This paper aims to contribute to the existing literature and empirical analysis by evaluating the relationship between securitisation and credit risk in the South African context. This paper follows the measures of credit risk used by Salah and Fedhila (2012), but utilises the relevant risk proxies and economic variables that represent the South African economic and financial landscape.

2. Empirical Literature

A number of researchers (Aggarwal & Jacques, 2001; Casu, Girardone & Molyneux, 2010; Gorton & Pennacchi, 1995; Pavel & Phillis, 1987; Pennacchi, 1988; Shrieves & Dahl, 1992; Uhde & Michalak, 2010) have studied the effects of, and relationship between securitisation and credit risk. From these studies, two conclusions regarding the relationship between securitisation and credit risk were reached. Some studies, i.e. Aggarwal & Jacques, 2001; Cabiles, 2011; Gorton & Pennacchi, 1995 and Loutskina, 2011, decided in favour of a positive relationship between securitisation and credit risk, whereas others, i.e. Jiangli and Pritsker, 2008, and Dionne and Harchaoui, 2003, concluded in favour of the negative relationship between securitisation and credit risk.

Findings in favour of securitisation suggest that banks benefit by increasing the amount of loans provided and reducing their risk by partaking in securitisation. This implies that banks that securitise more loans are able to provide additional loans and funding. By separating the source of funding from the bank, the bank can reduce its credit risk and increase its loan provision, profitability and liquidity (Pavel & Phillis, 1987; Pennacchi, 1988). A study by Demzetz (2000) focused on the diversification advantages associated with loan sales (securitisation) on the open market and found that diversifying the loan portfolio increases the ability to securitise more and provide more loans to customers. Jiangli and Pritsker (2008) also find that the securitisation process has a negative effect on the unsolvability of the United States (USA) of America’s banking sector. In the same vein, Casu *et al*. (2010) presented positive supporting evidence with regard to the stability effects of diversification on securitisation in the USA. One of the advantages of securitisation and credit risk is the fact that once the loans are no longer on the bank’s Statement of Financial Position, the bank is no longer required to carry the minimum capital requirements as set out by the regulations authority against that asset. This provides savings on the bank’s capital.

By applying the Capital Asset Pricing Model (CAPM), Krahnen and Wilde (2006) revealed that most European banks engaged in more risky assets after the announcement of securitisation, and this increased the credit risk due to unstable markets. Similarly, (Awdeh, El-Moussawi & Machrouh, 2011) find that adverse bank regulations affect the bank's credit risks and performance. Moreover, Baur and Joossens (2006) also find evidence that securitisation reduces a bank’s capital requirements, and this generally affects credit risk because it encourages banks to prioritise more profitable portfolios and riskier assets. Enforcing regulations, such as the capital requirements, increases the risk of a bank's failure and decreases the customer confidence in banks, which will affect the social repayment system and thereby increasing its credit risk (Kahane, 1977; Kohen & Santomero, 1980).

In the South African context, studies have been done on securitisation and its development, and include those of Tensfeldt, Firer, & Bendixen, 1993; Saayman & Styger, 2003; Gumata & Mokoena, 2005; Karoly *et al*., 2006; White, 2011; Smit, 2012; and Terblanché, 2012. The findings of these studies reflect that securitisation in South Africa has not developed as much, compared to the securitisation in developed nations, such as the USA. However, the relationship exists and is significantly positive, meaning that South African banks use securitisation as a form of hedging strategy and for speculation purposes. These South African studies focused on the relationship between securitisation and liquidity risk, or mortgage-backed securitisation. Therefore, this paper focuses on the relationship between credit risk and securitisation.

3. Methodology

3.1. Sample Selection and Data Description

This paper used a quantitative research approach with panel data analysis. The annual secondary data from 2005 to 2014 was collected from the audited financial statements of the selected banks, available from the McGregor BFA database. The securitisation information was collected from the Banking Association of South Africa and the South African macroeconomic variables data was obtained from the South African Reserve Bank (SARB) and Statistics, South Africa. The four major banks in South Africa namely, Absa Bank Ltd, FirstRand Bank Ltd, Nedbank Ltd and Standard Bank of South Africa Ltd, were selected for this paper. These four big banks provide a fair representation of the banking sector in South Africa, and they had securitisation data available for the period of the study.

