How Germane is Banking Regulation and Supervision to Financial Sector Stability in Emerging Economies? Empirical Evidence from Ghana

Kofi Kamasa,[†] Daniel Ankrah,[§] Akyene Tetteh[‡] & Isaac Bonuedi[*]

Abstract
The purpose of this paper is to investigate the impact of banking sector regulation and supervision on financial stability in Ghana. The paper utilises a macro-level annual time series data covering the period 1990-2019 on financial development, bank regulation and supervision and other economic and institutional variables. The autoregressive distributed lags (ARDL) cointegration and estimation method is applied to estimate results. Having established the presence of cointegration, the results provide strong evidence that overall bank regulation and supervision contributes significantly to fostering financial stability in Ghana in the long run. Unbundling the bank regulation and supervision into its sub-components, the paper finds that capital regulation and transparency in financial statement practices exert the strongest impact on financial stability in Ghana in the long run. With regards to the covariates, the paper finds that corruption adversely affects financial stability whiles trade openness and human capital index improves financial stability. The paper provides some important policy implications and recommendations to consolidate and sustain the gains chalked so far in stabilising the financial sector in Ghana.

Keywords: Banking regulation and supervision; Financial stability; Cointegration; ARDL; Ghana

JEL Classification Codes: E02, E44, E58

[†] Corresponding Author, Department of Management Studies,University of Mines and Technology, Tarkwa, Ghana, kofikamasa@hotmail.co.uk
[§] Marketing Department, Zenith Bank Ghana Limited, Email:danielankrah99@yahoo.com
[‡] Department of Management Studies,University of Mines and Technology, Tarkwa, Ghana, Email: akytet@live.com
[*] Bureau of Integrated Rural Development, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, Email: bonuediisaac@gmail.com

1. Introduction

A well-functioning financial system is vital for a growing and prosperous economy (Beck et al., 2000). Through its intermediation services of providing savings/deposits, credit/loans, payments/transfers, and risk management, the financial sector ensures that funds are channeled from individuals and firms who have surplus funds to those who have a shortage.

A large body of literature suggests that the developments in the financial sector have remarkable impacts on economic development through its influence on economic growth, firm performance, investment, poverty, food security, and other development outcomes. For instance, Levine (2005) and Adu et al., (2013) have shown that better developed financial systems significantly drive firm growth and overall economic growth by easing liquidity constraints while Boateng et al., (2017) reported that a well-developed financial sector acts an important vehicle through which foreign direct investment affects domestic investment and propels economic growth. At the micro-level, other studies have also shown that a sound and healthy financial sector, which facilitates credit access, also contributes to poverty alleviation (Shaikh, 2017), and improved household welfare in terms of consumption and food security (Annim and Frempong, 2018).

To the extent that most transactions in the real economy are carried out through the financial system, the stability dimension of financial development is paramount for economic growth and development. According to Beck et al., (2008) and Schinasi (2006), a stable financial system is able to efficiently allocate resources, evaluating and managing financial risks, preserving the levels of employment near the economy's natural rate, and eradicating relative price fluctuations of real or financial assets that impact on monetary stability or employment levels. Strong regulation and supervision of individual banks and institutions is, therefore, essential for the stability of financial sector. As revealed by the global financial crisis of 2008-2009, the absence of such regulatory controls can lead to widespread defaults and other adverse effects that may significantly derail entire economies (Anginer et al., 2019).

Following years of concerted reforms and restructuring, Ghana's financial sector has witnessed significant expansion, with several new banks launching their operations in the country over the last ten years (Huq and Tribe, 2018; Quartey and Afful-Mensah, 2014). However, between August 2017 and January 2020, the banking sector in Ghana experienced a severe crisis, which saw the collapse of several indigenous banks. Among the casualties were UT Bank Ltd, Capital Bank Ltd, Unibank Ghana Ltd, Royal Bank Ltd, Beige Bank Ltd, Sovereign Bank Ltd, and Construction Bank Ltd. The operation licenses of these distressed banks were revoked and consolidated, whilst some were merged. This move was part of the Bank of Ghana's (BoG) recapitalization and clean-up exercise aimed at restoring investor and public confidence in the banking industry and financial sector at large.

The onset of the global financial crisis ushered in an epoch of intense re-regulation of the banking sector, with many countries undertaking several initiatives to address the shortcomings in market discipline, regulation, and supervision as highlighted by the crisis. The occurrence of banking crisis in Ghana almost a decade after the 2007-2009 global financial crisis, especially with regulatory lapses as one of the major drivers, reveals Ghana's inability to draw lessons from the global crisis and to put adequate measures in place to prevent its repetition. Ghana's

banking crisis has re-opened important policy discussions about the right blend of regulation and market discipline to ensure the safety, stability and efficient functioning of banking systems (see Anginer et al., 2019).

A number of studies have shown that banking regulation and supervision contribute significantly to improved financial sector development, especially in the areas of efficiency and effectiveness (Barth et al., 2004; Beck et al., 2013; Chortareas et al., 2012; Djalilov and Piesse, 2019). In Ghana, several studies have examined the role of financial sector reforms in improving financial sector development (Quartey and Afful-Mensah, 2014), the effects of financial development on domestic investment and foreign direct investment (Boateng et al., 2017; Kamasa et al., 2020) and economic growth (Adu et al., 2013). However, little is known about the effects of banking regulation and supervision on financial stability in Ghana. In the light of the regulatory lapses leading up to Ghana's recent banking crisis, this paper aims to fill this research gap in three specific ways. First, the paper will determine the impact of banking regulation and supervision on financial stability in Ghana. Second, it will go a step further to determine the specific aspect(s) of banking regulation and supervision that affect financial stability in Ghana the most. Third, the paper will identify the role of other economic and institutional factors in driving financial stability in Ghana.

The remainder of the paper is organized in the following. Section 2 succinctly deals with overview of financial sector and stylised facts in Ghana while section 3 considers the review of literature. The methodology, which comprises of model specification, data description and estimation strategy is laid out in section 4 while results presentation and discussion are carried out in section 5. Section 6 concludes the paper with policy implications.

