Assessment of Environmental Sources of Financial Risks on Commercial Banks in Ghana

Kofi Twum Antwi

Agricultural Development Bank (ADB), P.O. Box 16, Techiman Branch-Ghana

Beatrice Darko Obiri

Council for Scientific and Industrial Research - Forestry Research Institute of Ghana (CSIR-FORIG), P. O. Box UP 63 KNUST, Kumasi- Ghana

Elizabeth Asantewaa Obeng

Council for Scientific and Industrial Research - Forestry Research Institute of Ghana (CSIR-FORIG), P. O. Box UP 63 KNUST, Kumasi- Ghana

Simon Abugre

Department of Forest Science, University of Energy and Natural Resource, Sunyani- Ghana

Abstract

This research examined environmental sources of financial risks and its impact on commercial banks in Ghana. Primary data from ninety-six (96) middle level bank managers and time series secondary data from thirty-two banks on banking performance and stability for the period 2006-2018 as well as performance of five major industrial businesses (agriculture, mining, construction, manufacturing and trade) were collected and analyzed using descriptive statistics and multivariate dynamic panel regression model. Banking performance was measured by return on assets (ROA) and return on equity (ROE) while banking stability was assessed by capital adequacy ratio (CAR) and non-performing loans ratio (NPLR). The results show that, in bank lending, mining was perceived to be the topmost source of indirect environmental risk (credit and reputational risks), while agriculture was perceived to be the leading source of direct environmental risk (business risk). Furthermore, perceptions of environmental sources of financial risk by managers of locally owned banks differed from that of foreign owned banks. Growth of mining, trade and manufacturing positively influenced bank performance while the growth of construction and agriculture negatively influence bank stability. The study thus provides supportive evidence that commercial banks require set standards that would guide clients' business towards environmental sustainability. The observation that except for agriculture, all the other environmental sources of financial risk had a significant influence on bank NPLR is thought-provoking engendering the need for further studies to establish the fundamental reasons for this relationship.

Keywords: Environmental Risk; Bank Performance; Stability; Return on Assets (ROA); Return on Equity (ROE); Capital Adequacy Ratio (CAR); Non-performing Loans Ratio (NPLR)

JEL Classifications: E50; G21

Introduction

All over the world, banks are in a continuous search for depositors (surplus sectors) and those in need of capital for investment (Daly and Frikha 2017; Hedvicakova and Prazak 2018). Such intermediation process allows for their continued existence in business. An efficient intermediation process, which aims at maximizing customer value is, therefore, important for a bank to increase its stakeholder profits and to meet the minimum capital requirement laid down by a supervisory body. Banks also identify, monitor, and provide investment guidelines and guarantees to existing and emerging businesses and sectors to function and grow (Senyo et al. 2015). Additionally, they contribute to industrialization and the sustainable development process (Yip and Bocken 2018). However, Scholtens and van't Klooster (2019) posit that banks may also finance or invest in clients whose projects harm the environment through pollution of land, air, and water bodies, which in turn, create environmental risks as lenders.

In banking, the definition of environmental risk is any financial risk or loss incurred by a bank as a result of financing a polluting project (Lui and Lin 2014). Environmental pollution causes severe climate events, which also have huge implications for the financial sector. The impact of such polluting projects in the long-run, negatively affect the financial sector, with banks bearing the brunt of a chunk of the adverse effects. The example is cited by Shimizu and Fujimura (2010) and Bjarnadottir et al. (2011) of extreme climate events such as the Great Kanto Earthquake that occurred in the Kanto District in Japan in 1923, and Hurricane Andrew and Hurricane Katrina that occurred in the South Florida economy in the USA in 1992 and 2005 respectively, which distorted the financial market, including the closure of some banks (Shimizu and Fujimura 2010; Bjarnadottir et al. 2011). Prior research has reported repeatedly that environmental pollution by a borrower may tarnish a bank's good reputation - reputational risk, and expose it to credit risk - indirect risk and direct environmental liability or business risk - direct risk (Thompson, 1998; Thompson and Cowton 2004; Liu and Lin 2014; Brown, 2015).