3.2. Model Specification

The model specification is to examine the allocation of assets between different categories of risks faced by a bank. A linear regression model with the independent variable of Risk-weighted Assets/Total Assets (RWATA) is used, while the Altman's Z-score Model will analyse the relationship between securitisation and bank stability.

$$RWATA_{it} = SECTA_{it} + \sum_{i}^{n} X_{it} + \mu_t \qquad (1)$$

$$\text{Z-Score} = SECTA_{it} + RWATA_{it} \sum_{i}^{n} X_{it} + \mu_t \qquad (2)$$

Where: $RWATA_{it}$ is the credit risk for bank i at period t, measured by the ratio of risk-weighted assets to total assets; $SECTA_{it}$ is the ratio of total securitised assets to total assets; X is the vector of the independent variables representing macroeconomic variables and specific control factors of bank i for the period t. Z-score measures the distance from insolvability, implying that the higher value of Z-Score indicates little default risk and u_t is the error term. Although Z-Score has been used by different authors (Altman et al., 1995, p. 3; Altman & Hotchkiss, 2006: 314; Roy, 1952; Uhde & Heimeshoff, 2009; Boyd, Nicolo, & Jalal, 2006; Levy, Kanat, Kunin, Tooshknov

& Tzruya, 2014). This paper adapted the Z-Score models used by Salah and Fedhila (2012).

$$Z - \text{Score} = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_5 \qquad (3)$$

Where:

X_1: Working capital/Total assets;

X_2: Retained earnings/Total assets;

X_3: EBIT/Total assets; and

X_4: Book value equity/Total liabilities.

The coefficients in Altman's Z-score formula are standard numbers formulated by Altman to accommodate the manufacturers, non-manufacturer industrials, and emerging market credits. The diagram below summarises this classification.

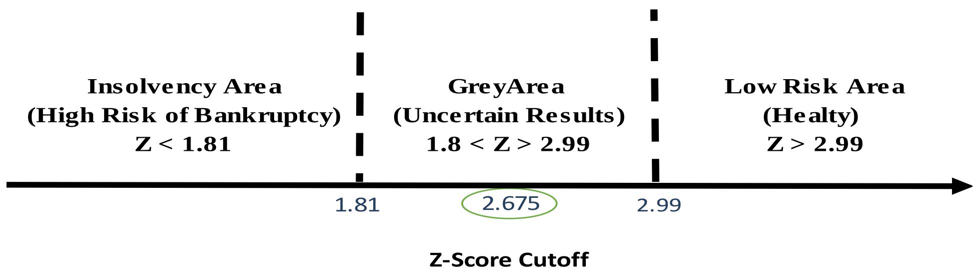

Figure 1. Z-Score classification areas

In explaining the risk performance of banks, this paper considers four types of variables: securitisation activity (total securitised assets), variables of banks, the South African macroeconomic variables, and bank specific variables as control variables. These variables are summarised in Table 1.

Table 1. Definition of variables

	Variables	Designation	Description	Expected effect on RC
Dependent variables)	Credit risk	RWATA	Risk weighted assets/ Total assets	N/A
		Z-Score	X1: Working capital/Total assets; X2: Retained earnings/Total assets; X3: EBIT/Total assets; X4: Book value equity/Total liabilities	N/A
Bank specific variables	Securitisation	SECTA	Securitisation assets/Total assets	(+/-)
	Capital	CAPTAL	Equity capital/Total assets	(+/-)
		ECRWA	Equity capital/Risk weighted assets	(+/-)
	Performance	ROE	Net income/Equity capital	(-)
	Size	LOGTA	Logarithm of total assets	(-)
Macro-economic variables	GDP	GDP	A sustained increase in the trend level of either (a) aggregate production, or (b) per capita GDP	(-)
	Ave CPI	Ave CPI	Inflation deflated by the Gross Domestic Product using CPI	(+/-)
	Exchange rate	EXCR	Country's real exchange rate.	(+/-)
Subprime crisis	Dummy for subprime crisis	Dummy	0 = Before or after the crisis and 1= during the crisis	(+)

3.3 Panel Root Unit Test and Cointegration

As the first step in the estimation of the model, the panel unit root test is conducted to determine whether the variables are stationary or non-stationary. Unit root is used to establish the order of integration between variables, i.e. to check if the variables are stationary at level or integrated of order, I(0), and whether a variable is stationary at the first difference or integrated of order 1, I(1). This test is performed to prevent the use of non-stationary variables, which can result in a spurious regression (Brook, 2014). Therefore, for the purpose of the panel unit root test, this paper used Levin, Lin & Chi (LLC), Im, Pesaran and Shin (IPS) and ADF Fisher Chi-square, and compared results to the results of these tests. If variables are stationary, then the normal panel regression is estimated. However, if variables are non-stationary, then a cointegration test is conducted to see if the linear combination of these variables is stationary.

