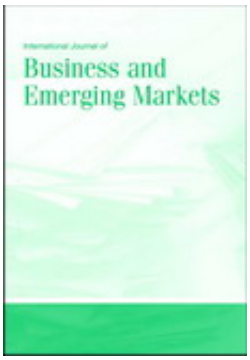

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Board dynamics, dividend pay-out policy and banking efficiency in an emerging market context

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Abstract: In this paper, we examine the interactive role of board dynamics in explaining the link between dividend pay-out policy and banking efficiency. Prior to that, it investigates whether board dynamics contribute to dividend pay-out policy. The study applies data from 23 Ghanaian banks over the period 2010–2020. The panel-truncated regression was used to examine the interaction effect of board dynamics and dividend pay-out on banking efficiency. We found that the banks in Ghana do not fully utilise their inputs to be able to operate on their optimal efficiency. We found that board independence, board size and tenure of CEO are important determinants of dividend pay-out policy. Further, free cash flow' hypothesis explains a negative impact of board dynamics and dividend pay-out policy on banking efficiency. The current study makes novel contribution to the existing literature by establishing that board dynamics play a strong interactive role in the relationship between persistent dividend pay-out policies and banking efficiency.

Keywords: DEA efficiency; board dynamics; dividend policy; panel-truncated model.

JEL codes: G3, G32, G35, G38, D46.

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1 Introduction

In making informed decisions about the financial sector, it is important for regulators to have sufficient and accurate information that will impact their operations. In particular, banking regulators need to have comprehensive knowledge based on empirical research on whether internal banking mechanisms and dividend policy may lead banks to operate in their optimal capacity. In view of this, banking efficiency is important to most policymakers, regulators, managers, and financial advisors (Thaker et al., 2022; Oteng-Abayie et al., 2019; Berger and Humphrey, 1997). Banking efficiency is the optimal use of possible combinations of input and output that offer the highest efficiency, given a specific level of input. In this case, efficient banks are those classified as 'best' banks relative to their counterparts under similar market conditions. According to Jensen (1988), "the free cash flow hypothesis indicates that a company that generates a large amount of free cash will be less disciplined in its spending than a company that has legal obligations (debts) on which to spend cash." Thus, efficient banks will invest the free cash flow in less growth opportunities rather than paying out to shareholders. Thus, the critical decisions for banks to operate within their optimal efficiency, including

incentives, dividend payments and internal control mechanisms and strategies, are taken up by the board of directors. As a result, internal policy mechanisms (dividend and board dynamics) are vital keys to understanding banking efficiency.

Studies have highlighted either a positive or a negative effect of dividend policy on firm value (Acharya et al., 2010; Ranti, 2013; Leung et al., 2014; Lumapow and Tumiwa, 2017). The latter results have largely been attributed to the measures of firm value, indicating that shareholders can benefit from higher dividend in a more sustainable firm (Matos et al., 2020). Of these relationships, board dynamics play a major role in facilitating the impact of dividend pay-out policy on the value of firms. This shows that the collective function of CEOs and the characteristics of the board play a key role in determining dividend pay-out policy (Alias et al. 2016; Fuzi, et al., 2016). Thus, several studies have examined the impact of board characteristics on dividend pay-out policy (Abdelsalam et al., 2008; Crittenden and Crittenden, 2012; Krechovska and Prochazkowa, 2014; Odeleye, 2017). However, the direct impact of board characteristics and dividend pay-out on the efficiency of banks may not be informative to policy makers. It may be interesting to understand how board dynamics interact with dividend pay-out policy to drive banking efficiency. This study fills in the gap by first examining the empirical relationship between board dynamics and dividend pay-out policy.

Second, the study empirically analyses the interaction effect of board dynamics on the relationship between dividend pay-out policy and banking efficiency, by employing robust estimations that cover an emerging economy, particularly, Ghana. Prior to examining this relationship, we test that board dynamics and dividend pay-out policy independently influence banking efficiency in emerging economy. Previous studies have tested these relationships from different perspective. For instance, Sheng et al (2020) show that dividend policy decision drives the future growth and profits of battery manufacturing firms in China and Taiwan. Al-Kahmisi and Hassan (2018) indicated that the nature of board dynamics varies from country to country, but all countries generally have their own corporate governance codes that govern their efforts and direction. Agoraki et al. (2010) showed that board size negatively affect cost and profit efficiency of European banks while board composition has a non-linear relationship with profit efficiency. Studies that analysed the interrelationship between dividend policy, board dynamics and firm performance were focused on firms in developed economies (Abdul and Muhibudeen, 2015; Mamaro and Tjano, 2019; Das, 2020). Moreover, Ofori-Sasu et al (2017) provide evidence that dividend policy increases shareholders' value at the firm level. However, these studies did not consider how both board dynamics and dividend pay-out policy may influence banking efficiency. Additionally, conflicting relationships exist in these studies and may be attributed to poor governance mechanisms, differences in context and institutional frameworks across different countries. In particularly, our study captures periods where the banking sector clean up occurred – when monetary authorities in Ghana allowed indigenous banks to takeover some non-performing banks in the country.

