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Sectoral Risk and Return: Implications on Commercial Banks' Credit Expansion in Kenya

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Sectoral Risk and Return: Implications on Commercial Banks' Credit Expansion in Kenya

By Ferdinand Othieno and Caroline Kariuki

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Abstract

The paper examines the effect of sectoral risk on bank returns that accrue from the extension of credit to the different sectors of the economy in Kenya. Based on Dynamic Panel Data regressions of quarterly sectoral data spanning from 2011Q1 to 2015Q4 the paper reports three key findings: (1) There is no strong evidence of risk-based pricing since the risk-return relationship although positive, it is statistically insignificant. (2) There is no evidence of a U-shaped or non-linear relationship between risk and return regardless of the measure of risk, (3) Sectoral credit expansion is significantly impacted by returns and risk. Whereas the pricing effect is not as sensitive to the risk profile of the respective sectors, credit availed to the sectors is highly risk sensitive regardless of the measure of risk; effectively higher risk ratings seem to drive credit availability as opposed to pricing of the extended loans. The results question the risk-pricing nexus in the Kenyan market, if the risk is at least measured at the sectoral level.

Key words: *Commercial Banks, Credit expansion, Dynamic Panel Data Analysis*

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1.0 Introduction

A number of reforms have taken place in the Kenyan Banking industry, which necessitate the need for better risk-based pricing. Probably the most profound move in the industry is the recent cap on interest rates charged on loans and floor on the interest paid on customer deposits.

These reforms are expected to lead to an increase in the quantum and quality of private sector credit. The expected outcome of the reforms is expected to accrue in a significant way if the different risks involved in the credit extension are correctly priced as opposed to "credit rationing" when the risk profile of the borrower increases.

It is evident that in dispensing the function of providing private sector credit, commercial banks are faced with a risk-return decision Gavin et al. (1997). This decision warrants sound risk management, the success of which is, gauged by the bank's ability to assume and aggregate risk within tolerable and manageable limits. One of the key ways a bank could achieve this noble objective is through sectoral diversification which benefits from less than perfect correlation among the returns and risk factors for the various sectors within the economy (Diamond, 1984). Greenwood and Jovanic (1990), show that financial intermediation provides a mechanism for diversification and sharing risks, which can be achieved by inducing a capital allocation shift towards risky but "high expected return" projects which spurs improved productivity and economic growth. The diversification benefits however come at a cost as posited by Winton (1999) who argues that there might be increased costs associated with loan diversification due to higher monitoring involved as the number of sectors increase.

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So as to optimise the cost-benefit outcomes of the lending decision, sound credit risk management requires the establishment of a framework that defines corporate priorities, loan approval process, credit risk rating system, risk-adjusted pricing system, loan-review mechanism and comprehensive reporting system. While risk profile is hypothetically identified as a key determinant of credit allocations to different sectors, it differs from form one sector to another. As such, the paper aims at empirically examining sectoral risk versus return status and their relationship with sectoral credit expansion in Kenya. Therefore, the paper specifically seeks to:

1. Examine the relationship between sectoral risk and return for the banking industry in Kenya.

2. Establish the effect of the risk-return nexus on sectoral credit expansion in Kenya

The paper examines the effect of sectoral risk on bank returns that accrue due to extension of credit to the different sectors of the economy in Kenya using quarterly sectoral data spanning from 2011Q1 to 2015Q4. The analysis is hinged on portfolio theory, first applied on loan portfolios by Gollinger and Morgan (1993), which assumes inverse relationship between risk and return. It also examines the nonlinear U-shaped relationships in all the tests (Winton, 1999) using Dynamic Panel Data regressions.

The rest of the paper is organized as follows: Section 2 presents empirical studies based on the theory of risk-return nexus and their implications on credit expansion. Section 3 presents the empirical approaches and econometric models adopted in estimating risk-return relationship and how both risk and return affect credit expansion. The section also describes the data used and its sources. Section 4 presents the findings of the study with section 5 concluding the study.

2.0 Literature review

Research carried out by Buch and Schertler (2006) assesses the response of bank lending to sectoral growth in Germany from 1996 to 2002 for more than 1,500 banks. Using the Generalised Method of Moments estimator and the finite sample correction proposed by Windmeijer (2005), the study concludes that bank heterogeneity affects how lending responds to sectoral growth. In particular, total lending from banks in Germany has a positive association with domestic growth, while lending that exceeds a threshold of 1.5 million to either German or foreign firms is not pro cyclical. In addition, the response of lending from German banks depends on factors such as the banking groups they belong to, the bank's asset size and the degree of sectoral portfolio concentration.

