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Risk-taking behavior, competition, diversification and performance of frontier and emerging economy banks

Nicholas Addai Boamah, Augustine Boakye-Dankwa and Emmanuel Opoku
Accounting and Finance, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

Abstract

Purpose – The study examines the dynamic association between competition, risk-taking, performance and income diversification of frontier and emerging economy (FEE) banks. It additionally, explores the effect of banking sector depth and economic performance on the level of competition, performance and risk-taking behavior of banks in these economies.

Design/methodology/approach – The paper adopts a panel vector auto-regressive technique and collects data across ninety (90) FEEs.

Findings – The paper finds that competition increases with improvement in the depth of the banking sector, a surge in risk-taking behavior and the adoption of focused strategy by banks. Similarly, income diversification activities are driven by competition, banking sector depth, the state of the economy and bank performance. Additionally, risk-taking behavior, banking sector depth and the state of the economy are relevant in describing bank performance. Also, risk-taking behavior is influenced by bank performance, banking sector depth and economic growth.

Originality/value – The evidence indicates that although competition improves banking sector health, excessive competition and non-competitive banking environment constrain banks' performance and stability.

Keywords Income diversification, Emerging markets, Bank stability, Moral hazard, Banks intermediation

Paper type Research paper

1. Introduction

The study examines the relationship among risk exposure, competition, diversification and the performance of frontier and emerging economies (FEEs) banks. Banking sector performance is essential for the economic growth of nations. Bank growth and effective banking system drive improvements in an economy (Barth *et al.*, 2004; Morshirian and Wu, 2012; Koivu, 2012; Rahman *et al.*, 2015; Tan, 2018) and influence money market development substantially (Akter *et al.*, 2019). An efficient intermediation by banks and enhanced banks performance thus result in efficient resource allocation to the productive sectors of an economy, productivity improvements and enhancement in social well-being.

Banks' ability to efficiently allocate resources may be influenced by competition, risk-taking incentives and income diversification activities. These factors have implications for systemic risk and efficient resource allocation. They impact on the intermediation effectiveness and performance of banks (García-Herrero *et al.*, 2009; Rahman *et al.*, 2015;

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Merin, 2016). In sum, excessive risk-taking and extreme competition may render banks less profitable and raise the likelihood of bank failure (Campbell, 2007; Majumder and Uddin, 2017; Akter *et al.*, 2018). On the other hand, minimal competition and risk aversion may be harmful to bank survival. That is, whereas risk-taking is essential for improved bank performance, excessive risk-taking however may threaten bank survival and soundness.

Banking sector competition may improve bank's performance, enhance efficiency and provide social welfare gains to an economy. That is, the extent of competition and the efficiency of the banking system affect the success of bank's intermediation function and its associated social welfare gains. As Bikker (2010) and Mlambo and Ncube (2011) suggest, healthy competition minimizes monopoly and inefficiency. That is, whilst competition is necessary for bank growth and stability, excessive competition could undermine banks solvency.

Despite the importance of the banking system to economic growth, very little is known about the relationship among risk-taking incentives, competition, diversification and the performance of frontier and emerging markets banks. The interactions among these factors have implications for the soundness, stability and the success of the intermediation role of FEE banks. Risk-taking and competition for instance, influence efficient resource allocation by banks. Exploring the dynamic relationship among these factors in FEE context will go a long way in enhancing our understanding of these uniquely characterized banks and their diversification opportunities for global investors. This may improve the flow of global capital to FEEs and also, promote the efficiency and performance of their banking sectors. For instance, the inflow of global capital may reduce intermediation cost and increase competition (Clarke *et al.*, 2001); expand the funding opportunities available to firms (Kasman and Carvallo, 2014; Zhao *et al.*, 2010); and strengthen shareholder rights and market discipline (Schaeck and Cihak, 2012).These may lead to efficient resource allocation and economic progress.

The evidence on the relationship amongst diversification, competition, risk-taking and the performance of FEE banks is limited and inconclusive. For example, whereas Petria *et al.* (2015) observe a positive influence of competition on performance, Tan and Floros (2014) find a negative relationship among them. Additionally, Tan (2016), Tan and Floros (2012) and Garcia-Herrero *et al.* (2009) observe an insignificant influence of competition on bank performance. Similarly, Brissimis *et al.* (2008) find a positive association between bank risks and its performance although, Majumder and Uddin (2017) and Majumder and Li (2018) observe a negative relationship among them. Thus, the debate on the dynamic engagement between these factors remains unsettled. Additionally, there is paucity of evidence on the relationship among risk-taking, diversification and competition.

The present study therefore builds on the few prior studies (see e.g. Scott and Dunkelberg, 2010; Anginer *et al.*, 2014; Tan, 2016) and examines the dynamic relationship among risk-taking, competition, risk diversification and the performance of banks in ninety (90) FEEs. The extended data improve the efficiency of this study's estimates. In addition, the results may be applicable to a wide range of frontier and emerging markets. The findings of studies that focus on a single country or few countries (see e.g. Goddard *et al.*, 2004; Akter *et al.*, 2018, 2019) may not be applicable to a larger FEEs context. The extended cross-country data may contribute in resolving the disparity in existing evidence. In addition, the study contributes to the FEEs banking literature. The evidence is relevant to frontier and emerging markets policy makers and banking practitioners.

The study provides evidence that banking sector depth, risk-taking behavior of banks and economic growth describe competition. In addition, bank performance is driven by banking sector depth, risk-taking incentives and the state of the economy. Also, the growth in banking sector depth, banks performance and economic growth affect the risk-taking behavior of banks. Additionally, diversification decreases as competition, profitability and banking

sector depth increase, but increases with inflation growth. In addition, focused strategy is more beneficial than diversification strategy. The findings show that competition, risk-taking behavior and banking sector depth Granger cause bank performance; risk-taking and banking sector depth cause competition; and performance, competition, banking sector depth and risk-taking cause diversification.