2. Stylised facts on bank regulation and supervision in Ghana

Depicted in Figure 1 is the evolution in bank regulation and supervision indictors of Ghana during the study period. Prior to the global financial crisis in 2008/2009, the stringency of bank regulation and supervision deteriorated in most of its dimensions. Overall restrictions on banking activities (insurance, real estate and securities) fluctuated in the period leading up to the global financial crisis. In general, its score registered a downward trend, falling from 10 during 1990-2000 to 8 during the 2008-2011 (which coincides with the global financial crisis). However, the post-crisis period (2012-2018) registered a remarkable increase in the stringency of restrictions on banking activities. This is also consistent with the adoption of stricter or stronger regulatory reforms across the world following the crisis (Anginer et al., 2019). The index for official supervisory power, which entails whether the supervisory institutions have the authority to take specific actions to prevent and correct problems, remained stable at 10 throughout the pre-crisis era. However, it tumbled to 7 during the post-crisis epoch, signifying weakening in the regulatory and supervisory power during this period. Such regulatory and supervisory lapses have been cited as one of the triggers of the recent banking crisis in Ghana, which saw the collapse of several local banks (Bank of Ghana, 2018; Nyalatorgbi, 2019)
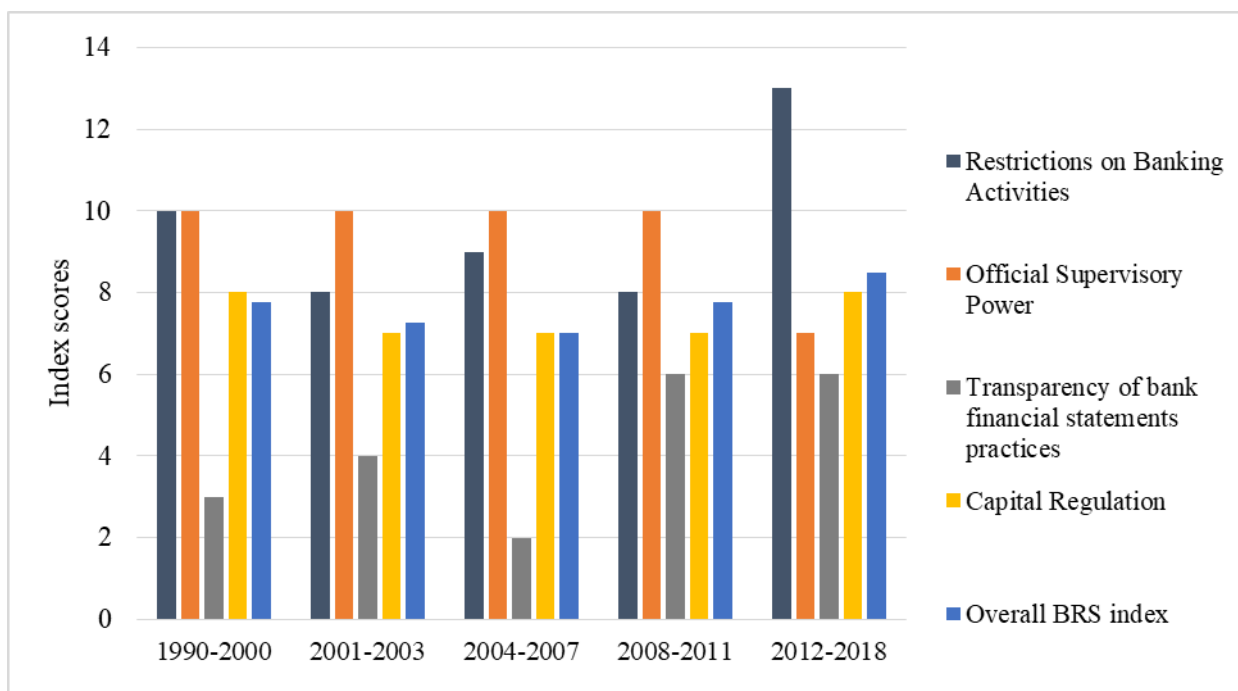
Figure 1: Evolution in bank regulation and supervision in Ghana
Source: Author's own construction based on the Barth et al (2013) & World Bank's Bank Regulation and Supervision (BRS) Surveys 1, 2, 3, 4 and 5.

Despite improving during 2001-2003, the transparency of practices to bank financial statements declined noticeably during 2004-2007. It however improved during the rest of the period. Capital regulation, which encompasses the stringency of overall and initial capital requirements, deteriorated throughout the pre-crisis period. Capital regulation however improved during the post crisis era as the Bank of Ghana consistently imposed higher minimum capital requirement (along with other regulatory measures) to protect depositors and promote the efficiency and stability of the financial system. In general, the overall bank regulation and supervision (BRS) index show positive trend over the study period. Although it declined slightly during 2001-2007, regulatory and supervisory responses in Ghana's banking sector have been stronger or stricter since the 2008 global financial crisis.

Figure 2 shows the development or the trend in bank credit to deposit ratio – the indicator of financial stability used in this paper. This ratio shows how much banks lend out of the deposits received or how much of their core funds are used for lending. As a measure of banks financial health, soundness or stability, a very high credit-deposit ratio is considered alarming because it indicates that the loans disbursed are high relative to the deposits, and hints at potential capital or liquidity problems in case unexpected fund requirements. Despite showing a general positive trend between 1990 and 2018, Ghana's credit to deposit ratio, expressed in percentages, remained below 100% between 1990 and 2018. This is indicative of a generally stable financial system over the study period. In terms of magnitude, the bank credit to deposit ratio averaged 59.318 % during this period, with a minimum of 34.160% in 1994 and 81.702% in 2000 (see Table 1).
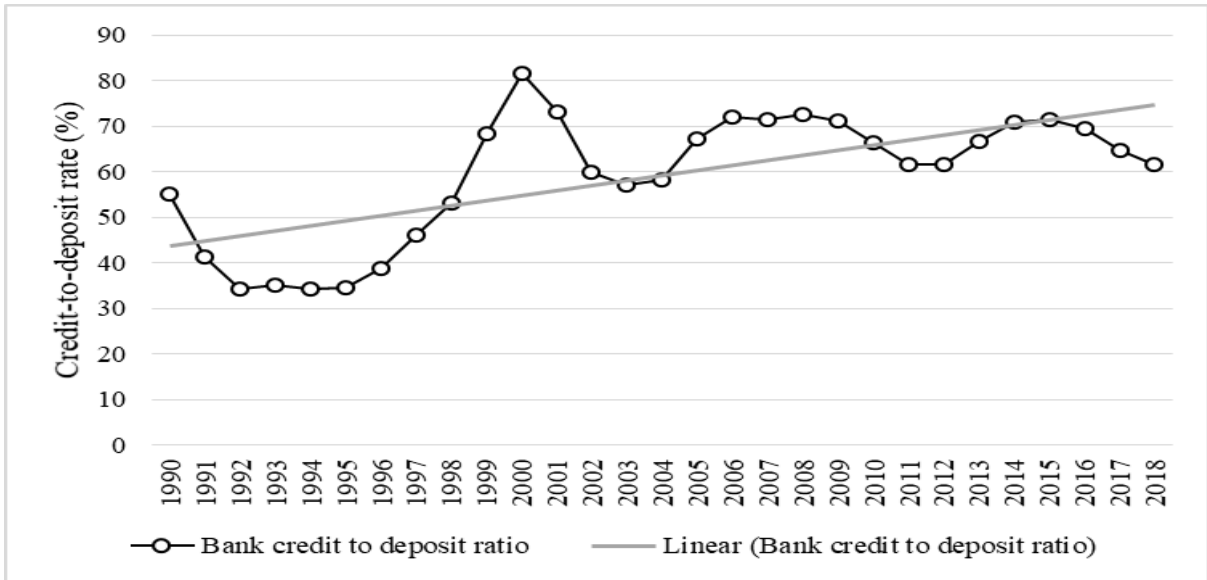
Figure 2: Trend in financial stability: bank credit to deposit ratio (%)
Source: Author's own construct based on Global Financial Development Indicators