Acharya et al. (2006) examined the trade-offs between loan portfolio specialisation and diversification on the return and risk of banks for 105 banks in Italy from 1993 to 1999. The study concludes that both industrial and sectoral loan diversification reduce bank returns while endogenously producing riskier loans for high risk banks. This may arise in the instance where a bank expands into industries where it faces a lot of competition or lacks prior lending experience. For low risk banks, both industrial and sectoral loan diversification produce a small risk-return trade off. In addition, this study concludes that diversification of bank assets is not guaranteed to produce a higher return or increased safety for banks.

Langrin and Roach (2009) examined the effects of concentration and risk on bank returns in Jamaica using panel data for 15 banks from 2000 to 2007. From the study, the bank level panel regression tests of the linear and non-linear effects of concentration and risk on bank returns support the hypothesis that greater diversification does not imply lower risk and/or greater returns. In addition and contrary to traditional portfolio theory they find that concentration rather than diversification

of bank level loan portfolios may be more consistent with achieving minimal systemic risk.

An investigation on the effects of sectoral diversification on Chinese banks' return and risk was undertaken by Chen et al. (2013) for 16 listed commercial banks from 2007 to 2011. The authors constructed a new diversification measure, which took the systemic risk of different sectors into consideration by weighting them with their betas. These results were then compared with the Herfindahl-Hirschman Index. Results from this study showed that credit portfolio diversification is associated with both reduced returns and reduced risk. The study further explains that credit portfolio diversification may result in higher monitoring costs for the banks, thus reducing overall profits.

In some countries such as India, the priority sector lending policy has been adopted as a strategy for channeling funds to specific sectors in the economy. In 2015, these sectors were agriculture, micro, small and medium enterprises, export credit, education, housing, social infrastructure, renewable energy and other weaker sectors of the economy (Reserve Bank of India-Notifications, 2015). Nathan Associates (2013) analysed the impact of priority sector lending on India's commercial banks. They conclude that priority sector lending is costly for Indian banks relative to the returns that it gets from these sectors. As such, the study recommended that banks should re-prioritize the sectors that they lend to based on their underlying business models. Institutions such as co-operative societies and rural banks should also be strengthened to meet the credit needs to these priority sectors in the long-run.

3.0 Empirical strategy

This study adopts the approach of Langrin and Roach (2009) to examine the effect of sectoral risk on bank returns that accrue due to extension of credit to the different sectors of the economy in Kenya.

To examine the relationship between risk and return for each sector, the paper pitches analysis on portfolio theory, which assumes that there is an inverse relationship between risk and return (see Gollinger and Morgan (1993). In addition, it incorporates the arguments by Winton (1999) who argues that there could be a non-linear and U-shaped relationship between loan portfolio returns and portfolio risk. To test the linear effect of sector risk on bank returns, the paper seeks to estimate **model (1)**

$$Return_{it} = \alpha_0 + \alpha_1 Return_{i,t-1} + \alpha_2 Risk_{it} + z_{it}\alpha + \varepsilon_{it} \quad \text{..... (1)}$$

Where $Return_{it}$ represents sector i return on loan asset at period t, which is measured as the difference between return on loans and advances and return on non performing loans; $Risk_{it}$ is measured by annual (4 quarters) rolling standard deviation of return as defined above. For robustness, we also estimate risk as the 4-quarter moving average of the probability of default in place of the standard deviation. z_{it} represents a vector of control variables including ratio of capital to total assets and and the ratio of liquid assets to total assets for the banking sector (which will be invariant across sectors). The parameter α is a vector of coefficients that captures the impact of control variables; ε_{it} is a residual vector that can partly reflect sector-specific fixed effects and white noise components.

It is expected that our coefficient of interest, α_2 should be positive. Variations in the magnitude of this coefficient across sectors reflect heterogeneity in the risk-return trade off across the different sectors of the economy.