The remainder of the paper is structured as follows. Section 2 reviews the extant literature. The discussion of methodology and data are presented in sections 3 and 4, respectively. The empirical evidence is discussed in section 5, whereas conclusions are presented in section 6.

2. The related literature

Gupta and Moudud-Ul-Huq (2020) investigate the dynamic association between income diversification, competition and risk-taking among BRICS banks. By employing a two-step system generalized methods of moments (2GMM), they note a positive relationship between competition and risk-taking behavior. Additionally, they find that income diversification influences the risk-taking behavior of banks negatively. The authors observe a non-linear association between competition, revenue diversification and bank risk-taking incentives. Similarly, González *et al.* (2017) explore the relationship between competition and bank stability for Middle East and North Africa (MENA) banks. González *et al.* measure competition by the Herfindhal index and the *H*-statistic (HST) and apply a dynamic panel model in a generalized method of moments (GMM) estimation framework. They observe a U-shaped relationship between competition and risk-taking behavior of banks in the MENA countries.

Recently, Saif-Alyousfi *et al.* (2020) examine the impact of competition and concentration on the risk-taking behavior and stability of banks in Gulf Cooperation Council (GCC) countries. By using a dynamic panel model and a GMM estimation technique, they observe that rising competition and concentration lead to financial fragility. Additionally, declining competition and asset concentration promote risk-taking among less capitalized, less liquid and small banks which may raise banking sector fragility. In a related study, Maji and Hazarika (2018) adopt the HST, Herfindahl-Hirschman index and concentration ratio as proxies for competition. Using a three-stage least squares (3SLS) framework, they find that the effect of competition on risk-taking and stability is respectively positive and negative. Recently, Sarkar and Sensarma (2016) argue that asset concentration reduces credit, market and asset risks although, it worsens capital and liquidity risks of Indian banks. Their findings imply that appropriate level of competition is desired for bank success.

Tan (2016) employs the Lerner index and Herfindahl-Hirschman index as surrogates for competition. Adopting a one-step GMM system estimator, Tan notes an insignificant influence of competition and risk on bank performance. The author attributes this to significant State intervention in the Chinese banking sector via capital injections. Tan's evidence suggests that State interventions could undermine competition in the banking system, thereby protecting inefficient institutions. This may create moral hazard problems and encourage excessive risk-taking. In a related study, Scott and Dunkelberg (2010) explore the effect of competition on the risk and performance of banks. Relying on a survey of small business owners, they find that concentrated markets are less competitive. Additionally, they note a positive relationship between competition and banking experience of customers. Also, increased competition enhances credit and non-credit ratings of banks. That is, competition minimizes the level of risk in the banking system. Similarly, Akter *et al.* (2018) investigate the effect of bank risk-taking and capital regulation on performance using a two-step system GMM estimator. They argue that excessive risk-taking impacts negatively on profitability.

Recently, Schaeck and Cihák (2014) using the Boone indicator as a measure of competition and a two-step GMM technique, observe a positive and negative effects of competition on

risk-taking and profitability, respectively. Their evidence shows that competition enhances bank stability, however, it affects the stability of stronger banks more than weaker ones. The authors argue that competition affects risk-taking incentives, performance and banks stability via the efficiency channel. Their findings suggest that competition is good for the health of banks and the entire banking system although it may be less beneficial to fragile banks. Schaeck and Cihák's (2014) finding is in agreement with Sarkar and Sensarma's (2016) evidence.

Tabak *et al.* (2012) examine the effect of competition on the risk-taking behavior of Latin American banks. They show that competition affects risk-taking behavior in a non-linear way. Their evidence indicates that competition minimizes risk-taking and in essence, enhances financial stability. Additionally, limited competition encourages risk-taking and undermines financial stability. They argue that bank size and capitalization may explain the non-linear relationship between competition and risk-taking. Similarly, Jiménez *et al.* (2013) investigate the effect of competition on banks' risk-taking incentives in the Spanish banking sector. They observe a non-linear relationship between market concentration and risk-taking in the deposits and loans market. They find support for the franchise value hypothesis in the loans market. In a related study, Soedarmono *et al.* (2013) observe that the risk-taking tendencies of Asian banks decrease with increasing market competition. This they observe, result in declining loan losses and stable banking system. Corroborating, Fiordelisi and Mare (2014) find that European cooperative banks assume more risk in less competitive markets.

Anginer *et al.* (2014) employ a co-dependence technique to examine the correlations in the risk-taking incentives of banks. By adopting various measures of competition including the Lerner index and the HST, they find a negative association between bank competition and systemic risk. Also, rising competition leads to risk diversification and improves the soundness of the banking system. In addition, weak supervision and private monitoring, government ownership of banks and anti-competitive public policies lead to correlated risk-taking and undermine the soundness of the banking system. The authors argue that efficient public and private monitoring of banks lessens the negative effect of limited competition on banking sector fragility.

In a study of the Barbadian banking system, Craigwell and Maxwell (2006) investigate the effect of income diversification on bank performance. The authors suggest that Barbadian banks have less diversified income. Additionally, diversification improves banks performance and raises earnings volatility. Their findings suggest that participation restrictions and limited technology adaptation lead to lower levels of diversification. Quite recently, Berger *et al.* (2010) examine the effect of focus and diversification strategies on banks' performance. They argue that diversification leads to reduced performance. The authors suggest that foreign participation and links with conglomerates moderate the relationship between diversification, profitability and costs. Additionally, diversification discounts are partly the outcome of limited managerial expertise or ineffective incentive packages for managers. Recently, Ghosh (2014), by employing 3SLS estimation, suggests that lesser degree of income diversification is associated with higher risk levels.

