

Journal of Finance and Investment Analysis, vol. 7, no. 2, 2018, 17-36
ISSN: 2241-0998 (print version), 2241-0996(online)
Scienpress Ltd, 2018

Sectoral credit diversification, bank performance and monitoring effectiveness; a cross-country analysis of east African banking industries

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Abstract

Traditionally, banking has been viewed as a pathway to reducing the frictions of transaction costs and information asymmetries. However, innovations in information technologies, deregulation, and financial deepening have deprived banks of the intermediation advantages by reducing the costs and information gaps. The emergence of shadow banking model further erodes these advantages. Banks have often responded by ameliorating their intermediation costs, through sectoral diversification. Indeed intermediation theories advocate for diversification to attain efficiency by reducing costs. However, given the nature of their operations, banks never hold sufficient balances to guarantee full liquidity. This exposes them to runs and portfolio losses if they don't efficiently monitor and recover the advances. This scenario raises two questions that are critical to the very core of bank intermediation. First, does sectoral credit diversification enhance bank profitability; and secondly, are banks able to effectively monitor the many portfolios resulting from diversification? To answer these questions, secondary data was collected from Bank Supervision reports of the central banks in four East African Community (EAC) countries for eight firm years from 2008 to 2015 and analysed using Generalized Linear Models (GLM). A positive and

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significant effect of sectoral credit diversification on banking industry returns on assets was observed while a significant negative relationship between diversification and asset quality as a proxy for monitoring effectiveness was reported. This shows that sectoral credit diversification improve the monitoring effectiveness of banks. The paper recommends a diversified loan portfolio where intermediaries distribute their credit offerings across various economic sectors.

JEL classification numbers: G21, G28, G32

Keywords: Credit Diversification, Bank Performance, Monitoring Effectiveness

1. Introduction

Traditional intermediation theories have emphasized the role of banking firms as that of reducing the frictions of transaction costs and information asymmetries (Allen and Santomero, 1998; Scholtens and Wensveen, 2003; Cetorelli, Mandel and Mollineaux, 2012). The wide range of costs associated with direct finance justifies the existence of financial intermediaries who could efficiently perform the multiple roles of screening, selection, monitoring and diversification of risk while simultaneously providing credit and liquidity services to fund suppliers (Cetorelli *et al.*, *op. cit.*). Transaction costs grant bank intermediaries an advantage over other intermediaries and individuals. This means that banks can more easily be diversified. However, developments in information technologies, deregulation and deepening in the financial markets have significantly reduced the transaction costs and information asymmetries depriving banks of the intermediation advantages they once enjoyed (Scholtens and Wensveen, *loc. cit.*). Additionally, a functional perspective – as an alternative to the institutional narrative that rest intermediation with banks – has emerged, describing intermediation as a decentralized rather than a bank-centered system. In this perspective, the matching of the supply of and demand for funds occurs along an extended credit intermediation chain, with specialized markets and non-bank institutions playing a part along the way (Merton, 1995). This is the so-called shadow banking model of financial intermediation (Cetorelli *et al.*, *op. cit.*) which decomposes the simple process of deposit-funded, hold-to-maturity lending conducted by banks into a more complex, wholesale-funded, securitization-based lending process that involves a range of shadow banks.

This new perspective has introduced enormous competition in the intermediation business by shifting intermediation risks from the banks' balance sheets by way of securitization and transfer of risk to issuers of asset backed securities. Such a

situation not only poses questions on the financial efficiency and profitability of banks but also on the prescriptions and validity of the traditional intermediation theory in this era. Apparently, it would appear plausible to conclude an end to the relevance and usefulness of bank intermediaries. However, this is not really the case since, as argued by Scholtens and Wensveen, (*op. cit.*); bank intermediation has instead become a value creating economic process with risk and risk management being the driving force behind this value creation. This is especially so because banks can absorb risk on a scale required by most market participants and which permits the sufficiently diversified portfolios desired by funds suppliers.

One way that banks have responded to these structural changes in the intermediation business is by ameliorating their intermediation costs, especially in the credit portfolios, through sectoral diversification. Indeed the theory of intermediation (Bhattacharya and Thakor, 1993; Diamond, 1984) advocate for diversification to attain efficiency by reducing the intermediation costs. They identify two types of diversification: that of sharing risks among many independent agents; and that of adding risks by a single agent. Theory of intermediation posits that diversification is beneficial to banks for at least two reasons. First, by increasing the risk tolerance of banks, diversification reduces the monitoring cost beyond what direct intermediation can achieve. Consequently, banks are able to earn a return beyond what is payable to the fund suppliers; thereby enhancing their profitability. Secondly, diversification reduces costs by centralizing monitoring to a single agent with several projects. In the process, the bank acquires a great deal of customer information in the process of making loans (Diamond, 1991; Rajan, 1992; Stein, 2002) which can be used in efficiently screening and monitoring borrowers thereby enhancing the bank's monitoring capabilities. Based on these theoretical prescriptions, it is plausible then to expect that diversification of credit portfolios across different economic sectors benefit banking institutions, first by enhancing their performance levels and, secondly by improving their monitoring effectiveness. The latter is so because the intermediary would be able to develop special skills in interpreting subtle signals presented in the customer information. However, given the nature of their operations, banks never hold sufficient balances to guarantee full liquidity and this exposes them to bank runs and portfolio losses if they don't efficiently monitor and recover the advances.