Arguably, environmental risk constitutes one of the most important sources of financial risk in bank lending and investment decisions due to increasing environmental polluting activities of clients and related climate change impact (Brown 2015; Park and Kim 2020). Financial risks have impacted significantly on the banking sector in both the developed and developing nations. In developing countries, empirical evidence suggest that financial risks have negatively impacted the performance of commercial banks. The study of Juma and Atheru (2018) for example point to a 2015 financial sector report in Kenya which found a reduction in 2015 of financial sector's assets as a share of nominal GDP to 83.27%, down from 88.41% recorded in the previous year. The exclusion of assets of three banks put under receivership accounted for this decline. The story is no different in developed nations. The collapse of Lehman Brothers for example, had a rippling effect in continental Europe. Consequently, banking regulators and stakeholders now urge banks to embrace sustainability as a new financial paradigm when executing their intermediary role (Zhang et al. 2011; Carè 2018). A sustainable development objective of banks seeks to address environmental and financial issues in a manner that improves the situation of the current and future generations (Weber 2018). This is also an important agenda of governments and environmentally concerned organizations in the achievement of sustainable development (Esposito et al. 2019). Recent studies argue that achieving both financial stability and environmental sustainability can be very challenging for banks (Delmas and Blass 2010; Hahn et al. 2010; Keele and DeHart 2011; Schaltegger and Wagner 2011; Finger et al. 2018). However, banks can pursue sustainable banking by offering guidelines, incentives, and products that promote the environmental sustainability behavior of their clients (Weber et al. 2019; Zimmermann 2019). Using the Chinese Green Credit Policy and Guidelines for example, banks can be mandated to lower interest rates for borrowers involved in environmental sustainability and increase interest rates, or in some cases where there is evidence of non-compliance or environmental controversies, withdraw already disbursed loans (Zhao and Xu 2012). To the banks, sustainable banking may build their reputation and improve their operational inefficiencies and financial stability in general (Forcadell and Aracil 2017; Scholtens and van't Klooster 2019). In a local context, the question that remains unanswered is what would be required to promote the sustainable banking behaviour of banks in Ghana. Halimatussadia et al. (2018) advocated that banks need to build a strong understanding, knowledge, and competence in environmental risk management to support the implementation of sustainable banking.

In Ghana, competition in the banking industry is rapidly increasing now than ever before. This trend is partly due to the rapid increase in foreign as well as locally-owned banks, and the central bank's implementation of new regulations (Amoako 2012; Ackah and Asiamah 2014). The increasing competition among banks to

attract and retain customers is likely to cause a rapid growth in industrial activities. Despite the high rate of natural resource degradation in the country, bankers' understanding of environmental risks as important sources of financial risks has the past years been very low (PricewaterhouseCoopers (PwC) 2019). According to PwC (2019) report, bank financial risks in the years to come will only be defined by the performance of the fiscal and monetary economy, governmental initiatives, central bank regulations, and to a very insignificant extent, to the performance of the external factors. Banks' decision to respond to environmental and social issues in lending may also depend largely on their perception of environmental sources of financial risks.

Despite the existence of some studies on commercial banks in Ghana (Alhassan et al. 2014; Owusu-Antwi et al. 2015; Adusei 2015; Senyo et al. 2015), empirical studies on environmental sources of financial risks for banks are very limited in Ghana. Furthermore, there are virtually no studies on the impact of environmental sources of financial risks on banking performance and stability in Ghana. Recent studies on sources of bank financial risks in the banking sector in Ghana are limited to monetary, fiscal, macro and micro economic. This study therefore examined environmental sources of financial risks and its impact on commercial banks in Ghana. Studies have established a correlation between environmental risks in bank lending and financial stability, most especially in developed countries (Thompson 1998; Thompson and Cowton 2004; Weber et al. 2008, 2010; Campbell and Slack 2011; Brown 2015; Carè 2018; Dafermos et al. 2018). These studies usually use return on assets (ROA) and return on equity (ROE) as proxies for assessing the relationship of the determinants with what the banks achieve as net results. For the purpose of comparability and applicability ROA and ROE are used in this study to denote bank performance while bank stability is measured using capital adequacy ratio (CAR) and non-performing loans ratio (NPLR). Following the introduction is a review of literature that summarizes findings of previous related studies which serves as the basis that guides the analysis and conclusions drawn from this study. This is immediately followed by the research methodology adopted for this study with the appropriate justification for its use. Following from this, results of the analysis and conclusions on the findings is presented.