The evidence from the literature suggests a dynamic engagement between bank competition, efficiency, risk-taking, diversification and performance. This may be explained by theories such as the market power theory (MPT) and the efficient structure theory (EST). The MPT posits a connection between market power, product diversification and bank performance. The theory suggests that market power or lesser degree of competition leads to higher profit margins. For instance, the structure-conduct-performance hypothesis (SCPH) of the MPT argues that concentration enables banks to collusively set higher prices and consequently earn supernormal profits. The SCPH suggests that market structure influences bank behavior and consequently performance. The relative-market power hypothesis (RMPH) of the MPT, however, argues that banks with larger market share and diversified

products acquire significant market power which enables them to influence prices and profitability. The MPT thus suggests interactions among competition, bank size, diversification and performance.

Similarly, the EST, proposed by Demsetz (1973) and extended by Berger (1995) to the *X*-efficiency and scale-efficiency hypotheses, sheds insights into the nexus between bank efficiency, competition and performance. The theory suggests that higher levels of cost and/or scale efficiency improves banks' performance and leads to larger market share and higher concentration. The *X*-efficiency hypothesis argues that management quality and enhanced practices deliver cost savings gains and consequently improve bank performance. The scale-efficiency hypothesis, on the other hand, links better bank performance to improved scale of operation and its associated cost reduction gains.

In sum, the market power (MPT) and the efficient structure (EST) theories point to a dynamic interaction between bank efficiency, risk-taking, competition, diversification and performance. The nature of the interaction between these variables may not be straightforward. As the theories imply, less competition may lead to higher profits due to collusive behavior of banks. On the other side, higher competition may improve efficiency and minimizes risk-taking thereby exerting positive effect on bank performance.

3. Methodology

The study adopts Equation (1), a panel-vector autoregressive (panel-VAR) model to examine the relationship among competition, performance, risk-taking and diversification of frontier and emerging markets banks. Equation (1) incorporates the growth in banking sector depth (DBAG), growth in gross domestic product (GDPG) and growth in average consumer price index (CPIG) as control variables. A panel-VAR specification is appropriate as it models the variables as an evolutionary process of the prior period's values, lagged values of other variables in the system and an error term. Thus, the panel-VAR technique helps in capturing both dynamic and static interdependencies, deals with potential endogeneity problems and ensures estimation efficiency by fitting the models as a system of equation (see e.g. Holtz-Eakin *et al.*, 1988; Canova and Cicarelli, 2013). Although, a GMM approach likewise deals with endogeneity and unobserved heterogeneity problems, we prefer panel-VAR due to its efficiency gains.

$$\sum_{k=1}^{n} Y_{i,t}^{k} = \sum_{k=1}^{n} \alpha_{k} + \sum_{k=1}^{n} \sum_{j=1}^{v} \beta_{k,j} Y_{i,t-j}^{k} + \varepsilon_{i,t}^{k} \tag{1}$$

$$\alpha = intercept, \varepsilon = error\ term.$$

$Y = N \times T$ *matrix* consisting of return on assets (ROA), provision for non-performing loans (PNPLs) or non-performing loans ratio (NPL), top five (5) banks asset concentration (COM) or the HST, growth in banking sector depth (DBAG), growth in gross domestic product (GDPG), growth in average consumer price index (CPIG) and diversification (NII). The superscript k and subscripts i and j respectively represent the variables (elements of Y), country and the lag length.

Our proxies for competition, performance and diversification are respectively the HST or top five (5) banks asset concentration (COM), the ROA or net interest margin (NIM) and banks non-interest income to total income (NII). We measure banking sector depth by the growth in deposit money banks assets to GDP (DBAG), risk-taking by the non-performing loans ratio (NPL) or the provisions for non-performing loans (PNPL). We follow prior studies such as Liu *et al.* (2012), Sarkar and Sensarma (2016), Zheng *et al.* (2017) and Li (2019) and measure competition by the HST. This measure of competition is appropriate as it measures the elasticity of bank interest revenues to input prices (Danisman, 2018), relies on bank-level data

to measure competition (Liu *et al.*, 2012) and permits comparison across banks of different size and specializations (Claessens and Laeven, 2004). We adopt COM as an alternative measure of competition since asset concentration signals market power. Thus, the concentration of assets in fewer banks implies significant market power by those banks and therefore, minimal level of competition in the banking sector. In addition, we incorporate a one year lag of the endogenous variables in Equation (1). A lag length of more than a year may be less meaningful in describing the time series and cross-sectional variations in the dependent variables. For instance, banking sector competition, risk-taking or growth in inflation at time *t-2* and beyond may not appropriately describe the variability in diversification or performance at time *t*. A longer lag length may introduce noise in system. A one year lag length appears most appropriate for the nature of the variables under study.

4. Data and descriptive statistics

The study collects banking sector data across ninety (90) FEEs over the period 2000 to 2015. It relies on a balanced panel data which consist of 90 cross-sections and 15 yearly observations for each country. Data on the top five banks asset to total banks asset (COM), domestic bank assets to GDP (DBA), non-performing loans to gross loans (NPL), PNPLs, non-interest income (NII), ROA after tax, NIM and HST are obtained from the Global Financial Development Database [1]. We collected data on consumer price index average prices (CPI) and GDP growth from the World Development Indicators database.

The descriptive statistics of the data are presented in Table 1. The average/standard deviations of the ROA and NIM are 2%/0.023 and 5%/0.029, respectively. Additionally, the average NPL and PNPL of FEE banks are 5.7 and 53.2% respectively. This appears to be inconsistent with Boateng (2019). The average largest five banks asset concentration ratio (70.3%) suggests minimal competition among FEE banks as these large banks may have monopoly power. Also, Table 1 shows that banks in FEEs generally show a higher degree of income diversification with an average NII of 35%. The skewness and kurtosis show that the variables are generally non-normally distributed.

Table 2 presents the correlation matrix of the studied variables. The table indicates a negative correlation between ROA and NPL/PNPL. This suggests that bank profitability decreases as risk-taking incentives increase. Also, the positive correlation between NIM and PNPL/NPL (Table 2) shows improvement in interest income as risk-taking incentives increase. In addition, there exists a positive correlation between NPL and NII and a negative correlation between NII and PNPL. This evidence may imply that banks diversify their income as loan losses increase. That is, FEE banks largely focus on interest income. These banks however diversify when significant losses are incurred in the loans market.