From emerging context, a previous study has tested the interaction effect of board dynamics on the relationship between dividend pay-out policy and shareholders' wealth (Ofori-Sasu et al. 2019). However, they focused on the value of shareholders using both firm value and market value of listed firms. This paper is conducted by focusing on how board dynamics moderate the impact of dividend pay-out policy on banking efficiency. Banking efficiency has been measured using sophisticated accounting measures (Staub et al. 2010). However, the use of accounting ratio analysis as a standard measure of

efficiency can be very misleading. Data envelopment analysis approach (DEA), which uses the non-parametric approach for measuring banking efficiency, has received much attention by researchers (Thaker et al. 2022; Blankson et al., 2022; Sarpong-Danquah et al., 2022; Aboagye et al. 2012; Yang, 2009). For instance, a recent study by Thaker et al. (2022) employ the DEA and random forest regression approach to examine corporate governance and bank efficiency in India and found that corporate governance play a significant role particularly in new profit efficiency. However, what is missing in earlier empirical literature, from emerging economies, is how board dynamics interacts with dividend policy to impact banking efficiency.

We contribute to literature by empirically examining interrelationship between board dynamics, dividend policy and banking efficiency. We also look at how past board dynamics and changes in dividend pay-out and its lags affect banking efficiency. Further, we argue that the decision of the board and dividend policy may not influence banking efficiency immediately. Therefore, we conduct a robust analysis to capture the moderating effect of board dynamics on the relationship between changes in dividend pay-out policy and its lags on banking efficiency. The study uses data on the Ghanaian banks, covering 2010-2020 period and presents data points helpful in testing the hypotheses of the study. We focus on banking efficiency by using the DEA approach which makes this study novel and different from the work of Ofori-Sasu et al (2019).

Ghana provides an interesting case study for our empirical experiment for a number of reasons. First, policy makers in Ghana are now viewing board dynamics and dividend pay-out policy as important mechanisms to drive banking efficiency. In July 2018, the Bank of Ghana attributed the collapse of some Ghanaian banks to corporate governance practices [Addison, (2018), p.1], but ignored the conditional effect of corporate governance mechanisms in explaining the relationship between dividend policy and banking efficiency. Secondly, some financial institutions have been commonly cited examples of the negative repercussions of weak board structures. Thus, the opportunistic behaviour of managers and board members, and agency interactions at various levels of the company may affect dividend policy and companies' ability to operate on the frontier efficiency. Finally, the direct effect of either board dynamics or dividend policy on banking efficiency may not be informative to policy makers in the Ghanaian context. Although, the dynamics of board of directors are characterised by individuals involved in issues related to the decision-making process, the role of board dynamics is necessary to understand how dividend pay-out policy may drive banking efficiency. Moreover, both dividend policy and dynamics of board are necessary and must complement each other to drive the banking efficiency. The current research contributes to the literature by examining how board dynamics affect dividend pay-out policy and how these two concepts interact to drive the banks to their optimal efficiency. This is informative to policymakers as it provides a novel approach in understanding how individual characteristics of the board interact with past and immediate dividend pay-out policies to achieve the best banking efficiency.

The 'rest of the section is organised into the literature review Section 2, methods Section 3 empirical results Section 4 and conclusion and implication of the study Section 5.'

2 Literature review

2.1 Theoretical review

An understanding of efficiency provides board governors with accurate information needed to take decisions for the firm. Banking efficiency has extensively been used to analyse the efficiency of banks. There is no consensus on the best efficiency approach or set of methods for measuring banking efficiency, because the choice of method may influence the policy conclusions that may be drawn from the analysis (Bauer et al. 1998). The theoretical evidence by Berger and Humphrey (1997) argues that the whole idea of measuring a banking efficiency is to inform managers and policy makers – to make decisions about market structure that affect banking efficiency. The data development approach (DEA) allows policy makers to measure the relative distance that a single decision making unit (DMU) (like banks) lies away from this estimated efficiency frontier.

One of the newly developing literature in corporate finance research is how corporate governance and dividend policy affect the performance in emerging markets. Moreover, quite a number of studies have been premised on how certain theories like agency cost (Berle and Means, 1932) and stewardship theory (Donaldson and Davis, 1991) influence corporate governance but conclusions were drawn on whether issues of corporate governance affect firm value in emerging markets (Kyereboah-Coleman, 2007; Hussein and Venkatram, 2013). Agency theory, according to Jensen and Meckling (1976), can be explained from the conflict of interest between insiders and outside shareholders. They proposed that dividend policy provides an incentive for managers to reduce agency costs related to principal-agent relationship. Managers are able to function well to increase dividends, thereby reducing agency costs. This suggests that paying higher dividends to shareholders, reduces the internal cash flows subject to management discretion and board decision. Thus, forcing the firm to seek for external funds at higher cost of capital. Monitoring management performance by outside suppliers of capital (new funds) ensures that managers work in the best interest of shareholders through dividend payments.