A panel cointegration model is used to check if there is a long-run or short-run effect between the variables (Brooks, 2014:373–379). The common panel cointegration model includes the Pedroni (Engle-Granger) and Kao cointegration model (Brooks, 2014). The first model is a less restrictive method of testing for cointegration, and is therefore used in this study to conduct the panel cointegration tests, and the Kao cointegration model is used to confirm the Pedroni model results. If both tests confirm that variables are cointegrated, then the cointegrating model, Fully-Modified OLS model (FMOLS), can be estimated and the results interpreted.

4. Empirical Results

This paper approximates the securitisation activity (SECTA) by using the total securitised assets to total assets. Dionne & Harchaoui, 2003, and Casu et al., 2010, used this method. Previous studies found that the relationship between securitisation and credit risk could either be positive or negative (Gorton & Pennacchi, 1995; Wagner, 2007). The paper will also use ECRWA and CAPTL. ECRWA being equity capital to risk-weighted assets and CAPTL, the capital per total assets. This paper used both (ECRWA) equity capital to risk-weighted assets and the capital per total assets (CAPTL) as the measures of capital. Return on equity (ROE) will be used to measure performance, while bank size is represented by the natural logarithm of total assets (LOGTA). This paper uses , macroeconomic variables such as Gross Domestic Product (GDP), Ave CPI and exchange rate will be employed to measure country economic growth, the level of inflation and the currency fluctuation, respectively. Lastly, Control Variable (used as a dummy variable) will be used to account for the instability of the global financial system caused by the 2007–2009 subprime crisis. In analysis, the control variable (dummy) is denoted by 1 during the crisis period from 2007–2009 and 0 before 2005–2006 and after 2010–2014.

4.1. Descriptive Statistics

Table 2 presents information about the descriptive statistics of both the dependent variable and the independent variables. From the table, we observe that the Z-Score, meaning the distance from solvency in the sample, has a mean of 2.8541 and the standard deviation of 3.6786.This indicates that small banks or banks with small market power present lower solvency compared to big banks. The reason for this is that bigger banks tend to securitise more because they have more capital and market power. This also correlates to the theory of Altman and Hotchkiss (2006); according to their studies, a Z-Score ranking above 2.99 is in the healthy safe risk area.

Therefore, this means that the sample banks perform well in terms of the Z-Score classification.

Table 2. Descriptive statistics

	Z-Score	RWATA	SECTA	CAPTAL	ECRWA	LOGTA	GDP	Ave CPI	EXCR	Dummy
Mean	2.8541	0.4591	0.0001	0.0767	0.3962	20.4930	0.0301	0.0555	-0.0173	0.3000
Median	2.8559	0.4950	0.0001	0.0779	0.1584	20.4642	0.0310	0.0576	-0.0335	0.0000
Maximum	12.5492	0.6887	0.0002	0.0933	2.7973	21.3666	0.0560	0.1004	0.1230	1.0000
Minimum	-7.4862	0.0328	0.0000	0.0529	0.1043	19.6799	-0.0150	0.0206	-0.1040	0.0000
Std. Dev.	3.6787	0.1772	0.0000	0.0111	0.6748	0.4006	0.0207	0.0212	0.0698	0.4641
Probability	0.4022	0.0001	0.2936	0.3611	0.0000	0.7212	0.2715	0.5665	0.1496	0.0220
Sum	114.1647	18.3636	0.0029	3.0686	15.8473	819.7182	1.2040	2.2212	-0.6920	12.0000
Sum Sq. Dev.	3.6786	1.2240	0.0000	0.0048	17.7577	6.2602	0.0167	0.0175	0.1899	8.4000
Observations	40	40	40	40	40	40	40	40	40	40

Furthermore, by analysing the total assets allocation to different risk categories from Table 2, this work observes RWATA and identifies that it has a mean of 0.4591 and a standard deviation of 1.2240. This indicates that, on average, only 45.91% of the banks ‘total assets are exposed to all the risk faced by the bank. With only almost 46% of the bank's assets exposed to different risk. This places banks in the right position to hedge against soft and hard risk in the industry, and leaves room for growth in the bank's books.