To test whether there is any form of non-linearity on the effects of risk on return across the different sectors, the study considers estimating **model (2)**, as proposed by Acharya et al. (2006) which is a modification of **model (1)**.

$$Return_{it} = \alpha_0 + \alpha_1 Return_{i,t-1} + \alpha_2 Risk_{it} + \alpha_3 Risk_{it}^2 + z_{it}\alpha + \varepsilon_{it} \quad \text{..... (2)}$$

Under the specification given by **equation (2)** above, the effect of risk on return is non-linear in risk. This means that the first derivative of risk on return is given by:

$$\frac{\partial Return_{it}}{\partial Risk_{it}} = \alpha_1 + 2\alpha_2 Risk_{it} \quad \text{..... (3)}$$

To establish whether risk (and therefore returns) affect sectoral credit expansion, we consider estimating **model (4)**

Where $Credit_{it}$ represents the log of total credit for sector ***i*** in period ***t***, and the rest of the variables are as described earlier. Since credit is in logarithms, the coefficient estimates from **Model (4)** are interpreted as semi-elasticities.

To establish the effect of return on credit expansion we estimate the following (see **Model (5)**).

A variation of the Sharpe ratio[1] was used as a measure of the risk-return trade-off commonly used in the finance literature. Using the Sharpe ratio we estimate the following equation **model (6)**:

Equations (1) to **(6)** are estimated based on Panel GMM estimation technique, in which case the lag effects will be taken into account in the selection of instruments. Panel GMM estimation is used as it is

$$Credit_{it} = \alpha_0 + \alpha_1 Credit_{i,t-1} + \alpha_2 Risk_{it} + z_{it}\alpha + \varepsilon_{it} \quad \text{..... (4)}$$

$$Credit_{it} = \alpha_0 + \alpha_1 Credit_{i,t-1} + \alpha_2 Return_{it} + z_{it}\alpha + \varepsilon_{it} \quad \text{..... (5)}$$

$$Credit_{it} = \alpha_0 + \alpha_1 Credit_{i,t-1} + \alpha_2 Sharpe\_ratio_{it} + z_{it}\alpha + \varepsilon_{it} \quad \text{..... (6)}$$

1. In Finance the Sharpe ratio of Sharpe (1994) is calculated as $S_h = \frac{E(R_i) - R_f}{\sigma_{it}}$ In this study the Sharpe ratio is measured as $S_h = \frac{Return - Return_t}{Risk}$

better placed to study cross-sectional dynamics, as well as capture effects that are simply not detectable in pure cross-sectional or pure time series analysis. In addition our study assumes that risk, return and credit (depending on the equation) are endogenous and therefore strong autocorrelation is expected for the dependent variable. This coupled with the presence of strong fixed effects, especially when NPL are used to gauge risk and the short time and dimension (in our case $T = 20$ and $N = 9$) and total observations are 180, makes the Arellano and Bond GMM estimation well suited for this study (See Arellano and Bond (1991))

The choice of the appropriate model for endogenous variables and intrumental variables is based on a sound balance between the Arellano and Bond (1991) AR(1) and AR(2) tests and the Sargan test for over-identification. Serial correlation that is commonly present in panel data which can bias the results is minimized by using robust standard errors in our estimation.

3.1 Data sources

The study uses quarterly panel data spanning 2011Q1 to 2015Q4 on total commercial banks' sectoral credit, non-performing loans, average bank-wide (and sector-wide) lending rate, ratio of capital to total assets of the banking sector and ratio of liquid assets to total assets. We consider nine sectors, namely, Trade, Personal/Households, Real Estate, Building & Construction, Transport & Communication, Manufacturing, Agriculture, Financial Services and Mining & Quarrying. The number of sectors is limited by the matching sectoral classification on credit by the Central Bank of Kenya (CBK) as well as GDP sectoral classification by the Kenya National Bureau of statistics (KNBS). Sectoral credit data, average lending rate and ratios of capital to total bank assets were sourced from CBK while data on sectoral non-performing loans was obtained from the Kenya Bankers Association.

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4.0 Empirical Results

The linear and non-linear risk-return interaction and their combined effects on sectoral credit expansion are studied using Panel Generalized Method of Moments procedure proposed by Arellano and Bond (1991). While Dynamic Panel Analysis can be potentially biased in tests where the number of observations and time periods are low, such as in our case, this limitation is to a great extent cured through the use of standard GMM based estimation.