Empirical evidence is equivocal on performance and monitoring outcomes of credit diversification in banking institutions. The relationship becomes even more

blurred when risk and returns are considered simultaneously. Opponents of bank credit diversification cite cost and scale inefficiencies, probably so because banks may have an expertise on some of the sectors, but not all, thus involving more sectors would make it more costly to monitor (Acharya, Hasan and Saunders, 2006). For instance, while investigating the effects of sectoral diversification on the Chinese banks' return and risk, Chen, Wei, Zhang and Shi (2013) and Chen, Shi, Wei, and Zhang (2014) used panel data on 16 Chinese listed commercial banks during the 2007 to 2011 period. They measured diversification using Herfindahl-Hirschman index (HHI) and a risk adjusted HHI where the measure was adjusted for risk using the betas for every sector. Financial performance was measured using Return on Assets (ROA) and Return on Equity (ROE) while the bank's monitoring effectiveness was measured using the absolute value of non-performing loans. The study reported a significant positive influence of concentration on bank returns and profitability. Concerning the banks risk as a proxy of monitoring effectiveness, a significant positive relationship was reported between portfolio concentration and bank's risk. These findings imply that sectoral diversification is associated with reduced return and risk.

In attempt to show how diversification affected the performance of banks, Turkmen and Yigit (2012) investigated the effect of sectoral and geographical credit diversification on the performance of forty (40) Turkish banks between 2007 and 2011. They used return on assets and return on equity to measure bank performance and Herfindahl-Hirschman Index to measure bank credit diversification with the number and amount of credits banks allowed borrowers being control variables. The study reported statistically significant negative relationship between diversification and both ROA and ROE. The researchers attributed this negative diversification-performance outcome to the increase in costs that is associated with diversification which more than offsets the expected benefits of diversification.

Chen and Lin (2010) examined the effect of diversification on risk and return of Taiwan domestic commercial banks using unbalanced panel data from 1997 to 2009. Returns were measured using ROA, ROE and Net Interest Margin (NIM) while risk was measured using a ratio of non-performing loans to total loans (NPL), the ratio of loan loss provision (LLP) and a Z-score measure of insolvency risk. Diversification was assessed as revenue diversification and credit diversification and measured using HHI. The study reported a significant negative effect of loan diversification on all three profitability measures. However, credit diversification improved the NPL ratio and therefore reduced a bank's risk.

In Tehran, Raei, Farhangzadeh, Safizadeh and Raei (2016) investigated the effect of credit portfolio diversification on ROA ROE and credit risk among seven stock exchange listed banks for the period 2009 to 2014 period. Credit diversification was measured using the Herfindahl-Hirschman index while credit risk was measured as the ratio of total deferred debt over total assets with performance being measured using returns on assets and returns on equity. The study observed a statistically insignificant relationship between credit diversification and credit risk which was also the case for both performance measures. This implied that credit portfolio diversification was not beneficial to banks' risk and therefore monitoring efficiency nor did it benefit the banks performance.

Using data on Chinese banks during 1996 to 2006 period, Berger, Hassan and Zhou (2010) investigated the effects of focus versus diversification on bank performance. In their study, diversification was characterized by loan diversification, deposit diversification asset diversification and geographical diversification and was measured using economies of diversification and the Herfindahl-Hirschman index. Performance on the other hand was measured by returns on assets and expenses to asset ratio. For both measures of diversification, all the four constructs of diversification pointed to reduced profitability and higher banking costs, which points to diversification discount on bank performance.

In Punjab, Ravi (2014), investigated the relationship between loan diversification and risk profile and profits of cooperative banks using secondary data from a sample of 19 district central cooperative banks for ten financial years from 2002/03 to 2011/12. The study measured credit diversification using the Herfindahl-Hirschman index while risk was measured by a ratio of non-performing loans to total assets and return as the average yield on assets. The study reported a negative and significant relationship between diversification and returns but an insignificant though negative relationship between diversification and risk. This point to a diversification discount on bank performance but which doesn't benefit the banks' monitoring effectiveness.