Theoretical Framework

Risk is inevitable and pervasive in all aspects of human life, including banking (Chernobai et al. 2008). Chernobai et al. (2008) defined risk as the likelihood of sustaining a loss. Banking is seen as a business full of uncertainty because it is conducted in an environment that cannot be easily predicted. Banks encounter several financial risks, especially when they lend to clients. Different studies tend to define financial risks into the following: credit risk, market risk, legal risk, operational risk, liquidity risk, rate of return risk, foreign exchange risk and capital management risk. There is also a growing body of literature on environmental and climate-related risks and financial market instability (Nieto 2017). The literature indicates that natural or environmental resource depletion or pollution can translate into climate risk or environmental risk for businesses and financial institutions (Thompson and Cowton 2004; Campiglio et al. 2018). Climate risks extend to banks in a form of physical, liability and transition risks (Bowen and Dietz 2016; Scott et al. 2017; Campiglio et al. 2018; Dafermos et al. 2018; Monasterolo et al. 2018; Monnin 2018; Esposito et al. 2019; Park and Kim 2020). The most immediate risks associated with climate issues are physical risks (Esposito et al. 2019). Physical risks directly influence financial institutions, specifically financial stability through damage to property (assets) of households, banks, and insurers and indirectly through disruption of global supply chains or resource scarcity (Batten et al. 2016; Monnin, 2018). Liability risk refers to financial risk arising from environmental pollution and contamination. Transition risks are the risks associated with the policy, litigations, regulation, and pricing of carbon as well as technology and market changes, all of which have clear implications on the economy and consequences most immediately for bank investments, as well as lending practices and other aspects of a bank's performance and stability (Carney 2015).

A strong association between environmental risks and financial risks has been established by recent studies (Weber et al. 2008; Weber et al. 2010; Bauer and Hann 2010; Goss and Roberts 2011; Battiston et al. 2016; Prorokowski 2016; Dafermos et al. 2018). Scholtens and van't Klooster (2019) analyzed the relationship between sustainability and bank risk and found that higher sustainability in banking is significantly associated with lower default risk. Current and previous perceptions of the environmental risks of banks is well documented by Brown (2015). According to Scholz et al. (1995), about 10% of the total non-performing loans arise from environmental-related risks. According to the analysis of the impact of environmental risk on the UK banking sector by Mckenzie and Wolfe (2004) in their analysis of the impact of environmental risk on the banking sector of UK suggest that banks have a stronger interest in reputational effect that comes with

providing credit to a polluter than the associated credit risk. Dafermos et al. (2019) examined climate change damages impact on financial assets' price and banks and firms financial position. The authors established that the liquidity of firms can be deteriorated gradually by climate change and reduce their profitability, engendering higher default and potentially harming banks. Empirical studies on environmental sources of financial risks for banks are very limited in Ghana. Recent studies on sources of bank financial risks in the banking sector in Ghana are limited to monetary, fiscal, macro and micro economic.

This study adopts the circular flow model to explain the sources of bank environmental risks. As depicted in Figure 1, banks provide loans to, or invest in productive activities such as mining, agriculture, construction, manufacturing, trade, and oil & gas production (indicated by the red arrow). In a circular flow format, households and businesses commit the capital to produce services and goods, and save or invest the surplus back into the bank (indicated by the green arrow). In this case, they borrower invests in a polluting project, the bank may suffer in return, and vice versa. From the figure, banks do not directly cause pollution. However, they cause businesses to do so through the kind of activity they finance or invest in. (This is depicted by the dotted arrow). Environmental pollution in turn generates environmental risks in a form of credit risk, reputational risk, and business risk for the banks (as indicated by the blue arrow). The impacts of environmental risks on banks also extend to the wider economy. As depicted by the orange arrow in the figure, in the long-run, households and businesses may receive inadequate funding from poorly functioning and unstable commercial banks as a result of environmental risks.

Figure 1: Conceptual framework of the study
Source: Adapted from Lui and Lin (2014)

The judgement and response of banks to existing and emerging risks invariably converge in the adoption of common risk mitigating frameworks; either home-grown policies or internationally tested and accepted standard practice. This explains a central perception of, and mitigation of evolving risks. Hence, we formulate the following hypothesis:

Hypothesis 1 (RH1): Credit risk perceptions of managers of foreign banks and locally owned banks regarding the financing of the seven selected industrial businesses are the same.