While it is theoretically possible to include additional moment conditions to improve the asymptotic efficiency of the standard GMM, it is doubtful how much efficiency gain one can achieve by using a huge number of moment conditions in a finite sample. In addition, if higher-moment conditions are used, the estimator can be very sensitive to outliers. Through a simulation study, Ziliak (1991) concludes that the downward bias in GMM is quite severe as the number of moment conditions expands, outweighing the gains in efficiency. The results for the effect of risk on return are shown separately from those showing the effect of return and risk on credit expansion.

4.1 Effect of sector risk on bank returns

Empirical results for the effect of sector risk on bank returns are presented in **Table 1**. The ***t-statistics*** are robust to heteroskedasticity and autocorrelation.

Table 1: Risk-return relationship for sectoral credit in Kenya 2011Q1 - 2015Q4. Estimation Equation (1)

Coefficient	Risk-1 STDEV	Risk-2 PD
Lag return	0.42*	0.75***
	(1.73)	(3.37)
Risk	1.20**	-0.05
	(2.53)	(2.53)
Liquidity	-0.077**	-0.15**
	(-2.12)	(-4.32)
Arellano Bond (AR 1) Test	-2.76	-2.28
	[0.006]	[0.023]
Arellano Bond (AR 2) Test	-2.34	-1.18
	[0.019]	[0.23]
Sargan Test	0.75	3.29
	[0.993]	[0.772]

NB: t-statistic are in parentheses, *,** and *** indicates that all the reported coefficients for the respective variables are statistically significant at 10%, 5% and 1% levels of significance respectively, Probability values of the Sargan and Arellano Bond AR(1) and AR(2) are in square brackets.

The dependent variable is $Return_{it}$, which represents sector ***i*** return on loan asset at period ***t***, measured as the difference between return on loans and advances and return on non performing loans; $Risk_1$ is measured by annual (4 quarters) rolling standard deviation. For robustness, we also estimate risk as the 4-quarter moving average of the probability of default - This is indicated as $Risk_2$. Control variables include capital ratio and liquidity ratio which are invariant across sectors.

Table 1 summarizes the estimation results examining the risk-return relationship for sectoral lending in Kenya. There is no clear evidence that risk is an important factor for loan return and as such pricing. When measured as the volatility of returns, risk attracts a positive (though not strongly statistically significant) price premium of about 1.2% at 5% statistical significance. Taken from this point of view there exists a positive relationship between return and risk, which would imply risk based pricing. On the other hand

the relationship is negative at about -0.05% when risk is measured as the moving average probability of default. This inverse relationship between return and probability of default, while intuitive and could indicate a penalty for default risk, which is taken into account in calculating our return measure, is not statistically significant. This inconclusive result on the risk-return relationship raises the question whether there is really risk-based pricing for sectoral lending in Kenya. We seek to establish if the relationship could be nonlinear instead.

Just like in conventional portfolio theory, (Gollinger and Morgan, 1993), the paper finds no evidence of a U-shaped or non-linear relationship between risk and return. The result is robust to changes in the measure of risk. In addition, inclusion of non-linear variable statistically weakens the linear coefficient. It also notes a strong AR(1) process for returns in the Kenyan banking industry. This could imply a lot of reliance of past return information in determining loan pricing.

It is interesting to note that liquidity is negatively related to returns, which would indicate the competing force between holding liquid assets and advancing the liquid funds as loans. We note that capital does not significantly affect the return on loans.

4.2 Effect of risk and return on credit expansion

Empirical results for equations (4) to (6) which are used to determine the effect of sector risk and return on sectoral credit expansion are presented in **Table 2**. The ***t-statistics*** are robust to heteroskedasticity and autocorrelation. The dependent variable is the log of credit to sector ***i*** at period ***t***. The Sharpe ratio is measured as excess return per unit of risk as defined under **Equation 6**. All other variables are as defined under **Table 1**.

All equations are estimated using the Panel GMM. Prob-values for the Sargan test, Arellano Bond AR(1) and AR(2)tests are shown in squared brackets.