	Mean	Standard deviation	Skewness	Kurtosis
Return on assets after tax (ROA)	0.020	0.023	−1.313	32.234
Net interest margin (NIM)	0.056	0.029	1.988	15.981
Provision for non-performing loans (PNPL)	0.532	0.559	1.821	11.962
Non-performing loans (NPL)	0.057	0.077	2.322	11.482
Top five banks asset concentration (COM)	0.703	0.280	−1.429	4.333
H-statistics (HST)	0.191	0.301	1.299	3.619
Growth in domestic bank assets to (DBAG)	0.036	0.114	0.167	12.419
Non-interest income to total income (NII)	0.348	0.153	0.334	3.456
Growth in the average consumer price index (CPIG)	0.058	0.080	7.218	102.009
GDP growth (GDPG)	0.081	0.131	−0.897	11.465

Note(s): The table presents the descriptive statistics of the data

Table 1.
Descriptive statistics

	COM	NIM	NII	NPL	ROA	HST	PNPL	GDPG	CPIG
COM	1								
NIM	−0.104	1							
NII	−0.055	0.036	1						
NPL	−0.100	0.018	0.045	1					
ROA	−0.133	0.440	0.037	−0.184	1				
HST	0.006	−0.112	−0.221	0.027	−0.066	1			
PNPL	0.019	0.043	−0.141	0.093	−0.030	0.248	1		
GDPG	0.022	0.122	0.149	−0.142	0.222	−0.128	0.016	1	
CPIG	−0.048	0.216	0.155	−0.038	0.096	−0.039	0.023	0.012	1
DBAG	0.007	0.076	0.017	−0.100	0.053	−0.049	0.014	−0.144	0.056

Note(s): The Table presents the correlation matrix of the variables for the study. COM, DBAG, NPL, NII, ROA, NIM, CPIG, PNPL, HST and GDPG are the top five banks asset to total banks asset, growth in domestic bank assets to GDP, non-performing loans to gross loans, non-interest income to total income, ROA, net interest margin, growth in consumer price index average prices, provision for non-performing loans, *H*-statistic and GDP growth respectively

Table 2.
Correlation matrix

The table shows that HST correlates positively with PNPL and NPL and negatively with NIM, NII and ROA. The correlation between HST and PNPL/NPL suggests that increased competition raises risk-taking incentives of FEE banks. Similarly, the correlations between HST and NIM, and ROA and NII show that competition reduces profitability and income diversification. Also, Table 2 indicates a weak negative correlation between concentration ratio and ROA/NIM. This appears inconsistent with Guidara *et al.* (2013) finding. The association suggests that an increase in concentration may exert negative influence on bank performance. Additionally, the association between COM and NPL is negative, which indicates that decreasing concentration might cause non-performing loans to increase. Most likely, a decrease in concentration leads to an increase in competition which consequently induces banks to create low quality loans. The generally low correlations contained in Table 2 (highest of 0.440) suggest that multicollinearity may have minimal effect on the results of the study.

5. Empirical results

Stationary series are essential for the reliability of the tests conducted in this study. We thus examine all the variables adopted in this study for unit root and report the results in Table 3. We adopt the augmented Dicky-Fuller test (ADF) (see Dickey and Fuller, 1979) to examine the variables for unit root with trend. The findings show that all the series are stationary. Therefore, unit root has no effect on the tests conducted in this study.

The results of estimating Equation (1) are presented in Table 4. We rely on the HST and the ROA as proxies for competition and performance, respectively. We investigate the stability conditions of the estimated models using the eigenvalues. The findings recorded in Table 4 indicate that all the eigenvalues are less than 1. This shows that the estimated models are stable.

Table 4 shows that competition loads positively on the PNPLs, diversification (NII), inflation growth (CPIG) and the growth in banking sector depth (DBAG). It, however, loads negatively on bank performance (ROA), non-performing loans (NPL) and GDP growth (GDPG). The Table shows that bank performance decreases with HST, GDPG, CPIG, NPL and DBAG but improves with PNPL and NII. Aside the PNPL and DBAG coefficients, all the coefficients are insignificant. The impact of these factors on bank performance is thus less meaningful.

Table 3. Univariate unit root test

Lags	COM	NIM	NII	NPL	DF/ADF test statistic ROA	HST	PNPL	GDPG	CPIG	DBAG	Critical value (5%)
0	−15.3	−17.2	−10.6	−13.6	−24.8	−6.50	−9.68	−26.9	−21.7	−26.1	−1.65
1	−12.9	−10.4	−9.73	−13.7	−17.4	−5.87	−7.82	−20.3	−20.8	−19.9	−1.65
2	−11.1	−9.1	−7.55	−11.1	−14.2	−5.62	−6.60	−16.9	−14.2	−18.6	−1.65
3	−10.9	−8.42	−6.91	−10.2	−11.9	−4.86	−5.61	−13.4	−11.9	−14.8	−1.65
4	−8.6	−7.46	−5.53	−8.89	−10.5	−4.41	−4.44	−10.6	−8.7	−14.1	−1.65

Note(s): The null of unit root is rejected at the 5% level of significance for all the series
The table presents the results of unit root test. COM, DBAG, NPL, NII, ROA, NIM, CPIG, PNPL, HST and GDPG are the top five banks asset to total banks asset, growth in domestic bank assets to GDP, non-performing loans to gross loans, non-interest income to total income, ROA, net interest margin, growth in consumer price index average prices, provision for non-performing loans, *H*-statistic and GDP growth respectively