The banking literature shows that banks tend to encounter credit risk more than any other risk of their operations are mainly tied to lending (Ariffin and Tafri, 2014; Win, 2018). Credit risk refers to the risk that a borrower fails to comply with a lender's term and conditions to repay a loan at the appointed time. Credit risk is mainly evaluated using non-performing loan ratio (Ruziqa, 2013).

Hypothesis 2: Reputational risk perceptions of managers of foreign and locally owned banks regarding the financing of the seven selected industrial businesses are the same.

Reputational risk as used in this study occurs when a bank gets a bad name or stigma after public scrutiny of a polluting activity it financed.

Hypothesis 3: Business risk perceptions of managers of foreign and locally owned banks regarding the financing of the seven selected industrial businesses are the same.

Chaffai and Dietsch (2015) defined business risk as the risk of adverse and unexpected changes in banks' profits arising from sudden changes in their activities. It is also the risk that a bank may lose value because its customers sharply curtail their activities during a market down-turn or because a new entrant takes market share away from the bank (Chockalingam et al. 2017). Here, business risk occurs when a bank's income is used to cleanup a contaminated site that it has taken from a sponsored client as collateral.

Research Methodology

Data was collected from primary and secondary sources between the period of 2006-2018. Primary data from a sample of ninety-six middle bank managers was collected using structured questionnaires. A 7-point Likert scale was used to assess financial risk exposure of banks to the financing of seven major industrial activities, namely agriculture (fishery, and forestry), mining, construction, commerce/trading, oil and gas production, oil and gas marketing, and manufacturing. As of 2019, there were about thirty-two commercial banks in Ghana. However, this research purposively focused on eight out of the thirty-two commercial banks and also distributed the questionnaires evenly among locally owned and foreign owned bank staffs. The data collection also took place in the southern parts of Ghana, especially in areas where it was possible to locate high-polluting environmental activities.

Time series secondary data was collected from a sample of thirty-two banks and five major industrial businesses, from 2006-2018. Data from the economic data unit of the Bank of Ghana (BoG) and the Ghana Statistical Service (GSS) were retrieved. Data from BoG was based on some financial performance indicators (including returns on asset (ROA) and returns on equity (ROE)) and banking stability indicators (including capital adequacy ratio (CAR) and non-performing loans ratio (NPLR) ratio). Also, data from GSS was based on growth of five major economic or industrial activities such as agriculture, mining, and quarry, construction, manufacturing, and trade, which we defined as environmental sources of bank financial risks. Data analysis was conducted using Stata version 14. Analysis involved a quantitative analysis of perceptions and impacts of environmental sources of financial risks on commercial banks in Ghana. Thus, quantitative research design was employed to examine relationships between key variables. The sample t-test was employed to compare the environmental risk perceptions of locally owned and foreign owned bank managers regarding the financing of the seven selected industrial businesses (agriculture, mining, construction, commerce/trading, oil and gas production, oil and gas marketing, and manufacturing).

Multivariate dynamic panel model was employed to find the relationships between environmental sources of financial risks, other economic factors and bank-specific factors, on the financial performance and stability indicators (including capital adequacy ratio (CAR), non-performing loans ratio (NPLR), return on equity (ROE) and return on assets (ROA)) of the banks. To analyze the effect of environmental sources of financial risks on financial performance and stability of banks, the study also included a yearly growth rate of the selected environmental sectors or economic activities and growth in gross domestic product (GDP) and headline inflation. Dynamic panel models are characterized by the presence of at least one lagged endogenous variable among the independent variables, as specified below:

The general dynamic model expression is:

$$y_{i,t} = \alpha y_{i,(t-k)} + \beta(L)X_{i,t} + \eta_i + v_{i,t} \quad (1)$$

where $|\alpha| < 1, i = 1, \dots, N$ and $t = 1, \dots, T$

where $y_{i,t}$ denotes individual i observed in period t ; $y_{i,(t-k)}$ is an observation on the same series for the same individual in the k previous periods; $\beta(L)$ is the $1 \times k$ vector of associated polynomials in the lag operator; $X_{i,t}$ indicates a $k \times 1$ vector of explanatory variables other than $y_{i,(t-k)}$; η_i are an unobserved individual-specific time-invariant effects which allow for heterogeneity in the means of the $y_{i,t}$ series across individuals; q is the maximum lag length in the model, the subscripts i and t denote the cross sectional and

time dimension of the panel sample, respectively, and $v_{i,t}$ is a disturbance term which is assumed to be independent across individuals.