3. Review of literature
3.1 Theoretical review
The first economic theory of financial regulation relates to the public interest theory of regulation, initially developed by Pigou (1932), which posits that economic markets have the tendency to operate inefficiently and in the interest of individuals, while neglecting the importance of the society as a whole. Therefore, government intervention in the form of regulations, is necessary to direct and monitor economic markets to make them work for social/public interest. In the case of finance, banks and other financial institutions are able to serve the social interest when resources are efficiently allocated and in the best interest of society. In this situation, the public interest theory requires the government to step in to regulate the markets for the benefits of society as a whole rather than a particular vested interest (Adams and Tower, 1994; Hertog, 2010; Huang and Shoenmaker, 2015).

As economic agents, regulators sometimes pursue their own interest, which may or may not be consistent with public interest. This assertion forms the premise of the capture theory, which predicts that regulation is a politically biased process bestowing benefits on politically powerful groups, firms or industries which may capture and control the regulatory process, and cause a regulatory agency to advance their special concerns that may be injurious to the public. Similar to the capture theory is the economic theory of regulation. Stigler (1971) noted that regulation does not exclusively arise to promote the overall public interest by addressing market failures, instead regulation is acquired by the industry and is designed and operated primarily for its benefit and that, regulation is an economic good whose provision and allocation are dictated by the market forces of demand and supply (Adams & Tower, 1994; Stigler, 1971).

The last but not least theory of regulation is the special interest groups theory of regulation. Proponents of this theory reject the capture theory's notion that one narrow group of vested interests can capture and monopolize regulatory agencies. Instead, they postulate that several

special interest groups actually contend for control of an agency's activities. Thus, per this theory, multiple powerful groups compete among themselves for the exercise of the coercive power of the government to legislate rules and regulations that would promote their commerce (Moosa, 2015).

3.2 Empirical review

The most notable study on bank regulation and supervision was the seminal work of Barth et al., (2004). Using their newly constructed database on bank regulation and supervision in 107 countries, Barth et al. (2004) found evidence that "policies that rely on guidelines that (1) force accurate information disclosure, (2) empower private-sector corporate control of banks, and (3) foster incentives for private agents to exert corporate control, significantly promote bank development, performance and stability". Chortareas et al., (2012) examined the linkages among bank supervision, regulation, and different aspects of commercial bank efficiency and performance. Their results revealed that strengthening capital restrictions and official supervisory powers can improve the efficiency of ban operations.

In a related study Klomp and Hann (2015a) examined whether the impact of bank regulation and supervision on banking risk depends on bank structure and found evidence that, capital requirements and supervisory control lowers banking risk. Again, Klomp and Hann (2015b) studied how bank regulation and the quality of institutions affect banking risk in emerging and developing countries and found that stricter regulation and supervision reduces banking risk. Yang et al., (2019) examined the relationship between regulation, supervision, and state ownership in commercial banks in the Asia-Pacific region for the period 2005 to 2014. Their results indicated that bank regulation and supervision contribute significantly to bank technical efficiency, while state ownership is not significantly related to bank efficiency. On their part, Bouheni et al., (2014) studied the effects of regulatory and supervisory policies on profitability and risk-taking for European banks over the period 2005 to 2011 and found that strengthening regulations and supervision improves profitability and boosts the stability of European banking systems. In their study on Turkey, Ozkan et al., (2014) investigated the effect of regulation on banking sector performance in an emerging country context. Not only did their results showed the positive effect of regulations on bank lending, asset quality, and profitability, but also, they showed that the sequence and timing of banking reforms in Turkey acted as a shield against the global financial crisis of 2008. In a recent study, Djalilov and Piesse (2019) investigated the effects of regulation on the efficiency of banks and found bank activity restrictions to be the only regulation contributing to improved banking efficiency in these countries.

In the case of Ghana only a handful of studies have examined empirically, the effects of banking regulation and supervision on the country's financial sector. In their study, Ackah and Asiamah (2014) examined the potential trade-off between financial regulation and financial stability in Ghana. They reported that although prudent and legal regulatory reforms pursued by the Bank of Ghana over the years ensured that the Ghanaian banking system continues to be sound, well-liquid and adequately capitalized, there remain significant counterparty risks as well as cross-border risks resulting from increasing integration of the financial markets in the sub region as a result of the expansion of regional banks. In the light of rapid loss of colossal amounts of money caused by the diamond micro-finance limited (DKM) financial saga in 2015, Wumbei et al. (2016) analyzed the strength, weaknesses, opportunities and threats inherent in the

banking and financial regulatory framework of the Ghana banking act and found that, supervision of the activities of various micro finance companies were not timely enough to avert some of the challenges witnessed in the DKM crisis. Last but not least, Dadzie and Ferrari (2019) documented that only the removal of entry restrictions contributed significantly to improving banks efficiency and that, private and global foreign rather than regional banks, benefit from the removal of entry restrictions.

Thus, while prior studies indicated significant impacts of bank regulation and supervision on bank performance, bank fragility, and bank efficiency, little attention has been paid to their impact on stability dimension of financial development in Ghana. This paper seeks to fill this literature gap.

4. Methodology
4.1 Model specification
Drawing from the existing literature (Chortareas et al., 2012; Dadzie & Ferrari, 2019; Klomp & Haan, 2015a, 2015b), the following is specified to estimate the impact of bank regulation and supervision on financial stability:

$$lnFINSTAB_t = \gamma_0 + \gamma_1 lnBRS_t + \gamma_2 lnTRADEOPEN_t + \gamma_3 lnINFLAN_t + \gamma_4 lnHC_t + \gamma_5 lnCORRUPT_t + \gamma_6 lnGOVSTAB_t + \gamma_7 lnTOTCRISIS_t + \varepsilon_t \qquad (1)$$

Equation (1) states that financial stability (*FINSTAB*) in year *t* depends on the degree of bank regulation and supervision (BRS_t), and a set of control variables namely trade openness (*TRADEOPEN*), inflation (*INFLAN*), human capital (*HC*), corruption index (*CORRUPT*), government stability (*GOVSTAB*), and total crisis (*TOTCRISIS*) experienced in the country at time *t*. Also, *ln* is the natural operator, t refers to time and ε is the error term.