Table 2: Effect of risk and return on sectoral credit expansion in Kenya 2011Q1 - 2015Q4. Estimation Equations (4) to (6)

Coefficient	Risk-1 STDEV	Risk-2 PD	Risk-return
Lag credit	0.30	0.41***	0.28*
	(0.76)	(2.92)	1.91
Risk	-5.88*	-10.02***	-
	(-1.66)	(-3.09)	
Sharpe	-	-	0.07
			(1.26)
Capital	9.72	1.735	1.735
	(1.57)	(1.47)	(1.38)
Liquidity	-6.38*	-3.66***	-2.46***
	(-1.91)	(-3.45)	(-3.45)
Arellano Bond (AR 1) Test	-1.15	-2.57	-3.12
	[0.25]	[0.010]	[0.002]
Arellano Bond (AR 2) Test	-5.70	-0.49	-0.93
	[0.57]	[0.62]	[0.36]
Sargan test	2.79	58.17	32.86
	[0.84]	[0.002]	[0.04]

NB: t-statistic are in parentheses, *,** and *** indicates that all the reported coefficients for the respective variables are statistically significant at 10%, 5% and 1% levels of significance respectively, Probability values of the Sargan and Arellano Bond AR(1) and AR(2) are in square brackets.

Table 2 presents the estimation results examining the effect of risk and return on sectoral credit expansion in Kenya for the period 2011Q1 to 2015Q4. Both risk and return are important factors for credit expansion regardless of

the transformations for the variables. Though weakly statistically significant (10% level) a unit increase in the variability of returns reduces credit expansion by about 6%. On the other hand a unit increase in NPL results in about 10% decline in credit expansion at 5% level of significance. Whereas the pricing effect is not as sensitive to the risk profile of the respective sectors, credit availed to the sectors is highly risk sensitive regardless of the measure of risk. This implies that commercial banks resort to risk avoidance as opposed to "risk management" where a commercial bank would actively evaluate the appropriate lending rate for a particular sector based on the risk profile of the sector.

It is notes that in all the analysis the there were no statistically significant time effects and as such these were not considered in our analysis. The ***J-Statistic*** of Hansen (1992), a test of overidentifying restrictions, fails to reject the goodness of fit of the risk-credit model at any conventional level of significance. However, it is noted that unlike for the risk-return models where the models were evidently strong with the least ***p-value*** being 0.77, the models for credit, risk and return nexus may not be significantly robust with ***p-values*** within the rejection level. Inspite of this, the selection of instruments in this paper does not weaken the test.

5.0 Discussion and Conclusion

The analysis of the relationship between bank returns and risk indicate mixed results. When risk is measured as the volatility of returns, it has a positive and significant effect on commercial banks' returns. However, when risk is measured as the moving average probability of default, risk has a negative though insignificant effect on bank returns. This finding questions the risk-return pricing mechanism for Kenyan commercial banks.

It would be expected that sectors that exhibit relatively higher risk profiles attract premiums on the respective lending rates but this doesn't seem to be the case for the period under review. The paper is cognizant of the cost of monitoring and evaluation of the risk profile for different sectors (Chen et al., 2013) which could explain the laxity to implement an active risk-based pricing. Also important for banks to note is that past returns have a significant and positive effect on the returns that a bank will receive in the current period. This indicates that banks may be relying on previous returns to determine the price of their loans.

Sectoral credit expansion is significantly affected by returns and risk. In addition, the risk-return interplay as captured by the "modified" Sharpe ratio plays a significant role in sectoral credit expansion. Whereas the pricing effect is not as sensitive to the risk profile of the respective sectors, credit allocation to the sectors is highly risk sensitive regardless of the measure of risks; Effectively higher risk ratings seem to drive credit availability as opposed to pricing of the extended loans.

Reference

1. Acharya, V. V., Hasan, I., and Saunders, A. (2006). *Should banks be diversified: Evidence from individual bank loan portfolios. Journal of Business,* 79:1355 - 1412.

2. Arellano, M. and Bond, S. (1991). *Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies,* 58:277-297.

3. Buch, C. and Schertler, A. and von Westernhagen, N. (2006). *Heterogeneity in lending and sectoral growth: evidence from german bank-level data.* Frankfurt am Main: Dt. Bundesbank.

4. *Chen, Y., Wei, X., Zhang, L., and Shi, Y. (2013). Sectoral diversification and the bank return and risk: Evidence from Chinese listed banks.* Procedia Computer Science, 18:1737-1746.

5. *Diamond, D. W. (1984). Financial intermediation and delegated monitoring. Review of Economic Studies,* 51(3):393-414.

