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Derivatives and Banking Lending Activities: Evidence from South Africa's Banking Sector

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Abstract: The study explored the impact of derivatives usage and bank credit extension within the South African banking industry from 1996 through to the end of 2017. The system generalised method of moments (GMM) estimation technique with dynamic panel data model was used. The GMM is robust in controlling for endogeneity, unobserved heterogeneity, autocorrelation and dynamic panel bias. The study revealed that derivatives positively influence lending to both the private and public sectors in South Africa. It became evident that South African banks hedge credit risk, interest rate risk and cash flow risk in order to generate more revenue so that they can lend more.

Keywords: Derivatives market; intermediation; hedging; risk management

JEL Classification: G21; G23; G32; G51; H81

1. Introduction

Diamond (1984)'s model suggests that for financial institutions to intermediate efficiently, they should be able to guard against risks, interest rate risk specific and permit banks to endure more credit risks. The exposure of a bank to interest rate risks is a result of it facilitating credit extension, which might result in a mismatch between assets and liabilities in the maturity structure and re-pricing (Purnanandam, 2007). Banks' performance are reflected in their ability to extend advances to deficit units that might need to fund investments, growth opportunities and other important sectors of the economy. Net interest income received from issued advances reveal the ability of a financial institution to carry out its main activity of intermediation. Turbulence in market variables exposes banks to vulnerability and leads banks to search for innovative ways of dealing with the instability of their playfields. In an initial theoretical model, Diamond (1984) explained that "banks can reduce the chances of failure if they hedge interest rate risk using derivatives contracts".

The building blocks of Diamond's model was empirically supported by Purnanandam (2007); Brewer III et al. (2014); Si (2014); Zhao and Moser (2017) and Akhigbe et al. (2018), proving that "hedged banks provide intermediation more efficiently than unhedged institutions". Institutions that hedge their

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loan book growth with derivatives instruments are booming. The same theorists concluded that the size of banks, economies of scale play an important role in the usage of derivatives, that is, large banks are the predominant users of derivatives. Based on the theory by Diamond (1984), financial distress costs positively affect a bank's hedging decisions, whereby it is explained that 'banks facing a higher likelihood of financial distress manage their interest rates risks better by engaging in higher derivatives activities."

If banks fail to balance the maturities between assets and liabilities, they will be exposed to interest rate risks. To avoid the danger of a collapse, banks must manage interest rate risks in order for them to be financial healthy. Recent evidence shows that banks are contracting in interest rates, foreign exchange, commodities and equities hedges (Akhigbe et al., 2018). The study by Akhigbe et al. (2018) revealed that banks' risk management strategies are anchored on the use of cashflow and fair value hedges through derivatives. They concluded that banks are more concerned with fluctuations in their assets and liabilities, hence engaging in derivatives hedging for their protection.

The use of interest rate derivatives helps banks to manage mismatches maturities and reduce monitoring costs, which can promote efficient lending (Zhao and Moser, 2017). In South Africa, interest rate derivatives are traded on the Johannesburg Stock Exchange (JSE). Based on The World Federation of Exchange (WFE), the JSE is the most robust capital institution in Africa, ranked 17th on the World League in terms of market capitalisation ($1 278 577 million) and positioned 19th in terms of market turnover ($46 340 million) (JSE, 2018).

The vitality of financial institutions in the era of technological change is in the ability to insure themselves against market variabilities and uncertainty outcomes in lending, taking deposits and transactional banking, foreign and rates trading. To indemnify against the brutality of market movements, banks resort to derivatives markets to undertake hedging, speculation and arbitrage market variables This study bridges the gap between theory and practice, influences public policy and contributes to the body of knowledge through the following suggestions: Firstly, given the background of the study, interest rate derivatives have received much consideration as a major source of facilitating lending activities in the banking sector. However, in practice, banks participate in derivative markets as dealers, end-users, and acting as counterparties for intermediaries. They also take positions in OTC swaps and exchange traded futures contracts to exploit arbitrage opportunities between two markets. Moreover, banks generate revenue by speculation through interest rates, commodities, equities changes and foreign exchange fluctuations. In addition, the derivatives market is populated with many instruments, namely foreign exchange, commodities, credit derivatives and equities derivatives, in which banks provide a market for intermediation and participate as end-users of these instruments. From this perspective, it motivates the researchers to inquire on all reported derivative instruments held and traded in the South African banking sector and their impact thereof on lending activities. The research will differ from other studies in that it will assess lending by the banking sector to the private and public sectors (overdrafts, advances, loans and mortgages) total borrowings. It will not distinguish which derivative instrument had a higher effect on bank lending activities because of the economies of scale effect.