We can estimate Equation (4) using the Generalized Method of Moment (GMM). The GMM estimation is based on the first difference transformation of Equation (1) and the subsequent elimination of individual specific effects. This can be shown as follows:

$$\Delta y_{i,t} = y_{it} - y_{i,(t-1)} = \alpha \Delta y_{i,(t-1)} + \beta(L) \Delta X_{i,t} + \Delta \varepsilon_{i,t}$$

$$\forall i = 1, \dots, N; t = 3, \dots, T; |\alpha| < 1 \quad (2)$$

where Δ is the first difference operator.

In Equation (3), the lagged dependent variable $\Delta y_{i,(t-1)}$ is by construction correlated with the error term, $\Delta \varepsilon_{i,t}$, imposing a bias in the estimation of the model. Rather the $y_{i,t}$ is expected to be correlated with $\Delta y_{i,(t-1)}$ but $\Delta \varepsilon_{i,t}$, $t = 3, \dots, T$ is used as an instrument in the estimation, given that the error terms are auto correlated. Using a lag of two or more may satisfy the following moment conditions.

$$E[y_{i,t-s} \Delta \varepsilon_{i,t}] = 0 \quad (3)$$

$$\forall t = 3, \dots, T; \forall s \geq 2$$

The dependent variables, capital adequacy ratio (CAR) was used to measure financial strength of banks while non-performing loan ratio (NPLR) was used to measure bank credit risk. CAR was evaluated as bank capital divided by its assets while NPLR was evaluated as the ratio of the total loan of banks that is in default at a particular time to the gross loan granted. Return on assets (ROA) and returns on equity (ROE) were used as proxies for banking performance. ROA measures the ratio of net income to the ratio of average total assets while ROE measures the ratio of net income to the ratio of average total equity. Banks' profitability shows their capacity to deal with potential risks. Higher ROA and ROE indicate a higher profitability. Headline inflation was calculated as total annual inflation, while GDP growth rate stood for the extent to which Ghana's economy is growing. The independent variables are the growth of mining, agriculture, construction, manufacturing and trade.

The general empirical models are as follows:

Capital adequacy ratio Equation

$$CAR_{i,t} = \beta_0 + \beta_1 CAR_{i,t-1} + \beta_2 agriculture_{i,t} + \beta_3 mining_{i,t} + \beta_4 trade_{i,t} + \beta_5 construction_{i,t} + \beta_6 manufacturing_{i,t} + \beta_7 GDP_{i,t} + \beta_8 headline_inflation_{i,t} + v_{it}, \forall i, t \quad (4)$$

Non-performing loan ratio Equation

$$Credit_Risk_{i,t} = \beta_0 + \beta_1 CAR_{i,t-1} + \beta_2 agriculture_{i,t} + \beta_3 mining_{i,t} + \beta_4 trade_{i,t} + \beta_5 construction_{i,t} + \beta_6 manufacturing_{i,t} + \beta_7 GDP_{i,t} + \beta_8 headline_inflation_{i,t} + v_{it}, \forall i, t \quad (5)$$

Return on Asset

$$ROA_{i,t} = \beta_0 + \beta_1 CAR_{i,t-1} + \beta_2 agriculture_{i,t} + \beta_3 mining_{i,t} + \beta_4 trade_{i,t} + \beta_5 construction_{i,t} + \beta_6 manufacturing_{i,t} + \beta_7 GDP_{i,t} + \beta_8 headline_inflation_{i,t} + v_{it}, \forall i, t \quad (6)$$

Return on Asset

$$ROE_{i,t} = \beta_0 + \beta_1 CAR_{i,t-1} + \beta_2 agriculture_{i,t} + \beta_3 mining_{i,t} + \beta_4 trade_{i,t} + \beta_5 construction_{i,t} + \beta_6 manufacturing_{i,t} + \beta_7 GDP_{i,t} + \beta_8 headline_inflation_{i,t} + v_{it}, \forall i, t \quad (7)$$