Table 4.
Empirical results

Panel		α	ROA	HST	PNPL	NII	DBAG	GDPG	CPIG	EIG
A	ROA	0.0057***	0.4271***	−0.0019	0.0016*	0.0037	−0.0048***	−0.0060	−0.0034	0.209
	HST	0.0759***	−0.0246	0.8810***	0.0225***	0.0341	0.0166***	−0.3130***	0.0059	0.424
	PNPL	0.1037***	−0.0506	0.0183	0.8617***	−0.0321	0.0109	0.0856	−0.0316	0.378
	NII	0.0723***	−0.3910***	−0.0574***	−0.0054	0.7694***	−0.0104***	0.0150	0.0939***	0.949
	DBAG	−0.0383***	0.4615**	0.0362**	0.0095	0.0084	0.9556***	0.2406***	−0.2116***	0.932
	GDPG	0.0260*	0.2784*	−0.0840***	0.0056	0.0973***	0.0008	0.2192***	0.2023***	0.762
	CPIG	0.0031	−0.0101	−0.0049	0.0125***	0.0292**	−0.0212***	−0.0275*	0.3930***	0.795
		α	ROA	HST	NPL	NII	DBAG	GDPG	CPIG	EIG
B	ROA	0.0067***	0.4268***	−0.0013	−0.0009	0.0032	−0.0047***	−0.0056	−0.0024	0.215
	HST	0.0970***	−0.0757	0.8904***	−0.1118**	0.0306	0.0192***	−0.3143***	0.0182	0.427
	NPL	0.0192***	−0.0638	0.0042	0.7819***	−0.0117	0.0024	−0.0142	0.0092	0.356
	NII	0.0669***	−0.3755***	−0.0597***	0.0338	0.7700***	−0.0110***	0.0157	0.0911***	0.766
	DBAG	−0.0262*	0.4163**	0.0402**	−0.0977	0.0091	0.9569***	0.2366***	−0.2076***	0.953
	GDPG	0.0284***	0.2867*	−0.0817***	0.0171	0.0946***	0.0013	0.2218***	0.2064***	0.933
	CPIG	0.0105*	−0.0067	0.0002	0.0058	0.0245*	−0.0201***	−0.0237	0.4015***	0.858

Note(s): The Table presents the results of estimating the Equation: $\sum_{k=1}^{n} Y_{i,t}^{k} = \sum_{k=1}^{n} \alpha_k + \sum_{k=1}^{n} \sum_{j=1}^{v} \beta_{kj} Y_{i,t-j}^{k} + \varepsilon_{i,t}^{k}, \alpha = intercept, \varepsilon = errorterm.$ $Y = N \times Tmatrix$ consisting of return on assets (ROA), provision for non-performing loans (PNPL) or non-performing loans ratio (NPL), HST, growth in banking sector depth (DBAG), growth in gross domestic product (GDPG), growth in average consumer price index (CPIG) and diversification (NII). The superscript k and subscripts i and j respectively represent the variable (elements of Y), country and the number of lags. EIG = eigenvalues

The evidence suggests that banks increase the PNPLs in an effort to improve performance. That is, banks enhance profitability via increased risk-taking activities. The NII evidence is in agreement with Craigwell and Maxwell (2006) but appears inconsistent with the observations by Berger *et al.* (2010) and Tan (2016).Also, the finding on the relationship between ROA and HST is consistent with the evidence in prior studies (see e.g.Tan, 2016; Garcia-Herrero *et al.*, 2009; Tan and Floros, 2012). In addition, the negative association between performance and banking sector depth implies that the expansion of FEE banks is associated with intense competition. This subsequently reduces interest income and thus performance. It may also be inferred that banks in FEEs with relatively larger banking sectors are outperformed by their counterparts in economies with smaller banking sectors. It is possible that competition and institutional quality are weaker in FEEs with less developed banking sectors which enable them to realize higher interest margins.

Table 4 indicates that rising competition and growth in domestic banks asset increase the risk-taking incentives (PNPL and NPL) of FEE banks. Also, profitability and diversification drive down the risk-taking tendencies of banks. Additionally, GDP growth dampens non-performing loans although it influences the PNPLs positively. In addition, competition, profitability and banking sector depth affect income diversification negatively. Also, diversification rises with inflation growth. The evidence suggests that FEE banks may reduce their risk-taking incentives in response to instabilities in the larger economy. Rising inflation may lead to rising interest rates and the likelihood of default which may lead to a decrease in the risk-taking activities of banks. The effect of PNPL and NPL on diversification may imply that FEE banks employ income diversification activities mostly as a risk management technique which is aimed at reducing non-performing loans.

The positive influence of HST on PNPL infers that excessive competition increases bank risk-taking tendencies and undermines the stability and soundness of the banking system. The NII findings imply that profitable FEE banks are less diversified, and that an increase in profitability is associated with declining non-interest income. Thus, the performance of FEE banks is driven mainly by interest income. This implies that profitable FEE banks have higher concentration on interest income and thus are riskier. The findings may also suggest that FEE banks have limited opportunity to diversify off balance sheet. The relationship between diversification and profitability appears to be in consonance with Berger *et al.*'s (2010) observation that diversification drives profit decline.

The relationship between NPL and GDPG suggests that as FEE banks grow, non-performing loans decrease. That is, economic well-being reduces loan default. Also, the GDPG influence on PNPL may imply that FEE banks increase the PNPLs in response to economic expansion. This may mean that FEE banks step-up their risk-taking activities in an effort to exploit the opportunities associated with economic growth. Additionally, as the economy improves, demand for loans may increase; banks may thus create more long-term assets or increase risk-taking in an effort to earn higher interest income. Consequently, they increase the PNPLs. This may explain the positive relationship between PNPL and GDPG. Arguably, the demand for bank loans increases during periods of economic expansion; this enables banks to increase their interest income as well as profitability.

We conduct further tests with alternative measures of profitability and competition. Equation (1) is thus re-estimated by measuring profitability and competition respectively by the NIM and the top five (5) banks asset concentration (COM). The results are presented in Table 5. The evidence in Table 5 largely corroborates those of Table 4. Consistent with the findings in Table 4, all the eigenvalues reported in Table 5 are less than 1. Therefore, the estimated models are stable.