Secondly, the study was carried out when OTC derivatives market regulations had made great inroads through the Dodd Frank Act. In South Africa this was through the Financial Markets Act of 2002, which came into effect in June 2013.The legislation surrounds the objectives for the regulation and supervision of the OTC derivatives market. The regulatory framework aimed to contribute to the maintenance of a stable financial market environment, reducing systematic risk; promoting fair,

efficient and transparent markets; and boosting investor confidence and investor protection. Most interestingly, banks are the major players in OTC markets. Price Waterhouse Coopers (PWC) (2012), their study, which was commissioned by the National Treasury of South Africa, reported that as at June 2012, OTC derivatives were valued at R27,7 trillion. This amount includes interbank trades between domestic and foreign banks and between domestic banks and other non-financial participants, including corporates.

Thirdly, the study employs the Generalised Method of Moment (GMM) estimation technique, which is robust in controlling endogeneity and a possible bidirectional causality between derivative use and bank lending. To the researchers' knowledge, this is the first study to use a dynamic panel data model and GMM estimation technique to analyse derivatives usage and bank lending activities. Lastly, the study uses data from an emerging country, which is in Sub-Saharan Africa. Most previous studies in this area were concerned with developed markets.

The study confirms that derivatives positively influence banks to increase their lending to the private and public sectors and that derivative usage had a negative coefficient to mortgage lending. The next section briefly describes the literature review. The third section describes sample and data sources. A discussion of the empirical specifications for the lending activities is provided in the fourth section. The results are presented in section five. The sixth section provides the conclusions and recommendations of the study.

2. Literature Review

Literature on bank lending and derivatives use has received considerable attention, the majority of which is concerned with the empirical data in developed markets, mainly from western countries (Brewer III et al. 2014; Purnanandam, 2007); Zhao & Moser, 2017) conducted research in the United State of America. They concluded that banks using derivatives participate more in lending activities than those banks which do not contract in derivatives. Their business loan portfolios also bloom at a significant rate, compared to competitors. A recent study by Zhao and Moser (2017) in the United States analysed 942 commercial banks for a period of nine years (1996-2004). Their study aimed to establish whether the relationship between derivatives markets and banking credit extension still exist. The authors found that "banks using interest rate options contracts, forward contracts and futures contracts have a positive association with the growth of commercial and industrial loan portfolios."

Brewer III et al. (2000) alluded that interest rate derivatives allow financial institutions flexibility to move more freely amongst various sources of financing, thereby limiting their dependence on less interest rate sensitive sources. This capacity of having several sources of funds gives a potential channel through which the usage of interest rate derivatives has a positive effect on bank lending. Therefore, banks participating in interest rate derivatives are likely to have greater financing flexibility and subsequently fewer funding constraints. Derivative instruments can make banks' lending policies less sensitive to macro-economic shocks by generating higher cash flows even during turbulent times.

Deng et al. (2017) indicate that derivatives hedging is associated with overall lending and banks take on greater credit risk in lending. They further assert that the funding flexibility enjoyed by banks using interest rate derivatives allow these banks to provide a smoother and higher level of intermediation, leading to more stable loan growth and greater economic stability. Banks, while taking positions in derivatives markets to mitigate their own risk exposure, also meet risk management needs of their

corporate customers. In return they generate fees and other revenue from this form of trading and cover their cost of funding.

Banks act as economic adapters that transmit fundamental resources between those with surpluses and those with deficits. Those who had an excess plug in and those who have a deficit can access the funds to finance their revenue and capital needs.Prabha et al. (2014) analysed the effects of derivatives on bank lending using American data and concentrating on, risk management and cost by which derivatives influence banks' lending activities. Their analysis reveals that banks' use of derivatives permit greater extension of credit to the private sector and increased US quarterly real GDP by around $2,7 billion each quarter from 2003 to 2012.

Brewer III et al. (2014) investigated 4404 bank holding companies in the United States of America on the relationship between interest rate derivative and loan growth. They found that interest rate derivatives positively affect bank lending activities. Similarly, Brewer III et al. (2000) analysed 734 commercial banks in the US using regression analysis. They conclude that commercial and industrial loan growth is positively related to the use of interest rate derivatives. The authors emphasise that OTC swaps are associated with higher growth rates in commercial and industrial loans.