Jahn, Memmel and Pfingsten (2013) investigated the impact of loan portfolio sector concentration on credit risk using a unique data set on German banks' sector specific loan exposures to the real economy and the corresponding write-offs and write-downs for the period 2003 to 2011. The study reported, on average, lower loan losses for banks specialized in certain industries with the loss rate of a given industry in a bank's loan portfolio being lower if the bank had major exposures to that industry. Additionally, they reported lower standard deviation of

the loan losses for more focused banks. This implies that diversification increased bank loan losses and therefore doesn't aid the banks monitoring effectiveness. However, Jahn *et al.*, (*op. cit.*) did not investigate the performance implications of loan portfolio concentration.

Yet in Germany, Behr, Kamp, Memel and Pfingsten (2007) analysed the effects of diversification in loan portfolios on the bank risk-return characteristics between 1993 and 2003. The study used data from the *BundesBank's* quarterly borrower's statistics to determine diversification degree while balance sheet audit report data were used for the risk return characteristics. In terms of return, the analysis reported slightly lower returns for diversified banks as compared to their fully specialized peers. Additionally, using asset quality and loan loss provisions as a risk indicator, the diversified banks recorded a poorer indicator than specialized banks indicating that diversification increased bank risk. However, when fluctuations in loan loss provisions and asset quality are used as proxies to expected losses, diversified banks recorded lower volatilities than the specialized ones indicating a lower level of expected risk. This portrayed a picture of typical risk return trade-off extended in the classical portfolio theory but which was practically unsound since the asset quality ratings revealed in the analysis were already poorer than the expectations.

In Brazil, Tabak, Fazio and Cajueiro (2011) investigated the impact of loan portfolio concentration on banks' return and credit risk using both static and dynamic regression analyses based on the traditional concentration as well as distance measures. They measured diversification using the Herfindahl-Hirschman index and the Shannon Entropy and return by return on assets while credit risk was measured as non-performing loans over total loans. The study reported a positive effect of concentration, measured with HHI, Shannon entropy and absolute and a relative distance measure, on banks' performance. In addition, the HHI and Shannon Entropy had a negative influence on banks' loan portfolio credit risk. This implied that loan portfolio diversification not only eroded a banks' financial performance but also exposed it to more risk.

Using bank level data and fixed effects regression, Simpasa and Pla (2016) investigated the effect of credit concentration on credit risk in Zambia. Bank concentration was measured using the Herfindahl-Hirschman index while credit risk was measured using the logarithm of non-performing loans. Similar to Jahn *et al.*, (*op. cit.*), the study reported an inverse relationship between banks' credit concentration and risk suggesting that banks with more concentrated credit

portfolios tend to have lower credit risk. This implies that portfolio diversification doesn't benefit the banks monitoring effectiveness and therefore risk.

In Italy, Acharya *et al.*, (2006) empirically examined the impact of loan portfolio concentration versus diversification on performance indicators of Italian banks using the Herfindahl-Hirschman Index (HHI) as a measure of loan portfolio concentration across different industries and sectors. The study reported that diversification per se is no guarantee of superior performance or greater bank safety and soundness. Industrial or sectoral diversification either did not affect or marginally increased return and increased credit risk for banks with a moderate downside risk in the loan portfolio, whereas banks with a high credit risk in their loan portfolio experienced decreased bank performance through diversification.

Using bank level panel data in Tunisia, Belguith and Bellouma (2017) investigated the impact of loan portfolio diversification on bank profitability on a sample of ten largest banks over the period 2000-2015. In their research, profitability was measured using ROA, ROE and risk adjusted ROA and ROE while loan portfolio diversification was measured using the traditional concentration measure HHI. Using a static random effect panel data model they reported that loan portfolio concentration seemed to improve Tunisian bank profitability. As such, loan portfolio diversification had a downward effect on bank profitability.

Proponents of diversifications cite managerial and cost efficiency benefits arising from diversification. For Instance, in Kenya, Maubi and Jagongo (2014) investigated the relationship between corporate loan diversification and credit risk management among commercial banks using primary data and a cross sectional survey method. Diversification was assessed from three fronts: geographical, industry and borrower size. The study reported no association between geographical diversification and credit risk management but found a positive and negative association between industry diversification and size diversification and credit risk management respectively. This implied that industry oriented credit diversification improve the firms credit risk management and therefore monitoring effectiveness.