4.2 Correlation Analysis

A common assumption is that there is an existence of multicollinearity among variables if the correlation coefficient is higher than 0.8 (Kervin, 1992; Gujarati, 2009; Jurczyk, 2011, p. 262; Studenmund, 2011, p. 258). From the correlation analysis in Table 3, this work observes that only RWATA and ECRWA have the coefficient of -0.9023, which is above the norm. Due to the strong correlation between RWATA and ECRWA, these variables cannot be included in the same model. It is observed that other independent variables are weakly correlated, and this allows us to exclude the possibility of overlapping this variable's significance in a multivariate model.

Table 3. Correlation matrix

Correlation Coefficient	**Z-Score**	**RWATA**	**SECTA**	**CAPTAL**	**ECRWA**	**LOGTA**	**GDP**	**Ave CPI**	**EXCR**
Z - Score	1.0000								
RWATA	-0.1539	1.0000							
Prob.	0.3430	-----							
SECTA	-0.0860	0.3497	1.0000						
Prob.	0.5978	0.0270	-----						
CAPTAL	0.3913	0.0021	-0.2571	1.0000					
Prob.	0.0125	0.9897	0.1093	-----					
ECRWA	0.2250	-0.9023	-0.4040	0.1670	1.0000				
Prob.	0.1627	0.0000	0.0097	0.3031	-----				
LOGTA	-0.0537	-0.2025	0.1963	0.2205	0.0020	1.0000			
Prob.	0.7419	0.2101	0.2247	0.1716	0.9902	-----			
GDP	0.3071	0.0478	0.2039	-0.4676	-0.0121	-0.3829	1.0000		
Prob.	0.0539	0.7695	0.2069	0.0023	0.9407	0.0147	-----		
Ave CPI	-0.1538	-0.0378	-0.2102	0.0552	0.0019	0.3609	-0.4835	1.0000	
Prob.	0.3435	0.8168	0.1930	0.7350	0.9909	0.0221	0.0016	-----	
EXCR	-0.3975	0.1018	0.1423	-0.1439	-0.1483	-0.1554	-0.2258	-0.3956	1.0000
Prob.	0.0111	0.5321	0.3809	0.3759	0.3609	0.3384	0.1612	0.0115	-----
DUMMY	-0.3482	0.0565	-0.0304	-0.4708	-0.1165	0.0026	-0.2063	0.7101	-0.0288
Prob.	0.0277	0.7289	0.8523	0.0022	0.4739	0.9873	0.2015	0.0000	0.8599

4.3. Regression Analysis

4.3.1. Results of Panel Unit Root Tests

Using the Levin, Lin & Chi (LLC) (2002); Im, Pesaran; Shin (IPS) (2003) and ADF Fisher Chi-square (ADF Fisher) unit root tests, the following hypotheses apply:

Null hypothesis (H_0): panel data has unit root

Alternative hypothesis (H_1): panel data has no unit root (stationary).

The unit root results are summarised in Table 4. The panel unit root test results for Z-Score, ROE, GDP and EXCR reveals that at level, the LLC model's p-value **is** less than 0.05, and therefore, the null hypothesis is rejected. While the Im, Pesaran and Shin W-stat method and ADF-Fisher Chi-square method p-values are greater than 5%, meaning that the null hypothesis cannot be rejected. This implies that when the models present mixed results; the decision is made by choosing the one with majority results. Therefore, the null hypothesis cannot be rejected at 0.05 significance level, implying that Z-Score, ROE, GDP and EXCR have a unit root at level and are therefore not stationary. This result leads to further tests for stationarity at first difference. When Z-Score, ROE, GDP and EXCR are converted to the 1^{st} difference, all three methods' (LLC, IPS and ADF) p-values at 1^{st} difference are less than 0.05. The null hypothesis is therefore rejected at 0.05 significance level, since all models' p-values are significant at first difference, compared to level. Then, the alternative hypothesis is accepted, meaning that Z- Score, ROE, GDP and EXCR are stationary at 1st difference or I(1).