Si (2014) examined China's banking sector's key characteristics that impacted on lending because of the growth of the interest rate derivatives market in their financial system. Their study found that derivatives have a positive impact on loan growth, which was suggested using the vector autoregressive (VAR) model. Additionally, it shows interest rate derivatives bi-directional granger causality with bank loan growth. Furthermore, (Si, 2014) found that in the long-run, 20 percent of variations in bank advances growth could be attributed to derivative transactions in China. For the period 2007 to 2014, using monthly data in China to analyse how the interest rate influences credit extension, the study showed that the use of derivatives resulted in an improved intermediation efficiency and increased the ability of banks to increase their lending (Si, 2014) suggesting that banks, when managing loan portfolios, should make decisions on how much to lend, the conditions involved under which loans to be made, and how to mitigate the associated risks. The use of derivatives for hedging enable banks to advance more credit to borrowers who might face higher credit risk. Moreover, in the period of financial turmoil between 2007 and 2009, even heightened hedging did not permit banks to increase the value of loans to promote their C & I loan or to advance funds to borrowers with a high credit risk. The results of Si (2014)'s study highlighted that commercial banks in China hedge their marketable risk (interest rate risk) so that they can facilitate their intermediation activity, which is key to the alleviation of default.

3. Data and Variables

The sample for this study included all publicly and non-publicly traded banks for the period 1996 to 2017 in South Africa, in order to broaden the analysis for a 22-year period, as well as to have a large number of observations. Banks with less than three years reported data from the BD900 statistical form were excluded from the sample. The sample included all registered banks, mutual banks, co-oporative banks and foreign banks operating in South Africa. The Bank Supervison Department (2018) documented that there were 71 banks by the end of the final quarter of 2017; 19 registered banks, 3 mutual banks,3 co-oporative banks, 15 local branches of foreign banks and 31 foreign banks with approved representative offices. Data for bank-specific variables, available on a monthly and quarterly basis, were obtained from reports of Bank supervision that banks file with the Reserve Bank

via the Statistics Section (see Appendix 1). Bank sector information, where banks fill in the "Banks BD900" and "BA900" economic returns form and aggregated D1 and BA returns for the South African banking sector (BA350) recording all banks' derivatives instruments and BA100 containing all banks' balance sheets. The final sample for the estimation comprised 39 banks that had filed the BA 900 with the Reserve Bank of South Africa statistics data-base, as well as with available data from Bloomberg's financial data-base.

3.1. Banking Sector Lending Activities

The basis for this empirical analysis was built upon the specifications of a study of banking sector lending by Prabha et al. (2014). Following the literature and early studies, Brewer III et al. (2000)'s model used commercial and industrial (C & I) loan growth as a measure of lending activity because they revealed that they represent a critical function of channelling funds between banks and productive sectors of the economy. The model was built on foundations drawn the from founding model of Sharpe and Acharya (1992), which relates that a change in C & I loans relative to the previous period's total assets $(\boldsymbol{CILGA}_{j,t})$ is a measure of loan growth in the model. In 2014, Prabha et al. (2014) extended the model to examine the impact of derivatives on the growth of bank loans. Their building blocks were anchored on Brewer III et al. (2000), who also utilise the growth of C & I loans to measure intermediary activity. In 2017, Zhao and Moser (2017) adopted Brewer III et al. (2000)'s model which had its roots in Sharpe and Acharya (1992)'s model. Prabha et al. (2014)'s model captures the effect of bank size and the effect of all derivatives contracting, which all other models did not take into consideration, (Brewer III et al. (2000); Brewer III et al. (2014); Purnanandam (2007) and Zhao and Moser (2017) by using only interest rate derivatives and demand and supply effects of loan extensions. Therefore, the model of Prabha et al. (2014) model was considered to be the most appropriate for this study.

3.2. Dependent Variable

The study seeks to examine the impact of derivatives on lending activities among banks in South Africa. Hence the dependent variable is the total loans $(\boldsymbol{TLCOPVT}_{i,t})$, yearly change in the total loans (see Appendix 1) to the private and public sectors and mortgages for bank ***i*** at a period **t** (Prabha et al., 2014). In examining the relationship between the growth in bank credit extension to the private sector and corporate sector and bank participation in derivatives markets, with various exploratory variables included in the model that influences bank derivatives participation is represented by the following equation:

$$\boldsymbol{TLCOPVT}_{i,t} = \boldsymbol{f}\,(\boldsymbol{X}_{i,t}; \boldsymbol{DRERIV}_{i,t}) \qquad \textbf{(1)}$$

Most studies used C& I loans as a measure of lending activity, Brewer III et al. (2000); Purnanandam (2007); Brewer III et al. (2014); Zhao and Moser (2017) but fundamentally, there are loans which banks are hedging using derivatives that fall under the private domestic sector and housing loans.. Small and medium enterprises, households and farmers may borrow to finance production, fund investment opportunities and fund expansions which contribute to the country's GDP all of which are captured in the model of this study.