Table 5 indicates that the top 5 banks asset concentration (COM) is influenced positively by DBAG, CPIG and NII. In addition, NIM, NPL, PNPL and GDPG affect COM negatively. The findings show that rising diversification, a surge in inflation and banking sector growth lead

Table 5.
Empirical results

Panel		α	NIM	COM	NPL	NII	DBAG	GDPG	CPIG	EIG
A	NIM	0.012***	0.658***	−0.002	0.004	0.002	−0.005***	−0.002	0.016**	0.2886
	COM	0.196***	−0.090	0.737***	−0.148**	0.054	0.009	−0.012	0.006	0.2886
	NPL	0.019***	0.099**	−0.005	0.779***	−0.009	0.006***	−0.017*	0.007	0.9539
	NII	0.040***	0.040	0.001	0.046	0.788***	−0.012***	0.006	0.081**	0.6757
	DBAG	0.010	−0.637***	0.011	−0.086	−0.026	0.942***	0.254***	−0.185***	0.7127
	GDPG	−0.002	−0.179	0.020*	0.019	0.105***	−0.012**	0.234***	0.203***	0.8015
	CPIG	−0.019**	0.771***	−0.004	−0.023	0.052***	−0.003	−0.032**	0.384***	0.8015
		α	NIM	COM	PNPL	NII	DBAG	GDPG	CPIG	EIG
B	NIM	0.011***	0.651***	−0.002	0.003***	0.003	−0.006***	−0.003	0.014***	0.2884
	COM	0.189***	−0.125	0.742***	−0.005	0.044	0.007	0.001	0.014	0.2884
	PNPL	0.078**	0.652**	0.005	0.859***	−0.014	0.027**	0.078	−0.043	0.6418
	NII	0.050***	0.098	−0.001	−0.012***	0.786***	−0.008	0.005	0.087**	0.9557
	DBAG	−0.006	−0.729***	0.014	0.018**	−0.025	0.937**	0.257***	−0.194***	0.8670
	GDPG	0.000	−0.165	0.020	−0.002	0.105***	−0.011*	0.233***	0.204***	0.8024
	CPIG	−0.025***	0.739***	−0.003	0.007**	0.054***	−0.004	−0.032**	0.380***	0.7440

Note(s): The Table presents the results of estimating the Equation: $\sum_{k=1}^{n} Y_{i,t}^{k} = \sum_{k=1}^{n} \alpha_k + \sum_{k=1}^{n} \sum_{j=1}^{v} \beta_{k,j} Y_{i,t-j}^{k} + \varepsilon_{i,t}^{k} \alpha = intercept, \varepsilon = error\ term.$ $Y = N \times Tmatrix$ consisting of return on assets (ROA), provision for non-performing loans (PNPL) or non-performing loans ratio (NPL), top five (5) banks asset concentration (COM), growth in banking sector depth (DBAG), growth in gross domestic product (GDPG), growth in average consumer price index (CPIG) and diversification (NII). The superscript k and subscripts i and j respectively represent the variable (elements of Y), country and the number of lags. EIG = the eigenvalues

to asset concentration in few banks. This may increase the market power and the influence of those few banks. Consequently, banking sector competition may be undermined. The effect of NII on COM appears consistent with the relative market power hypothesis which posits that concentration and for that matter market power increases with product diversification. The evidence shows that economic expansion, rising non-performing loans and the PNPLs minimize asset concentration. It is possible that economic expansion boosts the confidence of FEE banks which incentivizes smaller banks to create more assets and eventually enhances banking sector competition. Additionally, the findings may imply that increasing non-performing loans leads to significant asset losses for the top 5 banks which reduce their market power.

The table provides further evidence that NPL, PNPL and CPIG affect NIM positively. Also, the DBAG impact on NIM is negative. Additionally, NIM impacts on CPIG, NPL and PNPL positively and DBAG negatively. As inflation increases, non-performing loans and the likelihood of default may arguably increase.

In addition, rising non-performing loans suggests higher default risk probabilities. These may explain the positive influence of NPL, PNPL and CPIG on NIM. Banks may demand higher risk premium and expected inflation loadings as compensation for higher default risk and as a means of preserving the real value of their assets respectively. The negative effect of DBAG on NIM may be driven by intense competition and reduced margins as banking sector depth grows. The loadings of DBAG on NIM may suggest that FEE banks improve on their performance through asset growth. The relationship between GDPG and NIM is in agreement with Akter *et al.* (2018) and Tan's (2016) observations. Also, the positive association between NIM and CPIG is in consonance with Perry (1992) and Tan (2016). Perry for instance, argues that the relationship is due to the ability of banks to appropriately forecast and capture expected inflation in loan interest rates determination thereby transferring the extra cost to borrowers. Shifting the extra cost to borrowers could, however, increase loan default.

Taking together the association between NPL and NII, DBAG and NII, and PNPL and NII, the evidence in Tables 4 and 5 indicates that FEE banks increase the PNPLs in periods of asset growth. That is, banks anticipate the potential increase in non-performing loans and make provisions for it during periods of asset expansion. Also, banks engage in less diversification in periods of asset growth. However, they improve on diversification and reduce asset acquisition as non-performing loans rise. That is, as default risk increases FEE banks focus more on non-interest income. The evidence suggests that banks engage in a trade-off between asset growth and diversification. In addition, the negative influence of HST and COM on ROA and NIM, respectively, implies that a decrease in concentration and/or an increase in competition dampen bank performance. This appears consistent with the structure-conduct-hypothesis which associates improved bank performance to increased concentration and/or lesser degree of competition.