In Pakistan, Afzal and Mirza (2012) investigated the relationship between size, diversification and risk using unbalanced panel data from 21 listed commercial banks for the period 2004 to 2009. They measured sectoral credit diversification using the Herfindahl index why size was proxy by the amount of total advances. They estimated bank risk using asset quality measured by non-performing loans

ratio, the value at risk and the default likely indicator. The study found out that larger banks were more diversified than small banks especially because of their outreach and size of credit portfolio. However, the study didn't discover a significant relationship between accounting based measures of risk and diversification. However, market based measures of value at risk (VaR) and Default indicator were significantly related to diversification. As such Afzal and Mirza (*op. cit.*) concluded that though firms did not find any incentives in credit diversification, the market participants considered diversification as a relevant tool for risk management.

From, the foregoing discussion, it is evident that bank credit portfolio diversification has elicited both support in literature and disapproval in equal measure, despite the endorsements of the practice by intermediation theories. This literature divergence, first with itself and secondly with theoretical prescriptions, provokes two questions which this study seeks to answer. First, what is the effect of sectoral credit diversification on a banking industry financial performance? Secondly, how does sectorial credit diversification affect banking industry monitoring effectiveness?

1.1 East African Banking Industry

The East African Community consists of Kenya, Uganda, Rwanda, Tanzania and Burundi (EAC, 2017) and the commercial banking industry in the block is quite vibrant and expansive. The Kenyan banking industry is the largest in the block and the fourth largest in Sub Saharan Africa after South Africa, Nigeria and Mauritius with 43 commercial banks (EAC, *op. cit.*). The other countries have: Tanzania (26), Uganda (21), Rwanda (8) and Burundi (7) commercial banks respectively. Additionally, multinational banks have also set up operations in the East African community (African Business Magazine, 2011). Cross border expansion of the banks was started in the year 2000 by Kenyan banks followed shortly by Tanzanian CRDB in 2012. This expansion has been augmented by an expansion in volume of cross-border financial deals (African Business Magazine, *loc. cit.*). To promote member banks' interests, the commercial banks in the various countries have established national umbrella bodies, commonly known as Bankers' Associations, which among other things endeavor to promote a reputable and professional banking sector. Among the four countries (Kenya, Uganda, Rwanda and Tanzania) covered in this, Kenya has the largest banking sector by asset base followed by Tanzania, with Rwanda having the smallest sector while in terms of the total loans and advances made relative to the total assets, Kenya had the highest ratio, followed by Rwanda, Tanzania and then Uganda (EY, 2014). In

terms of profitability, Kenya's banking industry is the most profitable among the four followed by Uganda, Tanzania and then Rwanda. Ernst & Young (EY, *op. cit.*) attribute this to Kenyan banks ability to deploy a greater proportion of their assets to lending thus lowering their expense to income ratio coupled with the economies of scale benefits arising from the large sector size. In terms of asset quality, Kenya had on average a lower ratio of nonperforming loans to gross loans followed by Uganda and Tanzania with Rwanda having the highest ratio which points to Rwanda's weaker monitoring effectiveness compared to the other countries.

2. Theoretical Perspectives of Credit Diversification

This study will be informed by Diamond's 1984 financial intermediation and delegated monitoring theory. Diamond developed a theory of financial intermediation based on minimum cost production of information useful for resolving incentive problems whereby banks share gross cost advantages in collecting information. The theory envisioned two types of diversification; diversification by increasing the number of agents in the intermediary (sharing risks) and diversification by increasing the number of projects carried out by one intermediary (adding risk). The former approach works because each independent risk is shared by different number of agents while the latter is what Samuelson (cited in Diamond, 1984) calls the "fallacy of large numbers", but addition of independent risks reduces the per-entrepreneur risk and the fallacy of large numbers stops being a fallacy. However, the financial intermediary envisioned by Diamond is a pure asset transformer whereby the only diversification possible is that of adding independent identically distributed projects by one agent or what he called diversification within the intermediary. This reduces the per-entrepreneur cost of intermediation since for all projects with less than perfect correlation; the delegation cost for N projects monitored by a single intermediary would be less than the sum of delegation costs for monitoring proper subsets of them by several intermediaries through sharing risks.

Diamond (*op. cit.*) approaches diversification from a cost reduction perspective and recommends the latter approach by arguing that diversification within the intermediary would be key to possible net cost advantages due to the strong similarities between an intermediary and its depositors. As such, intermediation would be potentially viable where the delegation costs (equal to the risk premium)

is reduced by the centralization of monitoring to a single intermediary with several projects. The financial intermediation and delegated monitoring approach explains bank diversification both in the context of risk and that of risk neutrality. In the risk neutral model, the reasoning behind diversification is that diversification increase the probability that the intermediary has sufficient loan proceeds to repay a fixed debt claim to depositors thus reducing the probability of bankruptcy. In the risk aversion model, on the other hand, diversification increases the financial institutions risk tolerance toward each loan, allowing the risk bearing necessary for incentive purposes to be less costly.