3.3. Independent Variables

The main independent variable is derivative usage. In order to analyse the effect of derivative usage on bank credit extension to the private sector, public sector and corporate sector borrowers, the model specification includes ***DERIV*** as a variable measuring bank involvement in derivatives. Brewer III et al. (2014) suggest that the coefficient of ***DERIV*** summarises the impact of derivative activity, conditional on incorporating the intermediating process in the remaining terms of the specification**.** Inclusion of this variable allows an examination of whether dealing in derivatives is adding or replacing advancing activities. Loan contracts had systematic risks, which reveals the importance of derivative use as a third form of contraction. Diamond (1984) emphasises that "derivative contracts permit banks to lessen the systematic risk in their loan portfolio". This use of derivatives contracts to hedge systematic risks, enables banks to obtain further reductions in delegation costs, and in turn, will allow banks to intermediate more effectively. Diamond's model predicts that derivatives activity complements hedging activity. If banks participate in derivatives trading and hedging complements the credit extension as predicted by Diamond (1984), one would expect a positive coefficient estimate of the **DERIV** variable to bank lending. In order to capture the effect of derivative usage on bank loan portfolio growth, Zhao and Moser (2017) include various bank variables to measure participation in derivative contracts in private and corporate borrowers. A derivative is a binary variable with a value of one for banks that report a position in any type of derivatives, and zero otherwise. For a robustness check, the study further tests the impact of derivatives by examining several types of lending breached by type, that is private loans, public loans and mortgages.

Following the literature, bank lending is determined by many possible supply and demand factors (Brewer III et al., 2000) (Zhao and Moser, 2017). For them to control for the effect of these factors, they employ capital to asset ratios, loan quality by C &I loan charge-offs as a proxy and state employment rate in their model. This model follows Prabha et al. (2014) in order to test the impact of the extent of bank derivatives usage measured by the ratio of a bank's notional amounts to its actual assets. The model incorporated bank-specific factors $(\boldsymbol{X_{i,t}})$ to control the effect of bank size. The natural logarithm of total assets variable was used because larger banks are more expected to participate in derivatives activities due to their size effect, as well as to control for the financial distress effect which is reflected in the capital adequacy and profitability of banks, as predicted by hedging theorists Diamond (1984) and Smith and Stulz (1985). They highlighted that banks with high chances of financial distress participate more in derivatives hedging activities. The equity-to-total assets ratio (Equity /TA) was used to control for capital adequacy, and the liquid assets-to-total assets ratio to control for liquidity (Liquid /TA). Various loan types, which include overdrafts loans and advances to the public sector, private sector and mortgage advances to various segments of the economy were dependent variables. Economic circumstances are reflected by the nation's employment growth rate, which is a good measure of the country's economic state. In credit extension, nations' well-being and regional economic conditions are crucial factors to consider. Banks in nations with weak economic environments are likely to have fewer profitable opportunities than banks in states with stronger economies. The state employment rate $(\boldsymbol{EMPG_{i,t}})$ in the empirical specification is included as a proxy for economic environments, conditions that are not captured by the other explanatory variables. If the state employment growth rate is a proxy for economic conditions, the coefficient of the model is expected to have a positive sign in relation to lending growth and $\boldsymbol{\varepsilon_{i,t-1}}$ is the error term.

For controlling these bank-specific characteristics, the coefficient of the derivatives variables captures their impact on lending activity, conditional on others affecting a bank's lending process. Total assets are included to control for a bank's size. A bank's capital, liquidity and profitability positions reflect the conditions that determine a financial institution's ability to lend. Healthier banks those better capitalised, more liquid and more profitable are expected to lend more. Therefore, the coefficient of Equity/TA, Liquid/TA and ROA are expected to have a positive sign.