To determine the effects of the individual components of bank regulation and supervision on financial stability, four variants of Equation (1) are specified for each sub-index of BRS as follows:

$$lnFINSTAB_t = \gamma_0 + \gamma_1 lnRESTACTIV_t + \gamma_2 lnTRADEOPEN_t + \gamma_3 lnINFLAN_t + \gamma_4 lnHC_t + \gamma_5 lnCORRUPT_t + \gamma_6 lnGOVSTAB_t + \gamma_7 lnTOTCRISIS_t + \varepsilon_t \qquad (2)$$

$$lnFINSTAB_t = \gamma_0 + \gamma_1 lnCAPREQ_t + \gamma_2 lnTRADEOPEN_t + \gamma_3 lnINFLAN_t + \gamma_4 lnHC_t + \gamma_5 lnCORRUPT_t + \gamma_6 lnGOVSTAB_t + \gamma_7 lnTOTCRISIS_t + \varepsilon_t \qquad (3)$$

$$lnFINSTAB_t = \gamma_0 + \gamma_1 lnFINTRANSP_t + \gamma_2 lnTRADEOPEN_t + \gamma_3 lnINFLAN_t + \gamma_4 lnHC_t + \gamma_5 lnCORRUPT_t + \gamma_6 lnGOVSTAB_t + \gamma_7 lnTOTCRISIS_t + \varepsilon_t \qquad (4)$$

$$lnFINSTAB_t = \gamma_0 + \gamma_1 lnSUPOWER_t + \gamma_2 lnTRADEOPEN_t + \gamma_3 lnINFLAN_t + \gamma_4 lnHC_t + \gamma_5 lnCORRUPT_t + \gamma_6 lnGOVSTAB_t + \gamma_7 lnTOTCRISIS_t + \varepsilon_t \qquad (5)$$

where *RESTACTIV, CAPREQ, FINTRANSP,* and *SUPOWER* are sub-indexes for overall restrictions on banking activities; capital requirements; financial statement transparency; and official supervisory power respectively. All other variables remain as previously defined.

4.2 Data Sources

This paper employs annual time series data covering the period of 1990-2019. Data on the indicators of bank regulation and supervision are sourced from the World Bank's regulation and supervision surveys (BRSS) compiled by Barth et al., (2004, 2013) and world bank (Anginer et al., 2019). The five waves of BRSS were released in 1999, 2003, 2007, 2011 and 2019. Given that that each survey was conducted over several years and bank regulatory and supervisory measures are slow-changing, observations for the first wave in 1999 were used for the period 1990-1999. Those for the second wave in 2003 were used for 2000-2003; the third wave in 2007 were used for 2004-2007; the fourth wave in 2011 were used for 2008-2011 and the fifth wave released in 2019 were used for the period 2012-2019.

Data on inflation and trade openness are sourced from the World Bank's world development indicators. Data is obtained for human capital per person from the Penn World Tables. Data on indexes for corruption and government stability are taken from the International Country Risk Guide (ICRG). Lastly, data on total crisis (the sum of crises related to the domestic currency, inflation, stock market, sovereign domestic and external debt and banking) are sourced from the financial market regulation and financial crises dataset of the World Bank and the International Monetary Fund.

4.3 Description and measurement of variables

Dependent variable: Financial Stability (FINSTAB)

The global financial development database has several indicators of financial stability. This paper employs the bank credit to bank deposits (%) as a of measure financial stability. It measures the financial resources provided to the private sector by domestic money banks as a share of total deposits. The higher the bank credit to deposit ratio (or the lower the loan-to-deposit ratio) the higher the reserves available to meet expected or unforeseen contingencies, and hence, the higher the level of financial stability.

The main independent variable: Bank regulation and supervision (BRS)

Based on Barth et al. (2008, 2013)[1], the regulatory and supervision variables include measures for: overall restrictions on banking activities (*RESTACTIV*), capital requirements (*CAPREQ*), financial statement transparency (*FINTRANSP*), and official supervisory power (*SUPOWER*). The overall bank regulation and supervision (*BRS*) index is measured as a weighted average of *RESTACTIV, CAPREQ, FINTRANSP,* and *SUPOWER* scores. Following Wijayanti (2019) the BRS index is calculated as by the formular indicated in equation (6):

$$BRS = w_1 RESTACTIV + w_2 CAPREQ + w_2 FINSTRAP + w_4 SUPOWER \qquad (6)$$

where w_i are weights such that $w_1 = w_2 = w_3 = w_4 = 1/4$ *or* 0.25. Higher values of the BRS index indicates stronger banking regulation and supervision.

Controlled Variables

Financial stability is affected by other factors apart from banking regulation and supervision, which needs to be controlled for. Macroeconomic stability is captured by inflation rate (*INFLAN*), which measure the annual percentage change in the consumer price index. Trade openness (*TRADEOPEN)* is included to capture the effects of external trade policy and is measured as total trade divided by the gross domestic product (GDP). In this paper, education as captured by the human capital index (*HC*), measures as the average years of formal education per person per year. Corruption (*CORRUPT*) and the associated financial crimes such as money laundering, and bribery in international business carried out by bankers and other players in the financial sector have been argued to be a catalyst of the global financial crisis. Government stability (*GOVSTAB*) is also included to account for the effects of political stability in fostering financial stability. Lastly, an index of total crisis (*TOTCRISIS*) is included to capture any financial crises related to the domestic currency, inflation, stock market, sovereign domestic and external debt and banking sector.

4.4 Estimation technique

This paper employs autoregressive distributed lag (ARDL) bounds estimator ahead of other cointegration methods in the estimation of the long-run equilibrium inferred by equations (1) to (5). ARDL models are known to produce accurate results in testing for long-run associations in smaller samples. In addition, the application of ARDL is appropriate even in the presence of a mixture of different orders of integration (*I*(0) and *I*(1) series). A dynamic error correction model (ECM) can be derived from ARDL. Similarly, the ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information and avoids problems such as spurious relationship resulting from non-stationary time series data.