The delegated monitoring model predicts a well-diversified financial intermediary with capital structure consisting mainly of debt, arising from deposits, but a low probability for default despite the high leverage. The theory also identifies a number of conditions for a financial intermediary to be viable. First, depositors must receive an expected return of R per unit deposit; secondly, financial institutions must receive an expected return net of monitoring costs and deadweight penalties incurred which is at least zero; and lastly, each entrepreneur must retain an expected return at least as high as he would by contracting directly with depositors. The third is a necessary condition for bank diversification because if diversification does not reduce the transaction costs of monitoring to a level lower than the depositors can obtain by transacting directly with the borrowers, the bank would not be able to pay interest to depositors and retain an expected return net of monitoring costs and therefore the depositors would be better off contracting directly with borrowers.

The theory explains the benefits of bank diversification by bringing out the cost benefits accruing to a diversified intermediary and the monitoring efficiency attained by adding risks. By increasing the risk tolerance of banks, diversification reduces the delegated monitoring cost beyond what borrowers can achieve on their own and banks are able to earn a return beyond what is payable to the fund suppliers (depositors) while at the same time reducing its probability of bankruptcy through enhanced monitoring effectiveness. Based on this theory, the study proposes the following two hypotheses:

H₀1: Sectoral credit diversification improves banking industry financial performance

H₀2: Sectorial credit diversifications enhances banking industry monitoring effectiveness

3. Data and Methodology

Loan portfolio diversification or concentration can be measured in a number of ways; the most notably and widely used being the Herfindahl-Hirschman Index (Mulwa and Kosgei, 2016; Jahn *et al.*, 2013; Chen *et al.*, 2013; Skridulyte and Freitakas, 2012) and the Shannon Entropy (Jahn *et al.*, 2013; Tabak *et al.*, 2011; Kamp *et al.*, 2005). To measure credit diversification, Herfindahl-Hirschman index (HHI) is constructed following Jahn *et al.*, (2013). A review of bank data across the four east African countries revealed eleven sectors in Kenya, nine in Uganda, eighteen in Tanzania and ten sectors in Rwanda across which commercial banks are expected to diversify their credits. Denoting the total amounts lend by a bank to each of the sectors as L_i , for $i=1, 2, \dots, n$, then credit diversification was be measured as;

$$DIV = 1 - \sum_{i=1}^n \left[\frac{L_i}{Q} \right]^2 ; \text{ where } Q = \sum_{j=1}^n L_j$$

By definition, the DIV ranges from [0] when all loans are given to one sector to $\left[1 - \frac{1}{n}\right]$ when all the n sectors receive the same amount of loans. Higher values of the index point to more diversification while lower values point to concentration (Jahn *et al.*, *op. cit.*). Financial performance will be measured using Returns on assets (ROA) which is an accounting ratio of operating income to total assets (Ongore and Kusa, 2013; Turkmen and Yigit, 2012; Al-Smadi, 2011; Saksonova and Solvjova, 2011). Accounting methods based on the use of financial ratios have generally been used in assessing bank performance in most diversification studies (Li and Qiann, 2005; Ncube, 2009; Pan and Tsai, 2012; Mulwa and Kosgei, 2016). Bank monitoring effectiveness (ME) will be assessed based on a bank's asset quality and will be measured following Gwon (2011) and Saksonova and Solovjova (*op. cit.*), as the ratio of gross non-performing loans (NPL) to the total value of loan portfolio. According to Chen *et al.*, (2013), non-performing loans is an *ex post* measure of the banks actual losses from lending activities and can only be observed at some point in time after the loans were made. Therefore the measure of monitoring effectiveness will be lagged once to reflect this situation.

$$AQ_{t+1}[\%] = \frac{NPL}{Total\ Loans}$$

Secondary panel data was obtained for all the variables from the Bank Supervision reports of the central banks in four EAC countries for eight firm years from 2008 to 2015 giving a total of 32 observations. The East African Community (EAC) has five countries, namely, Kenya, Uganda, Rwanda, Tanzania and Burundi (EAC, 2017). However Burundi was dropped from this study because its banking data and supervision were expressed in French. Table 1 present summary statistics of the data while table 2 present correlations among variables.

Table 1: Descriptive Statistics of Variables

	ROA (%)	AQ_{t+1} (%)	DIV_{CR}
Mean	3.002	6.626	0.821
Median	2.700	6.600	0.837
Maximum	4.700	13.100	0.872
Minimum	0.740	2.100	0.733
Std. Dev.	0.980	2.403	0.044
Jarque-Bera	0.434	2.177	6.042
Probability	0.805	0.338	0.049
Observations	32	32	32

Source: Research data (2017)

As shown in table 1, ROA had a mean value of 3.002 percent while the banking industries had a low mean asset quality of 6.626 percent which point to a high level of monitoring effectiveness across the industries. On average, the banking industries across the EAC countries were highly diversified in credit portfolios with mean HHI of 0.821.