Results

The Bank of Ghana (BoG) classifies commercial banks into domestically-controlled and foreign-controlled. The sample comprised of fifty-two domestic bank managers and forty-four foreign bank managers. The domestic banks were Agricultural Development Bank (ADB) Limited, Ghana Commercial Bank (GCB) Limited, National Investment Bank (NIB) Ghana Limited, and Fidelity Bank Ghana, while the foreign banks were Zenith Bank, Stanbic Bank Ghana Limited, Ecobank Ghana Limited, and Barclay Bank (Ghana) Plc. Table 1 describes time series secondary data. The descriptive results show that the average CAR was 16.88%, with a minimum of 14.26% and a maximum of 19.49%. The mean NPLR was 13.73%, with a minimum of 6.92% and a maximum of 20.81%. The results also show that the commercial banking sector in Ghana has improved slightly, with around 23.93% and 4.43% increase ROE and ROA respectively, between 2006-2018. Also, some improvements were seen in the environmental sectors or economic activities over the same period. The mining sector recorded the highest growth, with a mean of about 27.78%, followed by the manufacturing sector (11.44%); trade (7.96%); agriculture (4.16%) and construction (3.19%).

Table 1: Summary statistics for secondary data on financial performance indicators and growth in environmental sectors

Variable	Obs.	Mean	Std. Dev.	Min	Max
CAR	13	16.88	1.47	14.26	19.49
NPL	13	13.73	4.30	6.92	20.81
ROE	13	23.93	4.37	17.67	31.26
ROA	13	4.43	1.06	3.42	6.29
AGRIC	13	4.16	3.06	-1.70	8.40
MNG	13	27.78	61.07	-7.60	206.50
CNSTRN	13	3.19	5.31	-1.30	17.00
MNFTRG	13	11.44	11.76	0.00	39.00
TRADE	13	7.96	4.48	1.60	14.50
INFLATION	13	13.57	3.70	8.73	19.30
GDP_GROWTH	13	6.67	3.53	2.20	14.00

Source: Field Data, 2019

Table 2-4 reports the results of bankers' perceptions of environmental sources of three types of financial risks in commercial banking, including credit risk, insolvency risk, and business risk. The sample t-test results in Table 2 indicate that the average credit risk perception of financing mining activities (4.875), agriculture (4.219), oil & gas marketing (4.125), oil & gas production (3.906), and commerce/trading (3.719) is higher compared to the average credit perception of financing manufacturing (3.479) and construction activities (3.167). Compared with foreign banks, managers of domestic banks perceive a significantly high credit risk of financing mining activities (6.250), agriculture (5.135), and construction (3.558) at 1% levels respectively while managers of foreign banks also perceive a significantly high credit risk of financing commerce/trading (4.795), oil & gas production (4.614), oil & gas marketing (4.409), and manufacturing (4.273) at 5%, 10% and 1% levels respectively when compared with domestic banks.

Table 2: Sample t-test results for bankers' perceptions of environmental sources of credit risk

	Pooled	Domestic Banks	Foreign Banks		
Sectors	Mean score	Mean score	Mean Score	diff	t-Ratio
Agriculture	4.219	5.135	3.136	1.998	4.028***
Mining	4.875	6.250	3.250	3.000	10.765***
Construction	3.167	3.558	2.705	0.853	4.079***
Commerce/Trade	3.719	2.808	4.795	1.988	5.777***
Oil & gas production	3.906	3.308	4.614	1.306	2.468**
Oil & gas marketing	4.125	3.885	4.409	0.524	1.713*
Manufacturing	3.479	2.808	4.273	1.465	7.359***

Source: Field Data, 2019

Table 3 also shows that, on average, reputational risk perception of financing mining (5.406), oil & gas marketing (5.031), oil & gas production (4.750), and agriculture (3.760) is higher, compared to reputational risk of financing manufacturing (3.219), construction (3.104), and commerce/trading (3.010). The results also suggest that domestic bank managers perceive a significantly high reputational risk regarding the financing of mining (6.538); agriculture (4.558), construction (3.250) and manufacturing (3.846), when compared with foreign bank managers at 1% and 10% significant levels respectively while foreign banks perceive a significantly high reputational risk regarding the financing of oil & gas marketing (6.000) and commerce/trading (4.205) at 1% significant levels respectively when compared with domestic banks.