6. *Gavin, M., Hausman, R., and Talvi, E. (1997). Saving behavior in latin america overview and policy issues. Inter-American Development Bank,* Office of the Chief Economist, 346.

7. *Gollinger, T. L. and Morgan, J. B. (1993). Calculation of an efficient frontier for a commercial loan portfolio. The Journal of Portfolio Management,* 19(2):39-46.

8. *Greenwood, J. and Jovanic, B. (1990). Financial development, growth and distribution of income. Journal of Political Economy, 37:464-475.*

9. *Hansen, L. P. (1982). Large sample properties of the generalized method of moments estimators.* Econometrica, 50:1029-1054.

10. *Langrin, R. B. and Roach, K. (2009). Measuring the effects of concentration and risk on bank returns: Evidence from a panel of individual loan portfolios in Jamaica. Journal of Business, Finance & Economics in Emerging Economies, 4(1):73-118.*

11. *Levine, R. (1997). Financial development and economic growth: Views and agenda. Journal of Economic Literature,* pages 688-726.

12. *Sharpe, W. F. (1994). Sharpe ratio. The Journal of Portfolio Management,* 21(1):49-58.

13. *Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM gmm estimators. Journal of Econometrics,* 126:25-51.

14. *Winton, A. (1999). Don't put all your eggs in one basket: Diversification and specialization in lending. Center for Financial Institutions Working Paper No. 00-16. Wharton School Center for Financial Institutions,* University of Pennsylvania.

15. *Ziliak, J. P. (1991). Efficient estimation with panel data when instruments are predetermined: An empirical comparison of moment-condition estimators.* Journal of Business and Economic Statistics, 15:419- 431.

Appendices

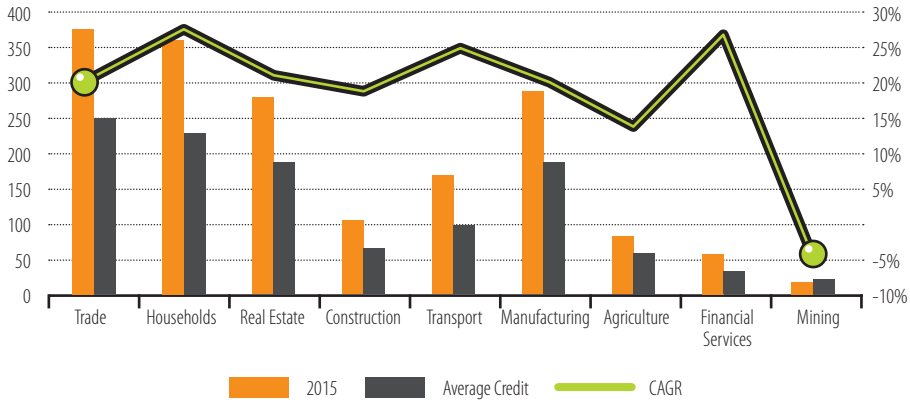
Appendix 1: Sector specific descriptive statistics 2011Q1: 2015Q4 Credit, NPL, NPL Ratio and sector GDP