The ARDL framework for analysing the long-run relationship between two variables *Y* and *X* can simply be specified as in equation (7) as:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \, \Delta Y_{t-i} + \sum_{i=1}^{p} \theta_k \, \Delta X_{t-i} + \alpha_1 Y_{t-1} + \alpha_k X_{t-1} + \varepsilon_t \qquad (7)$$

where Y is the dependent variable, X is the vector of all the explanatory variables included in equations (1) to (5). k is the number of explanatory variables. Δ is the difference operator and ε is error term. The long-run relationship between the variables of interest can be examined by testing the null hypothesis that the coefficients of the one period lagged level of the variables are simultaneously equal to zero (no cointegration): $H_0: \alpha_1 = \cdots = \alpha_k = 0$ against the alternative hypothesis that $H_1: \alpha_1 \neq \cdots \neq \alpha_k \neq 0$. The computed Wald test or *F*-statistic is the compared with the lower and upper critical values produced by Pesaran et al. (2001). If the calculated *F*-statistic exceeds the upper critical values, the null hypothesis of no cointegration is rejected, and if it falls below the lower critical values, then we cannot reject the null hypothesis of no cointegration.

When cointegration is established, the final step is to estimate the long-run and short-run parameters that characterized these relationships. The long-run ARDL (*p, q... q*) model is expressed as:

$$Y_t = \gamma_0 + \sum_{i=1}^{p} \gamma_{1,i} Y_{t-i} + \sum_{i=1}^{q} \gamma_{2,i} X_{t-i} + \mu_t \qquad (8)$$

The short-run error correction model is specified as:

$$\Delta Y_t = \gamma_0 + \sum_{i=1}^{p} \gamma_{1,i} \Delta Y_{t-i} + \sum_{i=1}^{q} \gamma_{2,i} \Delta X_{t-i} + \varphi ECT_{t-1} + \mu_t \qquad (9)$$

where all variables remain as previous defined, p and q are the maximum lag lengths of the respective explanatory variables, and μ_t is the error term. φ is the coefficient of the error correction term (ECT_{t-1}), which measures the speed of adjustment to the long-run equilibrium after a short-term shock.

5. Results and discussions
5.1 Preliminary results
The summary statistics of the other variables employed in the study are reported in Table 1.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Bank credit to deposit ratio (%)	59.318	13.946	34.160	81.702
Bank regulation & supervision index	6.336	0.355	5.750	7
Restriction on bank activities (3-12)	9.552	1.478	8	13
Transparency of financial statements (0-6)	3.828	1.466	2	6
Capital requirement (0-10)	7.40	0.548	7	8
Supervisory power (0-14)	9.690	0.930	7	10
Corruption index (0-6)	2.584	0.647	1.50	4
Government stability	8.089	1.638	5.333	11
Human capital (years)	2.175	0.166	1.874	2.465
Inflation (%)	19.634	12.058	7.126	59.462
Total crisis	0.724	0.882	0.00	3
Trade openness (%)	75.528	18.891	42.488	116.048

Source: Author's own construct

The average corruption index during the period under study is 2.584, which signals that Ghana is partly corrupt. The index for government stability, another indicator of institutional quality, averaged 8.089. This high value reflects the generally stable political environment that prevails in the country.

The average years of education in Ghana, as shown by the human capital index is 2.175 years person. This is relatively low and shows the low level of education for the average Ghanaian. Ranging from 7.126% and 59.462%, the rate of inflation is estimated to be 19.634% on average. The mean value of trade openness is 75.53% over the study period. This high value is indicative of the fact that Ghana's external sector has been highly opened and integrated into the global economy.

Unit root and cointegration test results

The results of the ADF unit root and cointegration tests are reported in panels A and B, respectively in Table 2. The *t*-statistics of the level results in panel A show that the null hypothesis of non-stationarity is rejected for only inflation and total crisis index. However, all the variables achieved stationarity after first differencing, which indicates that the variables are mixed integrated (of orders 0 and 1).

Table 2: Unit roots and cointegration results

Panel A. Unit root results			
Variable	**Level**	**1ˢᵗ Difference**	**Conclusion**
LNFINSTAB	-3.162	-4.327**	*I*(1)
LNBRS	-0.7183	-5.245***	*I*(1)
LNACTIVREST	-1.153	-5.243***	*I*(1)
LNFINSTRASP	-2.247	-4.986***	*I*(1)
LNCAPREQ	-1.859	-4.9755***	*I*(1)
LNSUPOWER	-1.042	-5.563***	*I*(1)
LNCORRUPT	-1.429	-4.671***	*I*(1)
LNHC	-2.563	-4.571***	*I*(1)
LNTRADEOPEN	-2.091	-5.414***	*I*(1)
LNINFLAN	-5.412***	-5.559***	*I*(0)
LNGOVSTAB	-1.556	-5.926***	*I*(1)
LNTOTCRISIS	-3.858***	-6.867***	*I*(0)

Panel B. ARDL bounds test for cointegration				
	Null hypothesis: No cointegration			
Test statistic	Value	Significance level	Lower critical bound I(0)	Upper critical bound I(1)
F-statistic	4.42	10%	2.03	3.13
K	7	5%	2.32	3.5
		2.5%	2.6	3.84

Notes: The figures in panel A are the t-statistics obtained from Augmented-Dickey Fuller unit root test. *** and ** denotes 1% and 5% level of significance, respectively

The results of the cointegration test reported in panel B show a computed F-statistic of 4.42, which exceeds the upper bound critical values at 5% significance level. This provides strong evidence of cointegration and thus the presence of a long-term equilibrium relationship between the outcome and explanatory variables.

5.2 Main results

The Long Run Results

The estimated effects of bank regulation and supervision on financial stability in the long run are reported in Table 3 in five separate models (columns). The results in Model 1 are based on the overall measure of bank regulation and supervision as the main explanatory variable of interest. The remaining results in Models 2–5 correspond to each sub-component of bank regulation and supervision.

Table 3: The long-run effects of bank regulation and supervision on financial stability

	Dependent variable: LNFINSTAB				
	Overall BRS	Individual components of BRS			
Variable	1	2	3	4	5
$LNCORRUPT_t$	-0.74***	0.20	-0.60***	0.02	0.22
	(0.20)	(0.35)	(0.13)	(0.21)	(0.39)
$LNHC_t$	2.79***	3.43***	1.86***	0.49	3.65*
	(0.70)	(1.13)	(0.71)	(1.34)	(1.69)
$LNTRADEOPEN_t$	0.39**	-0.61	0.45**	-0.12	-0.63
	(0.18)	(0.51)	(0.18)	(0.33)	(0.57)
$LNINFLAN_t$	0.03	0.05	-0.09	-0.13	0.02
	(0.07)	(0.14)	(0.06)	(0.08)	(0.16)
$LNGOVSTAB_t$	0.36	1.96**	0.41	1.63**	2.02*
	(0.31)	(0.86)	(0.28)	(0.58)	(0.96)
$LNTOTCRISIS_t$	-0.14	-0.19	0.08	0.11	-0.17
	(0.12)	(0.19)	(0.08)	(0.09)	(0.21)
$LNBRSINDEX_{t-1}$	2.11**				
	(0.82)				
$LNACTIVREST_{t-1}$		-0.29			
		(0.34)			
$LNFINTRANSP_{t-1}$			0.33***		
			(0.10)		
$LNCAPREG_{t-1}$				0.68**	
				(0.24)	
$LNSUPOWER_{t-1}$					0.24
					(0.65)
R-squared	0.97	0.96	0.97	0.98	097
Adjusted R-squared	0.94	0.94	0.95	0.96	0.94