Table 2: Correlation Coefficients

	[1]	[2]	[3]
[1] ROA (%)	1		
[2] AQ _{t+1} (%)	-.442*	1	
[3] DIV _{CR}	.508**	-.258	1

*. Correlation is significant at the 0.05 level (2-tailed)

** . Correlation is significant at the 0.01 level (2-tailed)

Source: Research data (2017)

As shown in table 2, asset quality had a negative and significant correlation with ROA implying that the higher a bank's non-performing loans were – and therefore the less effective a bank is in monitoring its credit portfolios – the lesser would be its returns on assets invested. However, diversification was positively correlated

with ROA pointing to the potential diversification premium on a bank's financial performance. This correlation was highly significant. Figures 1 to 4 present the trend plots for the variables across the various countries banking industries.

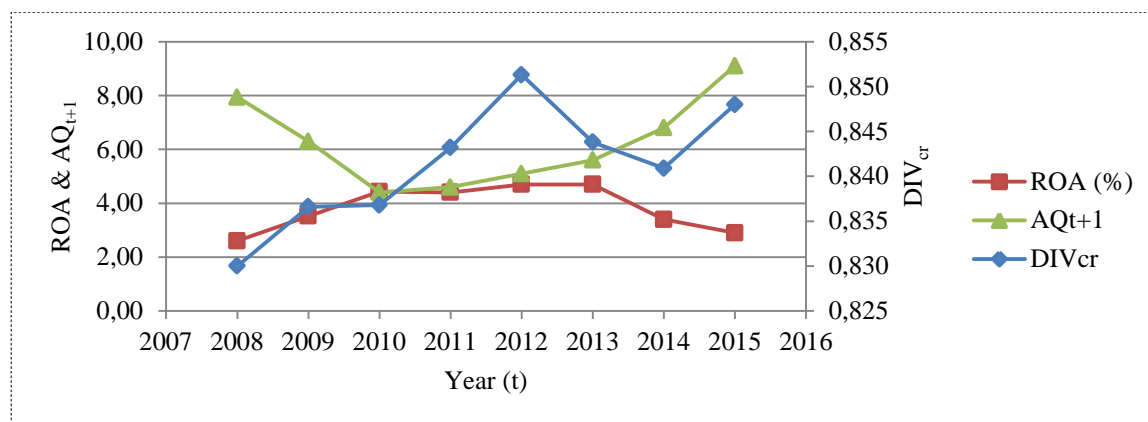


Figure 1: Variable trends for Kenya banking industry
Source: Research data (2017)

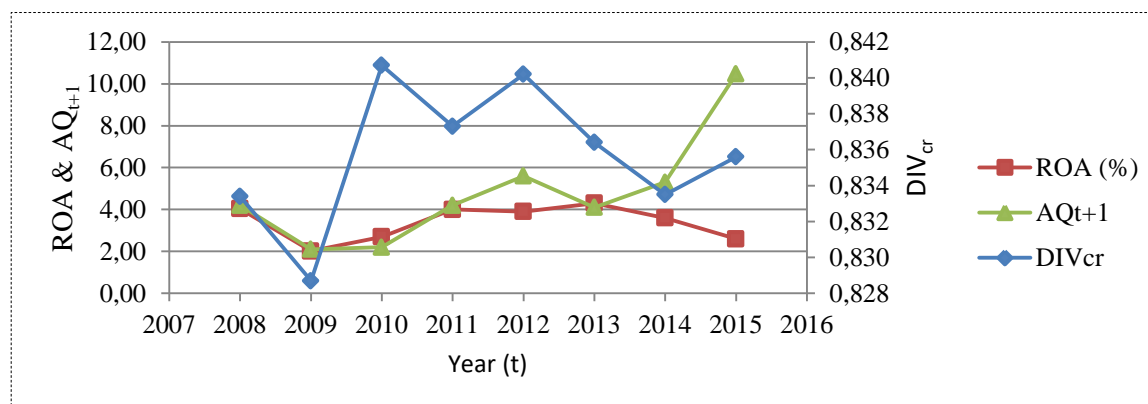


Figure 2: Trend plots for Uganda banking industry
Source: Research data (2017)