Sector 1_Trade	Credit	NPL	NPL_ratio	Sector_GDP	GDP_share	GDP_G	Credit_G
Mean	252.61	20.16	0.08	68.70	7.54	7.01	0.21
Median	235.65	20.95	0.08	69.23	7.48	6.10	0.21
Maximum	381.13	32.94	0.11	85.79	8.62	17.20	0.40
Minimum	144.54	7.38	0.05	54.91	6.20	-3.06	0.03
Std. Dev.	67.40	7.97	0.02	8.15	0.63	4.38	0.08
Skewness	0.50	0.03	-0.24	0.12	0.21	0.27	-0.15
Kurtosis	-0.67	-1.45	-1.17	-0.55	0.15	1.24	1.11
Sector 2_Personal/Households							
Mean	232.78	21.92	0.10	-	-	-	0.25
Median	218.72	21.01	0.09	-	-	-	0.28
Maximum	363.86	28.34	0.15	-	-	-	0.44
Minimum	108.02	15.16	0.07	-	-	-	0.06
Std. Dev.	77.76	3.74	0.02	-	-	-	0.11
Skewness	0.38	0.11	0.55	-	-	-	-0.27
Kurtosis	-1.16	-1.01	0.17	-	-	-	-0.75
Sector 3_Real Estate							
Mean	194.41	10.21	0.05	74.12	8.14	5.04	0.26
Median	180.25	10.70	0.05	73.23	8.26	4.81	0.26
Maximum	282.59	16.97	0.06	88.10	8.83	11.43	0.52
Minimum	104.86	4.37	0.04	57.82	7.29	-4.89	-0.01
Std. Dev.	55.23	3.71	0.01	6.76	0.37	3.11	0.13
Skewness	0.16	0.26	-0.39	0.10	-0.84	-0.96	-0.08
Kurtosis	-1.26	-1.05	-1.05	1.02	1.10	4.98	-0.40
Sector 4_Building & Constuction							
Mean	69.34	6.36	0.08	44.08	4.84	9.75	0.27
Median	69.93	4.65	0.07	42.51	4.71	9.25	0.25
Maximum	106.31	14.19	0.16	57.82	7.29	19.75	0.56
Minimum	39.53	1.60	0.04	34.53	4.11	-3.09	0.02
Std. Dev.	16.86	4.50	0.05	6.84	0.69	5.76	0.17
Skewness	0.31	0.46	0.29	0.51	2.17	-0.25	0.43
Kurtosis	0.12	-1.43	-1.78	-0.72	7.26	0.15	-1.05
Sector 5_Transport & Communication							
Mean	101.25	7.04	0.07	91.89	10.09	6.55	0.22
Median	87.18	6.00	0.07	89.40	9.70	6.93	0.29
Maximum	171.64	14.86	0.10	122.17	12.32	14.45	0.46
Minimum	56.72	2.51	0.04	57.82	7.29	-5.34	-0.15
Std. Dev.	31.71	3.64	0.02	13.73	1.26	4.26	0.20
Skewness	0.78	0.67	-0.29	0.04	0.16	-0.98	-0.49
Kurtosis	-0.43	-0.62	-0.96	1.36	-0.08	2.26	-0.93

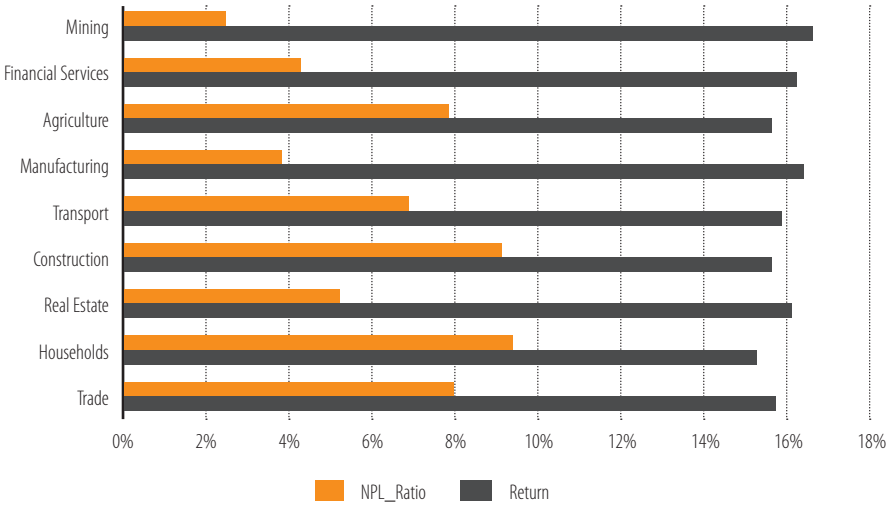
Appendix 1: Sector specific descriptive statistics 2011Q1: 2015Q4 Credit, NPL, NPL Ratio and sector GDP