3.4. The Extent of Bank Derivatives Usage

From above discussion, the general dynamic panel data model to be estimated is as follows:

$$\mathrm{InY_{it}} = \emptyset \mathrm{InY_{it-1}} + \partial \mathrm{Z_{it}^1} + \beta \mathrm{X_{it}^1} + \mathrm{d_t} + \varepsilon_{\mathrm{it}} \qquad (2)$$

$Z^1 - control\ variables\ ;\ X^1 - explanatory\ variables$, Y_{it}- dependent variable,Y_{it-1}lagged dependent variable,$\emptyset - parameter\ to\ be\ estimated$

The specific model will take the following form from equation 2:

$$TLCOPVT_{i,t} = InTLCOPVT_{it-1} + \beta 1\ DERIV_{i,t} + \sum_{j=1}^{4} V_i X_{i,t-1} + EMPG_{i,t-1} + \varepsilon_{i,t-1} \qquad \mathbf{(3)}$$

Where, $\boldsymbol{TLCOPVT_{i,t}}$ *is the yearly growth rate of a corporate, and private domestic lending for banks is at period* ***t****,* $\boldsymbol{DERIV_{i,t}}$ *represents derivative usage, which is a dummy variable equal to 1 for banks that use any type of derivative instrument and 0 for banks that do not use,* $\boldsymbol{V_i}$ *is the time indicator variable,* $\boldsymbol{X_{i,t-1}}$ *represents bank specific variables, that is, Total assets, Equity/TA, Liquid/TA and ROA, respectively,* $\boldsymbol{EMPG_{i,t-1}}$ *represents growth rate in state employment. It is noted that regional economic conditions should influence bank lending growth; and* $\boldsymbol{\varepsilon_{i,t-1}}$ *is the error term.*

From equation (**3**), the bank-specific variables are captured in equation (**4**)

$$\mathrm{TLCOPVT_{it}} = \mathrm{InTLCOPVT_{it-1}} + \beta \mathrm{i} * \mathrm{DERIVUSE_{it}} + \gamma \mathrm{TA} + \partial \mathrm{EQRA} + \vartheta \mathrm{LIRA} + \lambda \mathrm{ROA} + \mathrm{EMPG_{it}} + \mathrm{V_i} + \varepsilon_{\mathrm{i,t-1}} \qquad \mathbf{(4)}$$

Where TA is total assets; EQRA is equity to total assets ratio; LIRA is liquid assets to total assets ratio, and ROA is return on assets ratio; Other variables were explained in equation ***3***

3.5. Derivatives Use and Credit Extension on Sector Based

To further analyse the effects of derivatives impact on a sectorial basis, the dependant variable was substituted with private sector lending. This was to test if derivatives influence banks to lend to the private sector. From equation (3), total loans were excluded and now included private lending as a new dependant variable, resulting in the following equation:

$$\mathrm{PVTLENDING_{it}} = \mathrm{InPVTLENDING_{it-1}} + \beta \mathrm{i} * \mathrm{DERIVUSE_{it}} + \gamma \mathrm{TA} + \partial \mathrm{EQRA} + \vartheta \mathrm{LIRA} + \lambda \mathrm{ROA} + \mathrm{EMPG_{it}} + \mathrm{V_i} + \varepsilon_{\mathrm{i,t-1}} \qquad \mathbf{(5)}$$

PVTLENDING is the measure of total loans to the private sector, $InPVTLENDING_{it-1}$ *is the lagged dependent variable, Other variables are as in previous equations,*

$$\text{PUBLENDING} = \text{InPUBLENDING}_{it-1} + \beta i * \text{DERIVUSE}_{it} + \gamma \text{TA} + \partial \text{EQRA} + \vartheta \text{LIRA} + \lambda \text{ROA} + \text{EMPG}_{it} + V_i + \varepsilon_{i,t-1} \quad \textbf{(6)}$$

PUBLENDING is the measure of total lending to the public sector lending and $InPUBLENDING_{it-1}$ *is the lagged dependent variable.*

$$\text{MORTGAGE} = \text{InMORTGAGE}_{it-1} + \beta i * \text{DERIVUSE}_{it} + \gamma \text{TA} + \partial \text{EQRA} + \vartheta \text{LIRA} + \lambda \text{ROA} + \text{EMPG}_{it} + V_i + \varepsilon_{i,t-1} \quad \textbf{(7)}$$

where. MORTGAGE is the measure of lending to finance properties of government, households and corporate sectors and $InMORTGAGE_{it-1}$