Table 4. Panel unit root tests

Method	Z-Score		RWTA	
	Level *P-value*	First difference *P-value*	Level *P-value*	First difference *P-value*
Levin, Lin & Chu t*	0.0002	0.0000	0.8267	0.0000
Im, Pesaran and Shin W-stat	0.0602	0.2625	0.9966	0.0746
ADF - Fisher Chi-square	0.8434	0.0652	0.9667	0.0185
	SECTA		**CAPTAL**	
	Level *P-value*	First difference *P-value*	Level *P-value*	First difference *P-value*
Levin, Lin & Chu t*	0.1049	0.0000	0.0737	0.0000
Im, Pesaran and Shin W-stat	0.1717	0.0503	0.8020	0.0362
ADF - Fisher Chi-square	0.1485	0.0037	0.9144	0.0218
	ECRWA		**ROE**	
	Level *P-value*	First difference *P-value*	Level *P-value*	First difference *P-value*
Levin, Lin & Chu t*	0.1613	0.0000	0.0330	0.0000
Im, Pesaran and Shin W-stat	0.9456	0.0000	0.7653	0.0000
ADF - Fisher Chi-square	0.6906	0.0000	0.8465	0.0000
	LOGTA		**GDP**	
	Level *P-value*	First difference *P-value*	Level *P-value*	First difference *P-value*
Levin, Lin & Chu t*	0.0000	0.0013	0.0005	0.0000
Im, Pesaran and Shin W-stat	0.0355	0.1455	0.2448	0.0065
ADF - Fisher Chi-square	0.0382	0.1373	0.3113	0.0047
	AVE CPI		**EXCR**	
	Level *P-value*	First difference *P-value*	Level *P-value*	First difference *P-value*
Levin, Lin & Chu t*	0.0000	0.0000	0.0000	0.0000
Im, Pesaran and Shin W-stat	0.0000	0.0422	0.0997	0.0309
ADF - Fisher Chi-square	0.0000	0.0231	0.0814	0.0228

Unit root test for SECTA, CAPTAL, and CRWA reveals that at level all three models' p-values are greater than 5%, meaning the null hypothesis cannot be rejected and that SECTA, CAPTAL, and CRWA have a unit root at level. However, when converted to 1st difference, all three methods' (LLC, IPS and ADF) p-values at 1st difference are less than 0.05. Therefore, the null hypothesis is rejected at 0.05 significance level, as all models' p-values are significant at 1st difference, compared to level. The alternative hypothesis is then accepted, meaning that SECTA, CAPTAL, and CRWA are also stationary at 1st difference or I(1). Lastly, LOGTA and AVE CPI reveal that at level, all three models (LLC, IPS and ADF) methods' p-value is less than 0.05 and therefore, the null hypothesis is rejected and LOGTA and AVE CPI are found to be stationary at level or I(0).

4.3.2. Analysis of the Long-Run Relationship

Since all variables are integrated of I(1), with an exception for LOGTA and AVE CPI, which are both integrated at I(0) and I(1), the cointegration test was used to test for the existence of the long-run relationship. The hypothesis test for cointegration is set as follows:

H_0: there is no cointegration between variables.

H_1: there is cointegration between variables.

Using the Pedroni cointegration test, only six variables are allowed to be tested, as presented in table 5. First, without trend, second, with trend and intercept (but could not formulate results due to fewer observations), and last, with no intercept or trend. Therefore, only Z-Score, SECTA RWATA, ROE, LOGTA, EXCR and ECRWA were tested.

Table 5. Pedroni cointegration results

	P-value	*P-value*
Common AR coefs. (within-dimension)		
Panel v-Statistic	0.9931	0.9869
Panel rho-Statistic	0.9906	0.9910
Panel PP-Statistic	0.0000	0.2290
Panel ADF-Statistic	0.0001	0.3951
Weighted Statistic		
Panel v-Statistic	0.9817	0.9855
Panel rho-Statistic	0.9936	0.9875
Panel PP-Statistic	0.0000	0.8317
Panel ADF-Statistic	0.0153	0.7776
Individual AR coefs. (between-dimension)		
Group rho-Statistic	0.9995	0.9994
Group PP-Statistic	0.0000	0.6117
Group ADF-Statistic	0.0137	0.8373

The Pedroni cointegration results in table 5 reveal that data, with no deterministic trend, six tests out of eleven are significant. This means that the decision is based on the majority results, and therefore the Null Hypothesis: no cointegration test is rejected, and the alternative hypothesis: cointegration is accepted. However, when interception and trend are removed, none of the results is significant, and therefore this study cannot reject the Null Hypothesis: no cointegration. Using the Pedroni Residual Cointegration Test, we have tested a limited number of variables, which also gives this study mixed results, and therefore, the study can use the Kao cointegration test. This method allows us to test all the variables. The results of this test are presented in table 6.