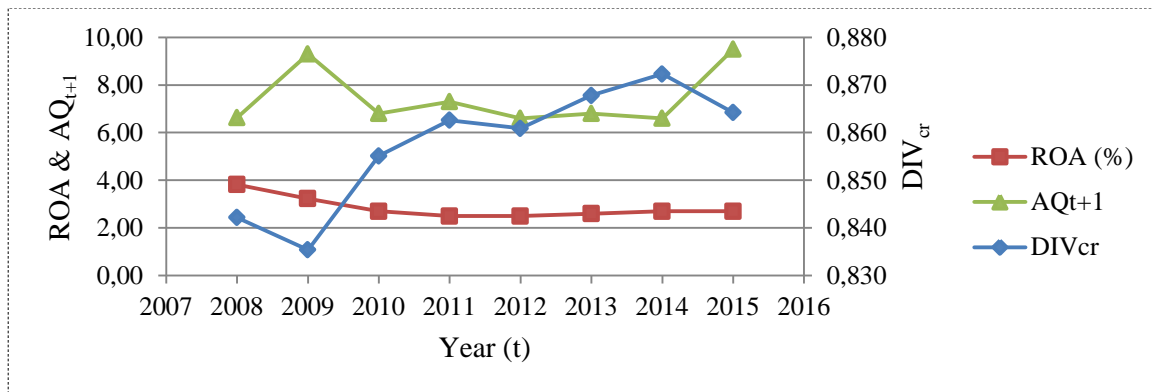


Figure 3: Variable trends for Tanzania banking industry
Source: Research data (2017)

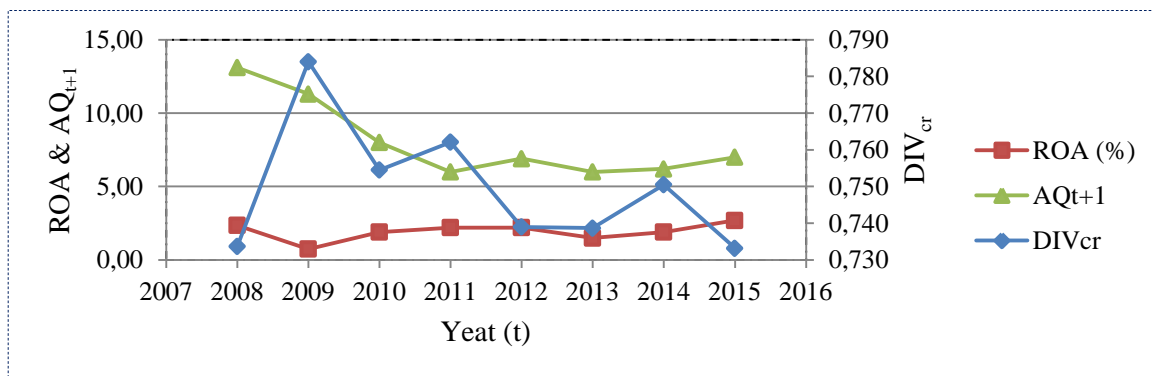


Figure 4: Variable trends for Rwanda banking
Source: Research data (2017)

As shown by the Jarque-Bera statistics in table 1, all the variables except Diversification (DIV) were normally distributed. This can also be confirmed by Shapiro-Wilk normality test statistics in table 3 where the p-value for the statistic corresponding to DIV_{CR} is less than the critical value and therefore pointing to non-normal distribution. In this regard, generalized linear models (GLM) are preferred in this study because of their ability to allow for response variables that have non-normal distributions (Czado, 2004). Instead, GLM allow an arbitrary link function of the response variable to vary linearly with the predicted values (Garrido and Zhou, 2006: 2009). Consequently, to attain the objectives of the study, the following GLM model is approximated for each of the two response variables.

$$\eta_{i,t} = \beta_0 + \beta_1 DIV_{i,t} + \varepsilon_{i,t}$$

Where $\eta_{i,t}$ is a linear predictor determining the expected value of response variable ROA or AQ, $DIV_{i,t}$ is sectoral credit diversification for country i at time t and $\varepsilon_{i,t}$ is the random error term.

Table 3: Shapiro-Wilk Test of Normality

Variable	Statistic	df.	Sig.
Credit Diversification	0.787	32	.000
Return on Assets (%)	0.960	32	.279
Asset Quality _{t+1}	0.959	32	.257

Source: Research data (2017)

4. Results

The objective of this paper were to investigate, first the effect of sectorial credit diversification on bank financial performance and second, the sectorial credit diversification effects on bank monitoring effectiveness. To achieve these objectives, sectoral credit diversification was regressed against financial performance indicator and asset quality as a proxy of bank monitoring effectiveness using a GLM model at 5 percent significance level. As shown in table 4 and 5, all the coefficients in the models were collectively significant since the value of the LR statistic is significant in both models (p -value<0.05). The results are presented in the following section.