3.6. Measuring Instrument

The study employed a dynamic panel data model estimated with the system generalised method of moments (GMM) because the panel data used is unbalanced. It has been discovered that difference GMM used first difference transformation which subtracts the previous observations from the contemporaneous one, thereby it magnifies gaps in unbalanced data. Arellano and Bover (1995) and Blundell and Bond (1998) articulately show that system GMM uses orthogonal deviations. Instead of subtracting the previous observations from the contemporaneous one, it subtracts the averages of all future available observations for a variable. No matter how many data gaps, it is computable for all observations except for the last individual. Hence it minimises data loss obtained under difference GMM if unbalanced panel data is used. Zhao and Moser (2017)'s model used the Hausman test to check the existence of endogeneity, which might arise because derivative use decisions and lending choice can be made simultaneously. In this analysis, system GMM was used to estimate the models because Blundell and Bond (1998) establish that the technique is handy in controlling endogeneity, heteroscedasticity and the correlation of errors over time. Furthermore, GMM controls for endogeneity using the lagged dependent variable in a dynamic panel model, that is if there is correlation between explanatory variables and the error term in the model. Another reason that makes the GMM a more robust estimating technique is that it controls for omitted variables bias, unobserved panel heterogeneity and measurement errors in the data (Roodman, 2009).

4. Results and Discussion

Using the yearly change in total loans, private sector lending, public sector lending and mortgage sector lending, this study utilized equations (4), (5), (6) and (7) to analyse the determinants of lending and the impact of derivatives on credit extension. Table **1** shows the results of the panel data estimated using system GMM for the period 1996 to 2017.

Table 1. Descriptive Statistics

Variable	*Description*	*Mean*	*Std. Dev.*	*25%*	*Min*	*75%*	*Max*
TLCOPVT	*Pvt +pub + mortgage lending*	*1.7707*	*5.2907*	*280396*	*2132*	*4644772*	*4.1508*
DERIV	*Derivatives nominal value*	*4103123*	*1.0507*	*11072*	*174*	*2892607*	*7.7107*
TA	*Total assets*	*3.5507*	*9.7507*	*894422*	*80819*	*1.6107*	*7.2608*
MORTGAGE	*Mortgage lending*	*1.6807*	*4.4807*	*82475*	*227*	*2455790*	*2.9808*
PUBLENDING	*Public lending*	*1.318493*	*1.920068*	*12442*	*1*	*1778766*	*1.1007*
PVTLENDING	*Private lending*	*7.946553*	*1.8907*	*187745*	*2132*	*3757594*	*1.1408*
QRA	*Total equity/total assets*	*0.155044*	*0.135534*	*0.7106*	*0.01995*	*0.18991*	*0.78442*
LIRA	*Liquid assets/total assets*	*0.204555*	*0.182876*	*0.6789*	*0.00747*	*0.286534*	*0.85832*
ROA	*Return on assets*	*2.146279*	*2.446491*	*0.8387*	*0.0073*	*1.7174*	*11.2115*
EMPG	*Employment growth rate*	*18.95201*	*84.35605*	*39.017*	*37.179*	*40.188*	*40189*

Source: Own calculations from Stata

Table 1 above summarises the descriptive statistics for the dependent and independent variables. The mean for the yearly total lending changes in the period is 1.77. Lending to specific sections have the following averages: advances to mortgages was 1.68; public lending was 1.31; and private lending had the highest mean of 7.95. during the same period; total assets (bank size) had a mean of 3.55; total equity to total assets, 0.155; return on assets average was 2.14; employment growth rate average was 18.95; and liquid assets to total assets was 0.204.

The researchers used equation (2) to assess the determinants of lending activities in the banking industry and the impact of derivatives on the growth of the loan portfolio in the banking sector of South Africa. Table 2 reports the results estimated with system GMM for the dynamic panel data model using Stata 15, with yearly data from 1994 to the end of 2017.

Table 2. Dynamic Panel Data Estimation Results [System GMM]

	Model 1	***Model 2***	***Model 3***	***Model 4***
LOANS	**TLCOPVT**	***PVTLENDING***	***PUBLENDING***	***MORTGAGE***
DERIVATIVES	*0.3074912*	*0.928262*	*0.0430239*	*-0.08432215*
	*4.03****	*6.88****	*2.44***	*-4.5****
LIRA	*3819999*	*1343472*	*9703728*	*-9195984*
	*2.06****	*3.25****	*2.23***	*-2.62****
TA	*0.3077828*	*48057*	*0.0002447*	*-0.00555164*
	*10.28****	*9.01****	*0.11**	*-2.31****
QRA	*3.8307*	*4638612*	*1.2107*	*5.4006*
	*4.03****	*6.32****	*2.34****	*0.72***
EMP	*18.18162*	*16.02246*	*26.59655*	*-22.12577*
	*4.84****	*8.38****	*0.96***	*-1.32***
AR (2) test	**0.184**	**0.210**	***0.822***	**0.416**
HANSEN TEST	**0.268**	**0.248**	***0.104***	**0.983**