Table 6. Kao cointegration results

	t-Statistic	Prob.
ADF	-2.198783	0.0139
Residual variance	5.056800	
HAC variance	1.930092	

According to the Kao cointegration test, all variables are significant at 0.139, which is less than 0.05, meaning that we can reject the Null Hypothesis: no cointegration, and accept the alternative hypothesis: there is cointegration among variables, meaning that they have a long-run relationship. Therefore, from the Pedroni cointegration test and Kao cointegration test, it can be concluded that the variable is cointegrated and then the cointegrating model, the Fully-Modified OLS model (FMOLS), is estimated.

4.3.3. Regression Output Analysis

Due to the high correlation between the variables, namely, RWATA and ECRWA. The regression results omitted ECRWA for both Z-Score and RWATA models.

Table 7. Regression output (Altman's Z-Score model and RWATA model)

Model variables	Z-Score model			RWATA model		
	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
RWATA	-2.663044	-1.120955	0.2718			
SECTA	2776.553	0.288005	0.7755	1558.383	2.363045	0.0250
LOGTA	-1.326942	-4.234481	0.0002	-0.021702	-0.936611	0.3567
CAPTAL	275.8296	5.162268	0.0000	6.019909	1.558962	0.1299
EXCR	-2.411420	-0.298163	0.7678	1.117668	1.899739	0.0675
GDP	60.70279	1.706786	0.0989	5.216535	2.055060	0.0490
Ave CPI	1.847546	0.053586	0.9576	4.703387	1.919339	0.0648
ROE	45.12035	3.915898	0.0005	-0.436309	-0.520645	0.6066

R^2 = 0.748572 and 0.938781 for Z-Score and RWATA respectively.

4.4. Discussion of Results

The regression results in Table 7 reflect that the R-squared for both models are higher with values of 0.748572 for Z-Score and 0.9387810 for RWATA respectively; the implication is that 74.86% variation in Z-Score is explained by the combination of the independent variables. Likewise, 93.87% variation in RWATA is explained by its independent variables.

The bigger the bank, the more credit risk it can take. Holding other things constant, this work expects the relationship between the bank's size and credit risk to be positive because of the bank's economies of scale, studies by Alexiou and Sofoklis (2009) and Iannotta *et al*., (2007) support this view). However, according to table 7, the bank size (LOGTA) results indicate an inverse relationship to Z-Score, with the coefficient of -1.326942 units. The implication is that the bigger the bank, the lower the securitisation ratio and risk-weighted assets. This demonstrates a non-linear effect on size (Athanasoglou *et al*., 2008, p. 133). This also aligns to the view that small banks can realise scale efficiency. The second variable capital coefficient (CAPTAL) exhibits a positive relationship with the Z-Score model, and is statistically significant at 5%, with the value of 275.8296 units, and not statistically significant for the Z-Score model. The implication is that if the banks' capital increases by 1%, the Z-Score will increase by 275.8296 units. These findings refer to Berger (1995, p. l435), who points out that banks with capital below the set bank's equilibrium ratio, may experience relatively high bankruptcy costs. Likewise, Athanasoglou, Brissimis, & Delis (2008, p. 129) assert that the positive relationship may be due to the capital function as a security and safety box for unexpected developments, such as credit risk. However, higher capital increases profitability, and this will offset the equity costs, which gives the bank the ability to provide more loans and thereby increase securitisation, but hedging the risks with the large capital reserves (García-Herrero, Gavilá, & Santabárbara, 2009, p. 2082). Finally, banks have a minimum capital requirement to hold against the risk-weighted assets as set out by the Basel Accord (Iannotta, Nocera, & Sironi, 2007, p. 2127).