*, **, and *** indicate statistical significance at 10%, 5% and 1% levels respectively.
Individual components of BRS displayed models 2, 3, 4 and 5
Model 2: restrictions on banking activities   Model 3: capital requirements
Model 4: financial statement transparency   Model 5: official supervisory power

From Model 1, the coefficient of the overall BRS is positive and statistically significant. This suggests that bank regulation and supervision exert positive and significant effect on financial

stability in the long run. The size of the estimated coefficient is 2.11 which means that a 1% increase in the strictness of bank regulation and supervision leads to a 2.11% increase in financial stability in Ghana. Displayed in Models 2–5 are the estimated long-run effects of the individual components of bank regulation and supervision on financial stability. As revealed, all the dimensions exert positive effects on financial stability in the long run, except restrictions on bank activities which proved negative albeit statistically significant. Transparency of practices related to bank financial statement and capital regulation are found to be the most significant drivers of financial stability in the long run. In terms of magnitude, the results show that a 1% increase in the financial transparency is estimated to increase financial stability by 0.33%. Similarly, a 1% increase in the stringency of capital regulation is found to increase financial stability by 0.68%. The effect of supervisory power, though positive, is not statistically significant. This result is consistent with both theoretical expectations as well as available empirical evidence. The more stringent the initial and overall capital requirement the more stable the financial sector is in the long run. This is because capital regulation ensures that banks have enough capital (liquidity) in relation to their assets to honour withdrawal requirements, whilst sustaining operation losses. It also prevents banks from engaging in financially irresponsible behaviours that leave them undercapitalized, and the entire financial system vulnerable to unforeseen shocks.

Similarly, increased transparency in financial reporting of banks ensures full disclosure of important information regarding the banks' activities, financial position and financial performance. By reducing information asymmetry and its associated risks, increased transparency strengthens market discipline and enhances financial stability. Barth et al. (2004) also found similar results that restrictions on bank activities affect negatively bank development, while capital regulations enhance bank stability. Similarly, Klomp and Hann (2015a) also found that stricter regulation and supervision, notably capital requirements and supervisory control diminish banking risk.

Aside regulation and supervision, the effects of some economic and institutional factors have been accounted for. Focusing on Model 1, the main results show that corruption, human capital (education), and trade openness exert significant effects on financial stability in the long run. In particular, an increase in the corruption index by 1% is estimated to lower financial stability by 0.74%, all other things being equal. This implies that weak institutions in the form of corruption pose a significant threat to the stability of the financial sector in Ghana. This finding is also in line with previous studies that document the negative effect of corruption on bank inefficiency (Chortareas et al., 2012) and bank profitability and stability (Asteriou et al., 2021). Also, a 1% increase in human capital results in a 2.79% increase in financial stability in the long run. In line with findings from elsewhere, this result points to the beneficial of education in enhancing financial stability by improving people's financial literacy, which encompasses financial knowledge, skills and behaviours (Reddy, 2019; Yates, 2019). In addition, a 1% in the degree of trade openness is estimated to increase the extent of financial stability by 0.39%. This can be explained by the view that higher trade openness increases competition and promotes diversified investment opportunities to banks. In a related study, Rahman et al. (2020) showed that trade openness has a beneficial impact on financial sector stability by increasing spread venture facilities and reducing the probability of bank risk-taking. With respect to the other control variables, while inflation and government stability had positive effects on financial

stability, total crisis had a negative effect on financial stability. However, none of them is statistically significant.

Short Run Results

Results of the short run estimation are reported in Table 4 in five columns (models). Focusing on column 1 which captures the overall regulation and supervision index, the coefficient of the error correction term (ECM) captures the speed of adjustment towards the long-run equilibrium. From the results, the coefficient of ECM (-0.652) is both negative and statistically significant. This implies that a deviation from the long-run in the previous period is corrected by 65.2% in the current period. Similar results are obtained for columns 2-5.

Table 4: Short run results

	Dependent variable: LNFINSTAB				
	Overall BRS	Individual components of BRS			
Variable	1	2	3	4	5
$\Delta LNCORRUPT_t$	-0.242*	0.088	-0.130	0.011	0.028
	(0.135)	(0.140)	(0.111)	(0.105)	(0.160)
$\Delta LNHC_t$	10.752**	1.472***	6.316*	-5.914	2.491
	(4.225)	(0.393)	(3.274)	(4.602)	(4.614)
$\Delta LNTRADEOPEN_t$	0.256*	-0.016	0.290**	0.167	-0.007
	(0.128)	(0.145)	(0.130)	(0.131)	(0.155)
$\Delta LNINFLAN_t$	0.017	0.054	-0.057	-0.017	0.050
	(0.047)	(0.050)	(0.041)	(0.039)	(0.054)
$\Delta LNGOVSTAB_t$	0.236	0.379	0.263	0.483**	0.315
	(0.193)	(0.247)	(0.166)	(0.207)	(0.274)
$\Delta LNTOTCRISIS_t$	-0.015	-0.017	0.052	0.054	-0.020
	(0.057)	(0.058)	(0.050)	(0.049)	(0.061)
ECM_{t-1}	-0.652***	-0.428***	-0.637***	-0.505***	-0.433***
	(0.112)	(0.101)	(0.108)	(0.094)	(0.123)
$\Delta LNBRSINDEX_{t-1}$	0.004				
	(0.482)				
$\Delta LNACTIVREST_{t-1}$		-0.123			
		(0.137)			
$\Delta LNFINTRANSP_{t-1}$			0.030		
			(0.066)		
$\Delta LNCAPREG_{t-1}$				-0.064	
				(0.067)	
$\Delta LNSUPOWER_{t-1}$					-0.178
					(0.290)

*, **, and *** indicate statistical significance at 10%, 5% and 1% levels respectively.
Individual components of BRS displayed models 2, 3, 4 and 5
Model 2: restrictions on banking activities   Model 3: capital requirements
Model 4: financial statement transparency   Model 5: official supervisory power

Again, focusing on column 1 (for the sake of brevity), the results show that overall bank regulation and supervision (BRS index) has a positive effect on financial stability in the short run, albeit statistically insignificant. This shows that while the regulatory and supervisory reforms may have positive impact on the stability of the financial sector, such beneficial effects are not realized (or significant) in the short run, possibly because of time lag between the implementation of policy measures and when they actually have the desired impact. The short run effects of corruption, human capital and trade openness are statistically significant. Corruption negatively affects financial stability, which is also consistent with the long run results. Similarly, improvement in human capital (education) is found to significantly increase financial stability in the short run. Trade openness also exerts a positive and significant effect on financial stability in the short run. These results show that improvements in both education and trade openness have beneficial impacts on financial stability both in the short run as well as long run. The effects of other covariates, namely inflation, government stability and frequency of crisis, remain statistically insignificant. These results are also consistent with the long run results.