4.1 Effect of Sectorial Credit Diversification on Bank Financial Performance

To determine the effect of sectoral credit diversification in the financial performance of east African banking industries, the study was guided by the hypothesis that: Sectoral credit diversification does not improve banking industry financial performance. Based on the regression results (table 4), this hypothesis was rejected ($\beta=11.32803$, p -value=0.0000). This implies that sectoral credit diversification improved the bank's financial performance across the east African banking industries. These findings concur with the theoretical prescriptions by Diamond (1984) that diversification reduced the intermediary delegated monitoring costs and therefore the intermediary is able to earn a return beyond what is payable to the fund suppliers. However, the findings contradict the findings by amongst others, Chen *et al.*, (2013 & 2014), Turkmen and Yigit (2012), Raei *et al.*, (2016), Fazio and Cajueiro (2011), Chen and Lin (2010) and Belguith and Bellouma (2017) who reported a sectoral credit diversification discount on bank financial performance.

Table 4: Regression model results for financial performance

Dependent Variable: Return on Assets (ROA)
Method: Generalized Linear Model (Quadratic Hill Climbing)
Sample: 2008 2015
Included observations: 32
Family: Normal
Link: Identity

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Credit Diversification	11.32803	2.788428	4.062514	0.0000
Constant	-6.298646	2.250275	-2.799056	0.0051
Mean dependent variable	3.001875	S.D. dependent variable		0.979626
Sum squared residual	22.00400	Log likelihood		-39.44647
LR statistic	10.56037	Prob.(LR statistic)		0.001155

Source: Research Data (2017)

4.2 Sectorial Credit Diversification effects on Banking Industry Monitoring Effectiveness

To test the hypothesis that sectoral credit diversification didn't affect monitoring effectiveness in banking industry, the diversification indicator (HHI) was regressed against a lagged value of asset quality as a measure of monitoring effectiveness. The results are presented in table 5. The regression results indicated that sectoral credit diversification had a negative and significant effect on banking industry asset quality ($\beta=-17.28129$, $p\text{-value}=0.0411$) and therefore the hypothesis was rejected. The negative coefficient implies that a higher diversification score translated to a lower asset quality. However, low asset quality, which is indicative of lower non-performing loans point to a more efficient bank monitoring effectiveness, and this therefore, means that sectoral credit diversification improved the monitoring effectiveness of banking industries in East Africa. These results concur with the theoretical perspectives of Diamond (1984; 1991) that in diversifying loans an intermediary's risk tolerance is increased, monitoring costs are reduced and a great deal of customer information is acquired in the process, which can be used in efficiently screening and monitoring borrowers thereby enhancing the bank's monitoring capabilities. Similar results were reported by Chen et al., (2013; 2014) in china that sectoral diversification reduced absolute non-performing loans and Chen and Lin (2010) in Taiwan that credit diversification improved the NPL ratio and therefore reduced a bank's risk.

Table 5: Regression model results for monitoring effectiveness

Dependent Variable: Asset Quality (AQ_{t+1})
Method: Generalized Linear Model (Quadratic Hill Climbing)
Sample: 2008 2015
Included observations: 32
Family: Normal
Link: Identity

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Credit Diversification	-17.28129	8.462279	-2.042155	0.0411
Constant	20.48732	6.957404	2.944679	0.0032
Mean dependent variable	6.299063	S.D. dependent variable		2.182766
Sum squared residual	129.6723	Log likelihood		-67.82704
LR statistic	4.170398	Prob.(LR statistic)		0.041136

Source: Research Data (2017)

5. Conclusions

This paper investigated whether sectoral credit diversification presented a premium or discount on banking industry financial performance and monitoring effectiveness. On financial performance, the paper finds a positive and significant effect of sectoral credit diversification on banking industry returns on assets. The findings concur with the theoretical prescriptions of Diamond (1984) in Financial Intermediation and Delegated Monitoring theory that through diversification an intermediary is able to earn a return beyond what is payable to the fund suppliers. This is attributed to the reduction in monitoring costs by adding less than perfectly correlated sector risks by a single intermediary through diversification which reduces the total delegation costs below what would be possible if the risks were monitored by several intermediaries through sharing risks. On whether sectoral credit diversification enhances a banking industry monitoring effectiveness, I find a significant negative relationship between diversification and asset quality. This shows that sectoral credit diversification improve the monitoring effectiveness of banking industries in East Africa. The results confirm the theoretical perspectives of Diamond (1984; 1991) that in diversifying loans an intermediary's risk tolerance is increased, monitoring costs are reduced and a great deal of customer information is acquired in the process, which can be used in efficiently screening and monitoring borrowers thereby enhancing the bank's monitoring capabilities. Based on these findings, this paper recommends a diversified loan portfolio where intermediaries distribute their credit offerings across various economic sectors.

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