Source: estimates from STATA

Note: *The models in the Table **2** each had a dependent variable. Model 1 – Total loans was dependent variable, Model 2 -private lending as dependent variable, Model 3 -public lending as dependent variable and model 4 -*

*Mortgage lending as a dependent variable. The main independent variable in all the models is derivative use, which is a dummy variable indicating 1 for derivatives use by a bank and 0 otherwise. The results reported are from the system GMM estimation technique. Statistically significant coefficients of the T-tests and probabilities values are included in parentheses. ***, **, * indicating that coefficients are statistically significant at 1%, 5% and 10% respectively. The sample contains 22 yearly observations from 1996 through to the end of 2017.*

As reflected in Table 2, the regression model (1) shows that banks participating in any type of derivative instruments are significantly increasing their lending activities and their loan portfolios are growing. A positive association between derivatives and lending implies that banks receive a benefit from using derivatives when hedge using them. Derivative use and total loan (TLCOPVT) growth had a positive statistical relationship and significant coefficient at a 1 percent level. The results are consistent with evidence from developed nations, that banks use derivatives to complement their lending activities (Brewer III et al., 2000); (Brewer III et al., 2014) and (Zhao and Moser, 2017). Moreover, is it aligned with the model of Diamond (1984) on financial intermediation, which posited that derivatives allow banks to channel more advances in an economy. Diamond's model reasons that derivatives permit banks to reduce their systemic risks to changes in market variables such as interest rates. Hedging interest rate and foreign exchange rate movements using derivatives, allow banks to manage risk, thereby provide more loans without increasing the risk faced by banks.

Overall, the current analysis of the intermediation process with supply and demand factors that influence the lending process in banking are consistent with the survey evidence from developed markets. Total loan (TLCOPVT) growth is statistically significant and its coefficient is positively related to total equity-to-total assets (QRA), which is the measure of capital adequacy. This is in conjunction with the theory which states that banks that are capital constrained adjust their loan portfolios in order to meet predetermined capitalisation requirements (Brewer III et al., 2000). Additionally, the positive association between total loan growth and QRA implies that well-capitalised banks are granting more loans than capital-constrained institutions.

The state employment growth rate (EMP) is statistically significant, which reflects the state of the economy, meaning that the welfare of the people in an economy influences the demand for loans. The results reveal that there was a positive relationship between total loans and EMP. Given all things equal, banks in economies which are developed tend to be more profitable than banks in weaker economies, therefore their loan books are growing. This result is consistent with Brewer III et al. (2000), which analyses a sample of banks that represent the advent of interstate. Furthermore, Zhao and Moser (2017) argue that deregulation has led banks to be geographically dispersed and fails to appreciate the effect of state economies' wellbeing on the growth of lending. Moreover, in the United States (US) the banking industry is more geographically diversified. The findings of Zhao and Moser (2017) disagree with this study's results because they cite the expansion of interstate banking as compared to South Africa. Hence, the state economies play a pivotal role in affecting banks' health and performance.

The TLCOPVT growth and liquid assets -to- total assets (LIRA) are positive and statistically significant. This result implies that bank lending is more likely if banks had better liquidity and were making profits. Hedging theorists argue that the usage of derivatives is greater when banks are likely to face financial distress, that is, if there is low liquidity and lower profitability, the institution tends to resort to derivatives for hedging financial distress (Smith and Stulz, 1985). The research also found that the size of a bank, which was measured as a natural logarithm of assets (RA) had a positive relationship with the growth of total loans. This was consistent with the findings of Prabha et al.

(2014) that the economies of scale effect impact lending activities and risk management in the banking sector. Larger banks utilise derivatives for hedging and lend more as compared to smaller banks. Regressions 2, 3 and 4 include decomposed lending into private, public and mortgage lending.