5.3 Diagnostic checks
To assess the validity of the results for policy inference, several diagnostic checks are conducted based on equation (1). The tests results for serial correlation, heteroscedasticity, model specification and normality are provided in Table 5.

Table 5: Model diagnostic tests

PANEL A: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.115094	Prob. F(2,19)	0.3484
Obs*R-squared	2.939978	Prob. Chi-Square(2)	0.2299

PANEL B: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.420680	Prob. F(12,14)	0.9298
Obs*R-squared	7.155559	Prob. Chi-Square(12)	0.8472
Scaled explained SS	0.991636	Prob. Chi-Square(12)	1.0000

PANEL C: Ramsey RESET Test
Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	0.400806	13	0.6951
F-statistic	0.160645	(1, 13)	0.6951

PANEL D: Normality Test:

	Value	Probability
Jargue-Bera statistic	2.395306	0.3019

The test results in panels A, B, C and D indicate the absence of serial correlation, heteroscedastic residuals/errors, model misspecification and non-normality, respectively. Figure 1 also show that the cumulative sum (CUSUM) and cumulative sum of squared (CUMUSQ) of the residuals lie within the 95% confidence bands. This shows that the residuals are stable over time during the period of study.
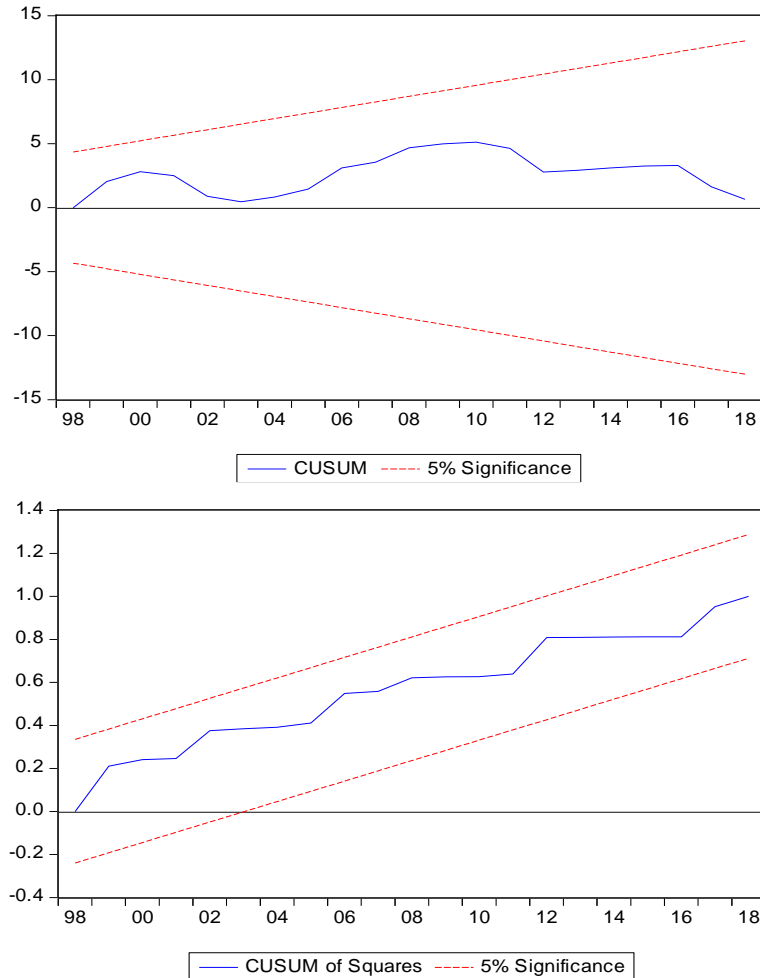
Figure 3: CUSUM and CUSUMSQ tests for stability

6. Policy implications

The findings have important implications for policies targeted at achieving financial stability in Ghana. To begin with, strengthening bank regulation and supervision can have significant beneficial impact on the stability of Ghana's financial sector. Thus, it is recommended that the Bank of Ghana take the needed steps to strengthen supervision and compliance across the industry with its regulatory measures, especially those related to capital requirements as well as transparency in financial statement practices to consolidate and sustain the gains made so far in stabilising the financial sector. Also, results provide evidence that corruption is a significant drag on the central bank and government's effort to achieving stability in the financial sector. This calls for instituting and strongly enforcing anti-bribery rules, anti-money laundering rules, and deploying tools that counter banking secrecy. Finally, policies that remove or limit

restrictions on cross-border trade and financial flows, and thus foster integration into the global economy should be promoted. This is because increased trade openness has the potential to increase efficiency in the allocation of capital through diversification of investments across local and international markets, to improve market liquidity due to inflow of external capital, as well as to improve financial stability by lowering the likelihood of asymmetric shocks and enhancing the capacity of the entire financial system to absorb shocks.

Note
1. For detailed methodology on the index construction, see Barth et al. (2008, 2013)

Funding
The authors received no direct funding for this research.

Disclosure statement
The authors report there are no competing interests to declare

References

Ackah, C. and Asiamah, J. P. (2014), "Financial regulation in Ghana : balancing inclusive growth with financial stability", *Overseas Development Institute Working Paper*, No. 410, London, UK.

Adams, M. B., & Tower, G. D. (1994), "Theories of Regulation : Some Reflections on the Statutory Supervision of Insurance Companies in Anglo-American Countries", *The Geneva Papers on Risk and Insurance*, Vol. 19 No. 71, pp. 156–177

Adu, G., Marbuah, G. and Mensah, J. T. (2013), "Financial development and economic growth in Ghana: does the measure of financial development matter?" *Review of Development Finance*, Vol. 3 No. 4, pp. 192–203.

Anginer, D., Demirgüç-kunt, A. and Mare, D. S. (2019), "Bank Regulation and Supervision Ten Years after the Global Financial Crisis", World Bank Group Policy Research Working Paper, No. 9044, Washington DC.

Annim, S. K. and Frempong, R. B. (2018), "Effects of access to credit and income on dietary diversity in Ghana, *Food Security*, Vol.10 No.6, pp. 1649–1663.