One of the vital and significant variables under the Z-Score and RWATA is the economic growth (GDP), with the positive relationship with the Z-Score and RWAT, the coefficients are 112.8191 units and 5.216535 units, respectively. The implication is that as the economic growth increases by 60.70279 units, the Z-Score will also be increased by 60.70279 units, while RWATA will increase by 5.216535 units. Generally, poor economic conditions have a negative effect on the bank's loan portfolio, causing credit loss and increasing capital reserves to be held by the bank. In contrast, improvement in economic growth, borrower's efficiency and solvency improve the loan (credit) demand, and this has a positive effect on the bank's bankruptcy position and lowers credit risk (Athanasoglou *et al*., 2008). Instejford (2005) and Wagner (2007) assert that higher capital, combined with a booming economy, reduces the credit risk on the bank's books. However, this risk reduction creates possibilities for the bank to take on more risk. Studies observing the economic growth effect on the bank's credit risk include Athanasoglou *et al*., 2008; Bikker & Hu, 2002; Demirguc-Kunt & Huizinga, 2000; and Dietrich & Wanzenried,

2011. Likewise, Albertazzi and Gambacorta (2009, p. 395) found that the economic cycle affects the interest rate income and loan provisions.

The securitisation coefficient (SECTA) exhibits a positive relationship with the RWATA model, with the value of 1558.383. This means that if securitisation increases by 1558.383, RWATA will also increase by 1558.383 units. This supports the findings of Gorton and Pennacchi (1995), which mention that more securitisation leads to more funding options and more capital reserves.

In addition, the coefficient of the exchange rate and inflation (CPI) exhibits a positive relationship with the RWATA model, with coefficient values of 1.117668 and 4.703387 units, respectively. This indicates that an increase in the exchange rate and CPI will increase RWATA by 1.117668 units for exchange rate and 4.703387 units for CPI units. This represents a linear relationship between RWATA and exchange rate and inflation. Revell (1979), who found that inflation affects borrowers' salaries and bank costs, introduced the relationship between inflation, credit risk, and profitability. Similarly, Perry (199, p. 26) states that the effect of inflation is dependent on the anticipation level. If fully anticipated, both banks and households are able to adjust their resources. Further studies on inflation effects include those of Alexiou & Sofoklis, 2009; Athanasoglou *et al*., 2008; García-Herreto *et al*., 2009; Kasman, Tunc, Vardar, & Okan, 2010 and Pasiouras & Kosmidou, 2007.

The final observation from these results is that return on equity (ROE) is also the significant variable to explain the variations in the Z-Score model, with the coefficient value of 45.12035 units. The implication of this is that a combination of capital and good economic conditions, which direct us to a proper policy coordination, will improve South African credit risk and the securitisation market.

5. Conclusion and Recommendations

This paper has empirically investigated the relationship between securitisation and credit risk in South Africa. A pooled analysis, using the panel data analysis of four major banks in South Africa, was tested for the period, 2005 to 2014. Two regressions were performed; first, to analysis the relationship between securitisation and bank stability, using the Altman's Z-Score model, and second, allocation of assets between different categories of risks faced by a bank. The regression results reveal that capital and economic growth are both significant when explaining the relationship between securitisation and credit risk. For the second regression, bank size and capital are significant when explaining the contribution to the allocation of banks' assets in different risk categories.

The results reveal that there is an increase in credit risk when banks securitise more loans. Moreover, the size of the bank plays an important role in securitisation, credit risk taking and risk-weighted assets kept by the bank. The implication of this is that the bank size explains the increase in securitisation and risk taking by banks. This supports the study of size-credit risk relevant hypothesis. In general, the results from both regressions reflect that capital influences securitisation positively and eventually affects the South African banking stability positively. This means that the South African banking system is still sound and healthy because of its good and strong capital structure and banking regulations.

In light of these findings, the following recommendations are made: banks should increase or maintain an acceptable level of capital to hedge against any unexpected risks. Proper systems should be established to encourage the repayment of loans by borrowers, and proper policy coordination by policy authorities should play a key role in limiting credit risk, securitisation and solvency risk. During the course of this paper, the following topics were identified for future research on the topic:

- The effects of macroeconomics on credit risk;
- Securitisation effects on credit risk: the use of credit spreads;
- Credit risk and liquidity risk: the case of South Africa;
- Contemporary credit risk modelling: a guideline for South African banks.

6. References

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