Zhao and Moser (2017) confirm that lending to commercial business and consumers and residential real estate reflects a positive coefficient of the derivative variable, but not significant at all levels. Therefore, banks benefit more from managing their lending, compared to corporates. The regression (2) results reported that private sector loans and derivative use had a positive relationship which is statistically significant at the 1 percent level, implying banks are hedging this type of loans using derivatives as compared to other loan types. This supports the hypothesis that lending to corporate business is riskier than lending to residential, real estate and consumers (Zhao and Moser, 2017). Furthermore, it also suggests that banks which are lending to the private sector are likely to participate more in derivative markets. In South Africa, this is the largest portion in the banking loan portfolio. The results were in disagreement with the evidence exhibited in the US, where Prabha et al. (2014) reported that consumer loans are granted in large numbers and to a homogenous group of borrowers, so they tend be lower in interest rate risk. Hence banks do not consider hedging such loans using derivatives.

In the models (3), public sector lending (government institutions borrowing) and derivative use is positive and statistically significant at the 5 percent level. The results suggest that banks use derivatives to reduce their risk of exposure from fluctuations in rates, thereby increasing their ability to provide loans. A negative coefficient of bank lending to mortgage lending and derivative use suggests that banks are not hedging for mortgage lending because they regard these as safe investments, when borrowing to finance properties. This contradicts the findings of Zhao and Moser (2017) in the US, which reveals that estate lending is perceived to be risky during financial crises and records a the positive relationship with derivative usage. From this study's analysis, the researchers further argue that if a borrower in mortgage lending defaults, the property can be used as collateral, which can reduce fluctuations in the markets. Brewer III et al. (2000) and Zhao and Moser (2017) suggest that a negative relationship reflects that banks are using derivatives for speculation or trading for revenue generation, and not as an aid to lending.

In regressions (2) and (3), bank sizes (TA), liquidity ratios (LIRA) and equity capital ratios (QRA) and employment rate (EMP) are positive and statistically significant at the 5 % confidence level determinant of lending, which suggests that healthier banks that are better capitalized have more liquid assets, and can provide more credit. In the regression (4) model only, QRA had a positive coefficient and all other explanatory variables exhibited negative relationships with the growth of mortgage loans.

5. Conclusion

The economic benefits of derivatives in the lending sector was the main aim of the study, using South African banking sector data for the period 1996 to 2017. The study utilised all listed and non-listed banking institutions because of data availability. In South Africa, there are seven listed banks on the JSE's main board. The South African Reserve Bank statistics section was the major source of data, from derivatives to bank lending and bank specific variables, which banks file in BA 350 statistical forms. A dynamic panel data model estimate using the system GMM technique was employed for a period of 22 years. It emerged that that banks can increase lending if they hedge using derivatives. Banks in South Africa are using the following derivatives: interest rate derivatives, currency swaps,

swaptions and caps and floors, to hedge risks. Mortgage lenders showed to be constrained if banks are not hedging sources of risks which are posed by fixed rate mortgages, thereby affecting their financial position and failing to raise funds for progressive lending.

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Appendix 1

Table 3. Bank Specific Variables and Derivatives Variables as per BA350

Bank specific Variables	**Definition**	**AD350 -ITEMS**
Total loans	Private + public + mortgage	
Private sector	*Overdrafts, loans and advances to the following institutions* *a) Overdrafts, including overdrafts under cash management schemes,* *b) financial corporate sector,* *c) non-financial corporate sector,* *d) unincorporated business enterprises of households,* *e) households,* *f) non-profit organisations serving households,*	*Total items 181 & 187& 188*
Public sector	*Overdraft, loans and advances to the following entities* *a) General government of republic* *b) Social security funds* *c) Provincial governments* *d) Local governments* *e) Land bank* *f) other public financial corporate sector (such as IDC)* *g) Public non-financial corporate sector (such as Transnet, Eskom)* *h) Foreign public sectors*	*172 to 179*
Mortgage advances	*Advances to the following sectors* *a) Farms (corporate, households, and other sectors)* *b) Residential sectors (corporate, households, and other sectors)* *c) Commercial and other mortgage advances) public financial, public financial and non-financial, private financial and non-financial and households' sectors)*	*151 & 155& 159*
Total assets		*327*
Total equity to total assets		
Net interest margin	*Net interest income as a percentage of average earning assets. Total* *interest income on a tax-equivalent basis, less total interest expense,* *divided by the average of the respective asset accounts involved in* *generating interest income*	
Return on assets		
Liquid assets	Calculated using: cash +NCDs/PNsc issued with an unexpired maturity of up to, 1 mouth ,1 to 6 month and other deposits with and loans and advances to SA banks + loans granted under resale agreements to SA reserve bank ,banks insurers, and financial and non-financial and other	*(104 to 106) + (112 & 116) + (119 to 125)*
Cash	Central bank money and gold + domestic currency deposits with resercve bank, cash reserve deposits, cash resrve	