We conduct Granger causality test and present the results in Table 6. The tests permit us to examine the direction of causality between the variables in Equation (1). The evidence indicates that NPL, DBAG, PNPL and GDP Granger cause HST; ROA, HST, DBAG and CPIG cause NII; HST, NIM, COM, CPIG and GDPG cause DBAG; and PNPL, HST, DBAG cause ROA. Similarly, there is a causal effect of NII and DBAG on CPIG; DBAG and CPIG on NIM; and NPL on COM. Additionally, causality is observed from NPL, PNPL and DBAG to COM. Table 6 shows a bi-directional causality between NIM and PNPL, ROA and DBAG, HST and DBAG, and CPIG and DBAG. That is, for these sets of variables, causality could be in any direction.

We estimate the Cholesky forecast error variance decomposition (FEVD) for the estimated models and present the results in Table 7. The Table indicates that the major drivers of the variance of ROA and HST are, respectively, lagged-ROA (98.2%) and DBAG (0.94%) and lagged-HST (98%) and NII (1.52%). Similarly, the variation in the variance of NPL is largely

Table 6.
Granger causality test

Panel		ROA	HST	NPL	NII	DBAG	GDPG	CPIG
A	ROA	37.87***	1.557	0.035	0.561	63.470***	2.096	0.193
	HST	0.399	5500.15***	10.857***	1.233	14.536***	77.664***	0.218
	NPL	0.859	2.169	1415.42***	1.392	3.174*	2.466	0.490
	NII	6.791***	44.310***	1.228	1367.27***	12.168***	0.691	16.316***
	DBAG	5.560**	16.613***	3.611	0.097	21511.15***	23.536***	7.212***
	GDPG	4.325**	69.430***	0.234	17.038***	0.079	50.629***	25.811***
	CPIG	0.007	0.001	0.138	3.351*	26.399***	2.899	75.49***
		ROA	HST	PNPL	NII	DBAG	GDPG	CPIG
B	ROA	33.175***	2.884*	7.158***	0.878	64.999***	2.217	0.286
	HST	0.031	4963.20***	9.737***	1.517	10.453***	77.393***	0.020
	PNPL	0.029	0.914	2261.45***	0.670	1.845	2.516	0.161
	NII	7.130***	40.967***	2.160	1265.48***	10.126***	0.622	16.167***
	DBAG	6.369**	16.319***	3.407*	0.080	20722.10***	25.170***	8.09***
	GDPG	3.043*	72.456***	1.292	17.776***	0.034	46.621***	25.184***
	CPIG	0.015	1.514	10.503***	4.801**	23.981***	3.633*	76.566***
		NIM	COM	NPL	NII	DBAG	GDPG	CPIG
C	NIM	817.36***	1.493	0.538	0.451	75.306***	0.635	8.768***
	COM	0.178	734.01***	6.269**	2.483	0.841	0.167	0.017
	NPL	5.956**	1.941	1302.21***	0.886	14.984***	3.811*	0.215
	NII	0.138	0.003	2.349	1353.00***	9.190***	0.103	12.894***
	DBAG	7.330***	0.635	2.656	1.054	12615.81***	28.492***	5.191**
	GDPG	1.412	3.826*	0.225	20.146***	5.124**	50.709***	27.871***
	CPIAVG	60.703***	0.473	1.628	22.974***	0.565	5.686**	88.51***

(*continued*)

		NIM	COM	PNPL	NII	DBAG	GDPG	Cpiavg
D	NIM	677.658***	1.606	26.604***	1.252	88.50***	1.202	6.140**
	COM	0.325	747.35***	0.925	1.674	0.553	0.001	0.085
	PNPL	5.636**	0.052	1959.56***	0.119	9.286***	2.168	0.277
	NII	0.755	0.004	11.023***	1290.12***	4.775**	0.069	13.12***
	DBAG	9.738***	0.933	8.839***	0.878	12038.23***	29.54***	6.75***
	GDPG	1.067	3.593**	0.202	20.657***	4.346**	46.75***	26.22***
	CPIAVG	47.767***	0.345	2.824*	24.35***	1.510	4.860**	94.62***

Note(s): The Table presents the results of Granger causality test for the Equation: $\sum_{k=1}^{n} Y_{i,t}^{k} = \sum_{k=1}^{n} \alpha_k + \sum_{k=1}^{n} \sum_{j=1}^{v} \beta_{k,j} Y_{i,t-j}^{k} + \varepsilon_{i,t}^{k}$; $\alpha = intercept$, $\varepsilon = errorterm$, $Y = N \times T$ *matrix* consisting of return on assets (ROA), provision for non-performing loans (PNPL) or non-performing loans ratio (NPL), top five (5) banks asset concentration (COM), growth in banking sector depth (DBAG), growth in gross domestic product (GDPG), growth in average consumer price index (CPIG) and diversification (NII). The superscript k and subscripts i and j, respectively, represent the variable (elements of Y), country and the number of lags

Table 6.