Sector 1_Trade	Credit	NPL	NPL_ratio	Sector_GDP	GDP_share	GDP_G	Credit_G
Sector 6_Manufacturing							
Mean	192.94	7.44	0.04	102.40	11.15	3.79	0.22
Median	173.05	7.20	0.04	101.38	11.04	4.13	0.22
Maximum	290.07	12.96	0.06	127.54	13.00	13.51	0.39
Minimum	115.62	3.99	0.02	91.26	10.19	-2.54	0.05
Std. Dev.	49.66	2.83	0.01	8.14	0.65	3.95	0.10
Skewness	0.50	0.41	0.14	1.34	1.15	0.43	-0.14
Kurtosis	-0.80	-1.17	-0.99	3.27	1.81	0.22	-1.03
Sector 7_Agriculture							
Mean	62.67	4.97	0.08	201.43	22.10	4.08	0.16
Median	57.04	5.03	0.08	195.00	20.84	3.65	0.16
Maximum	89.02	6.00	0.10	264.62	26.85	11.81	0.38
Minimum	44.27	4.00	0.05	158.71	18.49	-0.75	0.00
Std. Dev.	12.37	0.63	0.01	34.82	2.99	2.64	0.11
Skewness	0.75	-0.07	-0.09	0.37	0.30	0.99	0.10
Kurtosis	-0.39	-1.04	-1.11	-1.30	-1.68	2.42	-0.89
Sector 8_Financial Services							
Mean	35.97	1.56	0.05	53.60	5.87	6.89	0.22
Median	30.82	1.50	0.04	52.67	5.86	7.15	0.22
Maximum	61.04	2.07	0.07	64.78	6.53	11.18	0.68
Minimum	18.76	1.28	0.03	45.28	5.27	0.28	-0.12
Std. Dev.	12.11	0.23	0.01	6.07	0.32	3.13	0.21
Skewness	0.79	0.89	0.71	0.24	0.41	-0.71	0.13
Kurtosis	-0.53	0.07	-0.13	-1.17	-0.04	0.03	-0.50
Sector 9_Mining & Quarrying							
Mean	24.31	0.61	0.03	8.63	0.95	11.83	0.09
Median	24.63	0.33	0.01	8.66	0.95	14.74	0.01
Maximum	28.47	1.75	0.08	10.96	1.09	27.30	0.73
Minimum	20.14	0.06	0.00	6.74	0.73	-20.86	-0.22
Std. Dev.	2.37	0.56	0.03	1.26	0.09	11.69	0.27
Skewness	-0.15	0.74	0.93	0.18	-0.38	-1.33	0.89
Kurtosis	-0.74	-0.81	-0.34	-0.78	-0.03	2.01	0.04
ALL SECTORS							
Mean	129.59	8.92	0.06	80.61	8.83	6.87	0.21
Median	95.16	6.00	0.06	71.58	7.82	6.20	0.21
Maximum	381.13	32.94	0.16	264.62	26.85	27.30	0.73
Minimum	18.76	0.06	0.00	6.74	0.73	-20.86	-0.22
Std. Dev.	94.55	8.04	0.03	55.11	5.96	6.15	0.17
Skewness	0.77	1.11	0.51	1.35	1.27	-0.05	-0.02
Kurtosis	-0.36	0.37	0.18	1.98	1.57	3.09	0.19

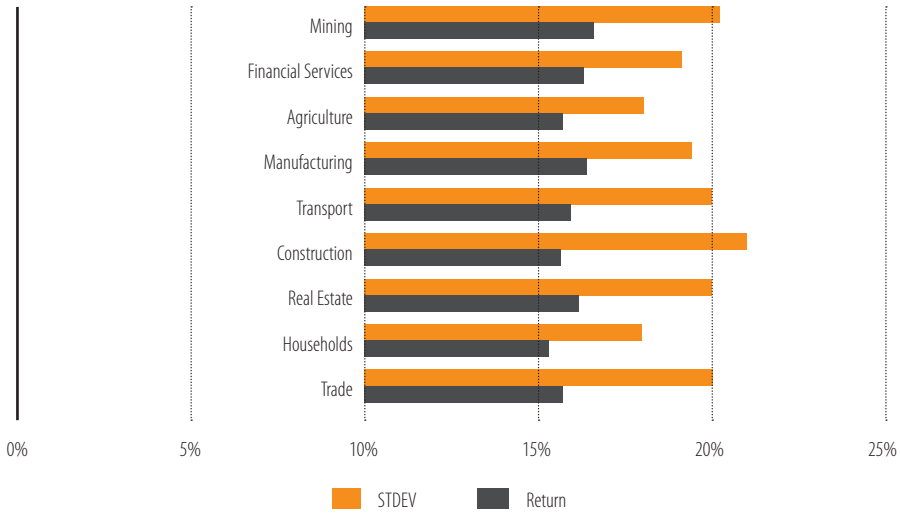
Appendix 2: Sectoral credit growth 2011 - 2015



Appendix 3: Sectoral risk and return 2011 - 2015



Appendix 3: Sectoral return and Vairability 2011 - 2015



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