Asteriou, D., Pilbeam, K. and Tomuleasa, I. (2021), "The impact of corruption, economic freedom, regulation and transparency on bank profitability and bank stability: evidence from the Eurozone area, *Journal of Economic Behavior & Organization*, Vol. 184, pp. 150–177.

Bank of Ghana. (2018), BoG collapses 5 banks into Consolidated Bank Ghana Ltd, *Graphic Online*. https://www.graphic.com.gh/business/business-news/bog-collapses-5-banks-into-consolidated-bank-ghana-ltd.html

Barth, J. R., Caprio, G. J. and Levine, R. (2013), "Bank regulation and supervision in 180 countries from 1999 to 2011", NBER Working Paper No. 18733, Cambridge, Massachusetts

Barth, J. R., Caprio, G. J. and Levine, R. (2004), "Bank regulation and supervision: what works best?", *Journal of Financial Intermediation*, Vol. 13 No. 2, pp. 205–248.

Barth, J. R., Caprio, G. J. and Levine, R. (2008), "Bank regulations are changing : for better or worse?", World Bannk Policy Working Paper No. 4646, Washington, DC

Beck, T., Demirguc-Kunt, A., Laeven, L. and Levine, R. (2008), "Finance, firm size, and

growth", *Journal of Money, Credit and Banking*, Vol. 40 No. 7, pp. 1379-1405.

Beck, T., Jonghe, O. De. and Schepens, G. (2013), "Bank competition and stability : Cross-country heterogeneity" *Journal of Financial Intermediation*, Vol. 22 No. 2, pp. 218–244.

Beck, T., Levine, R. and Loayza, N. (2000), "Finance and the sources of growth", *Journal of Financial Economics*, Vol. 58 No. 1, pp. 261–300.

Boateng, E., Amponsah, M. and Annor Baah, C. (2017), "Complementarity effect of financial development and fdi on investment in sub-saharan africa: a panel data analysis", *African Development Review*, Vol. 29 No. 2, pp. 305-318

Bouheni, F. B., Ameur, H. B., Cheffou, A. I. and Jawadi, F. (2014), "The effects of regulation and supervision on European banking profitability and risk: a panel data investigation", *Journal of Applied Business Research*, Vol. 30 No. 6, pp. 1655-1670.

Chortareas, G. E., Girardone, C. and Ventouri, A. (2012), "Bank supervision , regulation , and efficiency : evidence from the european union", *Journal of Financial Stability*, Vol. 8 No. 4, pp. 292–302.

Dadzie, J. K. and Ferrari, A. (2019) "Deregulation , efficiency and competition in developing banking markets : Do reforms really work ? A case study for Ghana", *Journal of Banking Regulation*, Vol. 20 No. 4, pp. 328–340.

Djalilov, K. and Piesse, J. (2019), "Bank regulation and ef fi ciency : Evidence from transition countries", *International Review of Economics and Finance*, Vol. 64, pp. 308–322.

Hertog, J. den. (2010), "Review of Economic Theories of Regulation", Tjalling C. Koopmans Research Institute, Discussion Paper Series 10-18, Utrecht University, Utrecht, Netherlands.

Huang, H. R., & Shoenmaker, D. (2015). *Institutional Structure of Financial Regulation: Theories and International Experiences*, Routledge.

Huq, M. and Tribe, M. (2018), *The Economy of Ghana: 50 Years of Economic Development*, 2nd ed., Palgrave Macmillan UK.

Kamasa, K., Mochiah, I., Doku, A. K. and Forson, P. (2020), "The impact of fi nancial sector reforms on foreign direct investment in an emerging economy : empirical evidence from Ghana", *Journal of Humanities and Applied Social Sciences*, Vol. 2 No. 4, pp. 271-284.

Klomp, J. and Haan, J. De. (2015a) "Bank regulation and financial fragility in developing countries : does bank structure matter?", .*Journal of Advanced Research*, Vol. 5 No. 2, pp. 82–90.

Klomp, J. and Haan, J. De. (2015b), "Emerging markets finance and trade bank regulation , the quality of institutions , and banking risk in emerging and developing countries : an empirical analysis", *Emerging Markets Finance and Trade*, Vol. 50 No. 6, pp. 37–41.

Levine, R. (2005), "Finance and growth: theory and evidence", Handbook of Economic Growth, in: Philippe Aghion & Steven Durlauf (ed.), Handbook of Economic Growth, edition 1, volume 1, chapter 12, pages 865-934, Elsevier.

Moosa, I. A. (2015), *Good Regulation, Bad Regulation: The Anatomy of Financial Regulation*, Palgrave Macmillan.

Nyalatorgbi, E. (2019), "Bank of Ghana closes seven banks in banking crisis", *African Agenda*, Vol. 21 No. 3, pp. 33–35.

Ozkan, S., Balsari, C. K. and Varan, S. (2014), "Effect of banking regulation on performance : evidence from turkey effect of banking regulation on performance : evidence from Turkey", *Emerging Markets Finance and Trade*, Vol. 50 No. 4, pp. 196-211.

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001), "Bounds testing approaches to the analysis of

level relationships", *Journal of Applied Econometrics*, Vol. 16 No. 3, pp. 289–326.

Pigou, A. C. (1932), *The Economics Welfare*, MacMillan and Co Limited.

Quartey, P. and Afful-Mensah, G. (2014), "Financial and monetary policies in Ghana: A review of recent trends, *Review of Development Finance*, Vol. 4 No. 2, pp. 115–125.

Rahman, M. M., Begum, M., Ashraf, B. N. and Abdul, K, M. (2020), "Does trade openness affect bank risk-taking behavior? Evidence from BRICS countries, *Economies*, Vol. 8 No. 3, pp. 1 - 30

Reddy, D. P. S. (2019), "Financial literacy and stability of the financial system", *GIS Business*, *14*(4), 163–169.

Schinasi, G. J. (2006), *Safeguarding Financial Stability: Theory and Practice*, International Monetary Fund.

Shaikh, S. A. (2017), "Poverty alleviation through financing microenterprises with equity finance", *Journal of Islamic Accounting and Business Research*, Vol. 8 No. 1, pp. 87-99.

Wumbei, I. S., Ibrahim, H. Y. and Alhassan, N. (2016), "An assessment of the banking regulatory and market framework in ghana in the wake of dkm diamond micro- finance limited financial saga", *Research Journal of Finance and Accounting*, Vol. 7 No. 18, pp. 114–120.

Yang, Z., Gan, C. and Li, Z. (2019), "Role of bank regulation on bank performance : evidence from asia-pacific commercial banks", *Journal of Risk and Financial Management*, Vol. 131 No. 12, pp. 1–25.

Yates, S. R. (2019), "From financial education to financial literacy to financial stability: evidence of national and regional connections", *Journal of Personal Finance*, Vol. 18 No. 2, pp. 51–59.