Panel		ROA	HST	NPL	NII	DBAG	GDPG	CPIG
A	ROA	98.19	0.21	0.07	0.29	0.93	0.29	0.02
	HST	0.12	97.98	0.04	1.52	0.26	0.08	0.00
	NPL	4.66	0.15	94.65	0.36	0.05	0.09	0.04
	NII	1.16	7.61	0.95	89.05	0.27	0.55	0.40
	DBAG	0.73	4.19	0.07	2.50	89.84	2.60	0.07
	GDPG	3.82	3.64	1.43	1.36	0.88	87.37	1.51
	CPIG	0.01	0.92	0.03	1.03	1.55	1.65	94.81
		ROA	HST	PNPL	NII	DBAG	GDPG	CPIG
B	ROA	98.13	0.22	0.02	0.33	0.95	0.32	0.03
	HST	0.15	97.58	0.37	1.62	0.20	0.08	0.01
	PNPL	0.02	2.92	96.54	0.02	0.02	0.47	0.01
	NII	1.12	7.43	0.37	89.86	0.23	0.56	0.43
	DBAG	0.76	4.05	0.50	2.44	89.54	2.63	0.08
	GDPG	3.79	3.71	0.20	1.33	0.96	88.57	1.43
	CPIG	0.01	0.94	0.51	1.22	1.72	1.64	93.96
		NIM	COM	NPL	NII	DBAG	GDPG	CPIG
C	NIM	97.99	0.12	0.06	0.03	1.05	0.66	0.10
	COM	0.24	98.95	0.28	0.46	0.02	0.04	0.03
	NPL	0.20	0.04	98.94	0.41	0.23	0.16	0.02
	NII	0.70	0.95	1.32	95.72	0.31	0.67	0.32
	DBAG	13.89	1.00	0.03	4.48	77.61	2.94	0.05
	GDPG	1.35	0.06	2.39	2.42	0.40	92.04	1.34
	CPIG	6.99	0.10	0.09	2.03	0.13	1.05	89.60
		NIM	COM	PNPL	NII	DBAG	GDPG	CPIG
D	NIM	97.72	0.13	0.10	0.07	1.17	0.74	0.07
	COM	0.27	99.25	0.00	0.38	0.00	0.08	0.02
	PNPL	0.19	0.05	99.11	0.07	0.10	0.47	0.00
	NII	0.58	1.01	1.14	95.99	0.21	0.71	0.35
	DBAG	14.27	1.00	1.30	4.02	76.35	3.00	0.06
	GDPG	1.37	0.05	0.35	2.26	0.51	94.12	1.34
	CPIG	6.73	0.10	0.19	2.21	0.20	0.89	89.67

Note(s): The Table presents the results of the Cholesky FEVD test for the Equation: $\sum_{k=1}^{n} Y_{i,t}^{k} = \sum_{k=1}^{n} \alpha_k + \sum_{k=1}^{n} \sum_{j=1}^{v} \beta_{kj} Y_{i,t-j}^{k} + \varepsilon_{i,t}^{k}$; $\alpha = intercept, \varepsilon = errorterm. Y = N \times Tmatrix$ consisting of return on assets (ROA), provision for non-performing loans (PNPL) or non-performing loans ratio (NPL), top five (5) banks asset concentration (COM), growth in banking sector depth (DBAG), growth in gross domestic product (GDPG), growth in average consumer price index (CPIG) and diversification (NII). The superscript k and subscripts i and j respectively represent the variable (elements of Y), country and the number of lags

Table 7.
Forecast error variance decomposition

driven by ROA (4.7%) and lagged-NPL (94.5%) whereas that of PNPL is mainly driven by HST (2.9%) and lagged-PNPL (96.5%). In addition, the cross-sectional and time series variability in NII is described by ROA (1.2%), HST (7.6%), NPL (0.95%) and lagged-NII (89%), whilst the variability in DBAG is described by HST (4.2%), NII (2.5%), GDP (2.6%) and lagged-DBAG (89.8%). Similarly, the variations in COM and NIM are explained by NII (0.5%) and lagged-COM (99%); and lagged-NIM (98%) and DBAG (1.1%) correspondingly. The evidence shows that the one period lag of each variable is the most important factor describing its variations through time and within the cross-section. This notwithstanding,

the other variables in the system are relevant in describing the variations in the endogenous variables.

For instance, ROA and NII describe about 5.1% of the variance of NPL; 9.75% of the variability in NII is explained by ROA, HST and NPL; and about 1.51% of the variability in ROA are described by DBAG, NII and GDPG. Additionally, 3.4% of the variance of PNPL is explained by HST and DBAG whilst about 1.78% of the variance of HST is captured by NII and DBAG. These values are economically meaningful.

6. Conclusions

The study examines the drivers of competition, risk-taking, performance and risk diversification of banks in FEEs. It explores the dynamic relationships among these variables. Additionally, it investigates the influence of banking sector depth and economic performance on the competition, performance, diversification and risk-taking activities of FEE banks.

The study finds that the PNPLs and banking sector depth exert positive effects on competition (HST) whereas non-performing loans and growth in GDP impact banking sector competition negatively. Additionally, improvements in bank performance (net interest margin) and a surge in non-performing loans reduce asset concentration in few banks (increase competition). The results may imply that the expectation of rising competition particularly in periods of economic expansion may drive banks to make more PNPLs. However, as non-performing loans surge, banking sector competition is reduced. In addition, the study finds that bank performance (return on assets) slumps with rising banking sector depth and competition (HST). That is, banks in countries with well-developed and competitive banking sectors are less profitable. Also, the growth in inflation and the PNPLs improve bank performance (net interest margin) although performance is constrained by rising banking sector depth. The paper provides evidence that risk-taking incentives (provisions for non-performing loans) increase with strengthening competition, rising NIM and deepening banking sector depth. Additionally, rising competition, profitability, PNPLs and banking sector depth reduce income diversification. In addition, inflation growth increases income diversification activities. As inflation increases, the likelihood of default may also rise. As a consequence, banks may reduce their focus on interest income and explore other opportunities for improving performance.

The findings from the study have implications for policy and banking practice. The findings suggest that whereas competition is essential for banking sector growth and development, excessive competition may undermine banking sector profitability. Anti-competitive behaviour may lead to increased inefficiency which may consequently undermine banking sector growth. The evidence shows that asset growth may drive up competition and thus improve on efficiency and soundness of the banking sector. Excessive asset growth however, may reduce profitability and diversification activities of FEE banks. Also, lower levels of profitability may lead to higher insolvency risk. Additionally, inadequate diversification opportunities or limited technology to promote diversification may lead to a rise in risk-taking activities and thus undermine banking sector profitability and soundness. Policy that supports sustainable asset growth should be encouraged. That is, policy should dissuade asset growth that is driven by excessive risk-taking. Sustainable asset growth would improve economic activities and drive growth and social welfare enhancement in an economy. In addition, policy should aim at ensuring sufficient level of banking sector competition and not excessive or fierce competition. That is, policy should strike the right balance between competition, performance and stability.

Note

1. Data on the variables for each country are contained in the Global Financial Development Database.

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Corresponding author
Nicholas Addai Boamah can be contacted at: addaianas@yahoo.com