Table 3: Sample t-test results for bankers' perceptions of environmental sources of reputational risk

	Pooled	Domestic Banks	Foreign Banks		
Sectors	Mean score	Mean score	Mean Score	diff	t-Ratio
Agriculture	3.760	4.558	2.818	1.740	4.430***
Mining	5.406	6.538	4.068	2.470	7.681***
Construction	3.104	3.250	2.932	0.318	1.699*
Commerce/Trade	3.010	2.000	4.205	-2.205	-18.693***
Oil & gas production	4.750	4.750	4.750	0.001	0.001
Oil & gas marketing	5.031	4.212	6.000	-1.788	-6.130***
Manufacturing	3.219	3.846	2.477	1.369	5.367***

Source: Field Data, 2019

The results in Table 4 further indicate that the financing of agriculture (4.625), commerce/trading (4.115), mining (3.969), and construction (3.865) is associated with a high business risk perception among bank managers, compared to the financing of oil & gas production (3.481), oil & gas marketing (3.346), and manufacturing (3.156). Managers of domestic banks had a significantly high business risk perception of financing agriculture (5.500), oil & gas production (4.865), mining (4.846), and oil & gas marketing (4.192) at 1% statistically significant levels respectively, while managers of foreign banks perceived a significantly high business risk of financing of commerce/trading (5.250), construction (4.273) and manufacturing (4.273) at 1% levels statistically significant respectively.

Table 4: Sample t-test results for bankers' perceptions of environmental sources of business risk

	Pooled	Domestic Banks	Foreign Banks		
Sectors	Mean score	Mean score	Mean Score	diff	t-Ratio
Agriculture	4.625	5.500	3.850	1.615	2.881***
Mining	3.969	4.846	2.932	1.914	5.646***
Construction	3.865	3.519	4.273	-0.753	-7.655***
Commerce/Trade	4.115	3.154	5.250	-2.096	-6.338***
Oil & gas production	3.481	4.865	2.500	2.365	4.804***
Oil & gas marketing	3.346	4.092	3.000	1.192	3.822***
Manufacturing	3.156	2.212	4.273	-2.061	-9.004***

Source: Field Data, 2019

Table 5 shows the coefficient, standard errors and statistical significance of the model estimating the impact of environmental sources of financial risk on banking performance and stability. The results reveal that, whereas the growth of agriculture, construction and trade are positively associated with bank CAR, mining and manufacturing have no positive association with bank CAR. Also, the growth of agriculture had a positive and significant effect on bank CAR. Except for agriculture, all the other environmental sources of financial risk had a significant influence on bank NPLR, with p-values less than 5%. However, the growth of mining, trade, and manufacturing negatively influence bank NPLR while the growth of construction positively influences bank NPLR. The results indicate that a unit increase in the growth of mining, construction, and trade increases CAR by a factor of 0.15, 0.18, and 0.14, respectively, while a 1unit increase in the growth of mining and manufacturing reduces CAR by a factor of 0.180 and 0.128. Also, a unit increase in the growth of mining, manufacturing, and trade reduces NPLR by a factor of 0.104, 0.436, and 0.126, respectively, while the growth of construction increases NPLR by 0.698.

Table 5: Factors determining non-performing loans (NPL)

Independent variables	CAR		NPLR		ROE		ROA	
	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.	Coefficient	Std. Err.
Agriculture	0.154**	0.07	0.075	0.087	0.149	0.4	0.008	0.057
Mining	-0.018*	0.009	-0.104***	0.007	0.072*	0.039	0.019***	0.005
Construction	0.181***	0.042	0.698**	0.055	-0.624***	0.199	-0.155***	0.035
Manufacturing	-0.128***	0.038	-0.436**	0.029	0.451***	0.172	0.060**	0.025
Trade	0.141***	0.043	-0.126**	0.046	0.267	0.166	0.068***	0.023
Headline inflation	-0.025	0.176	1.136	0.141	-1.852***	0.482	-0.342***	0.098
GDP growth	0.157	0.288	2.234	0.218	-3.198**	1.544	-0.610***	0.222
Constant	9.250	7.628	-21.287	3.644	57.833	18.682	10.539	2.920

Source: Field Data, 2019

The results show that ROA increases by 0.720% and 0.451% for a 1% increase in the growth of mining and manufacturing, respectively, and decreases by 0.624%, 1.852%, and 3.198% for a 1% increase in the growth of manufacturing, inflation and GDP respectively. Also, except for agriculture all the environmental sources of financial risk have a significant impact on ROA. However, mining, trade, and manufacturing cause an increase in bank ROA while growth in construction, inflation, and GDP cause a fall in bank ROA. From the results, a 1% increase in the growth of mining, manufacturing, and trade increases ROA by 0.019%, 0.060%, and 0.680%, respectively, while a 1% increase in the growth of manufacturing, inflation and GDP respectively, while manufacturing decreases ROA by 0.155%, 0.342%, and 0.610% respectively.

Discussion

The study clearly establishes that the financing of mining activities, agriculture and construction had significantly high credit risk perception by locally owned banks when compared with foreign owned banks while financing of commerce/trading; oil and gas production, oil and gas refinery and marketing and manufacturing had significantly high credit risk perception by foreign owned banks when compared with locally owned banks. Correspondingly, financing of mining activities, agriculture, construction and manufacturing had significantly high insolvency risk perception by locally owned banks when compared with foreign owned banks while financing of oil and gas refinery and marketing and commerce/trading had significantly high insolvency risk perception by foreign owned banks when compared with locally owned banks. Also, financing of oil and gas production, mining activities, and oil and gas refinery and marketing had significantly high profitability perception by locally owned banks when compared with foreign owned banks while financing of commerce/trading, construction and manufacturing had significantly high profitability perception by foreign owned banks when compared with locally owned banks. The perceptions of bankers about environmental risk are primarily important for financial risk management (Coulson, 1996). The findings further establish that the growth of mining, trade and manufacturing positively influence bank performance while the growth of construction and agriculture negatively influence bank stability; thus, providing supportive evidence that commercial banks require set standards that would guide clients' business towards environmental sustainability.

These findings agree with the affirmation by Thompson (1998) who observed that unsustainable activities of companies and businesses on the environment create significant financial risks for banks. Out of the seven explanatory variables included in the model, five had a significant influence on ROE, including the growth of mining, construction, manufacturing, inflation and GDP growth. The growth in mining and manufacturing cause an increase in bank ROE while the growth of construction, inflation, and GDP growth lower bank ROE. Further, the findings generally suggest that the growth of mining, trade, and manufacturing cause a rise in banking performance while the growth in construction and agriculture cause a fall in banking stability. This is not consistent with Dietrich and Wanzenried (2014) and Nouaili et al. (2015) who found that the growth of GDP is significantly associated with the improvement of banking performance in Tunisia. However, Daly and Frikha (2017) reported that the rapid growth in the customers' deposits are the important factors of bank performance.

Conclusion

The banking sector inevitably faces various financial risks through its lending and investment practices. Unsustainable production activities create environmental sources of financial risks for banks that in turn affect the performance and stability of banks. This study took a deeper look into the impacts of environmental sources of financial risks and establish empirical links or relationships between environmental sources of financial risks and financial performance and stability. A sample of ninety-six bank officials (including fifty-two domestic bank managers and forty-four foreign bank managers) in management positions from eight commercial banks was purposively selected in Southern Ghana. The study obtained time series secondary data on banking performance (denoted as ROA and ROE) and stability (denoted as CAR and NPLR) and growth of five major industrial businesses (including agriculture, mining, construction, manufacturing, and trade) as the environmental sources of financial risks, for a period of 13 years (thus, from 2006-2018). The results show that, in bank lending, mining was perceived to be the topmost source of indirect environmental risk (credit and insolvency risks), while agriculture was perceived to be the leading source of direct environmental risk (business risk). The findings suggest that perceptions of environmental sources of financial risk of domestic bank managers differ from those of foreign bank managers. Bankers' perceptions of environmental risk are important for financial risk management. The growth of mining, trade, and manufacturing are important for enhancing banking performance while growth of construction and agriculture are significant for improving banking stability. The findings could force banks to tackle environmental risks in their lending. The study suggests that commercial banks in Ghana should set standards that guide clients' business towards environmental sustainability.

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