In addition, theories in the literature, have been used to explain the behaviour of board members in the dividend distribution decision. These theories are relevant in efficiency framework of DMUs. Despite the contributions of these theories to the efficiency literature, our study draws motivation from the cash flow hypothesis which suggests that agency costs and free flows can be reduced when companies pay dividends (Richardson, 2006). An argument by Myers (2000) posits that managers may even be willing to pay dividends in order to avoid disciplinary action by shareholders. Managers of banks are able to work in the best interests of shareholders, increasing dividends, and thus reducing agency costs. This suggests that paying higher dividends to shareholders will reduce internal cash flows, subject to management's discretion and the decision of the board. Contrary to the pivotal work by Modigliani and Miller (1958), dividend irrelevance theorists argued that companies that have higher returns than cost will retain the earnings to finance the project and shareholders will be paid the residual dividends. Thus, managers or board members may pay dividend to shareholders in order to maximise the wealth of shareholders by constructing a well-diversified portfolio.

Drawing from the free cash flow hypothesis, the study argues that the free cash flow hypothesis may induces a positive or a negative impact on board dynamics in explaining the link between dividend pay-out policy and banking efficiency. The free cash flow

hypothesis claims that a company that produces a lot of free cash will be less disciplined in its expenses than a company that has legal obligations (debt) to which cash should be spent. Thus, when profits are made, the bank may provide some cash dividend to the owners in a certain percentage of the profits realised or made on an investment project. It is the responsibility of the bank to issue the cash dividend or not, by going through a decision process by the board of directors.

2.2 Empirical review

2.2.1 Board structure and dividend pay-out policy

The board of directors take decisions about dividends payments and may be influenced by the amount of dividends to be paid to its shareholders (Al-Kahmisi and Hassan, 2018) and their level of discipline in the payment of dividend from free cash flows. Empirical evidence established on the relationship between board structure and dividend policy in emerging economies (Adjaoud and Ben-Amar, 2010) show a positive relationship between board composition and dividend policy. Khedmati et al. (2020) find that stronger CEO ties to independent board members make monitoring ineffective, which in turn, aggravates the pay-out decision and lead to inefficient labour investment problem. Al-Kahmisi and Hasan (2018) found that CEO duality and board independence were negatively linked to dividend pay-out policy while the work of Dissanayake and Bandara (2018) used the logistic regression model to investigate the characteristics of the board in explaining dividend policy in Sri Lanka. They found an inverse effect of the size of the audit committee and the independence of the board on the likelihood to pay dividend. They also found a negative association of women on board, size of the board and CEO duality on the likelihood of dividend pay-out. Dzingai and Fakoya (2017) examined the impact of corporate governance on corporate performance and observed that the tenure of the CEO, the size of the board and the independent boards are positively related, while CEO duality and firm value are negatively related. Moreover, Alias et al (2016) applied 361 listed corporations on the Malaysian Stock Exchange for the period 2002–2007. They interacted free cash flow with the characteristics of board of directors (independent directors, size of the board of directors and dual roles of CEOs) and dividend per share. They found that the dividend pay-out increases with large size of independent directors. Additionally, there was a negative and significant relationship between role duality and dividend per share.' The discussion above implies that different measures of corporate governance have an impact on dividend pay-out policy. In light of this, the study formulate the hypothesis as follows:

H1 Characteristics of board dynamics are important determinants of dividend pay-out policy of banks.

2.2.2 Interrelationship between board structure, dividend pay-out policy and efficiency

The board of directors play an important role in driving the banks to their frontier efficiency when taking dividend pay-out decision. In the literature, Oteng-Abayie et al. (2019) used DEA methods and regression techniques to examine the level of technical efficiency of rural commercial banks in Ghana and the impact of corporate governance variables on the efficiency of these banks. They found that 11% to 20% of banks operated

close to the efficiency frontier during the period, 2007–2013. In addition, they found that the number of directors and the frequency of board meetings have a significant impact on the efficiency of rural banks. A study by Dzingai and Fakoya (2017) shows that the characteristics of the board structure affect company's efficiency. Recently, Thaker et al. (2022) applied the DEA and the machine learning based random forest regression to examine the impact of corporate governance characteristics on bank efficiency in India over the period 2008–2018. They provide evidence that board characteristics play a significant role in new profit efficiency while gender diversity contributes significantly to both new technical and new cost efficiency. In examining the determinants of efficiency of banks, Blankson et al. (2022) used the DEA approach, the static and dynamic panel regression estimators for 21 banks in Ghana over the period 2008–2019. They found a remarkable improvement in both the pure technical efficiency and cost-efficiency levels of banks due to an increase in the size of banks, GDP growth and inflation over the period.

It is obvious that dividend policy affects company performance (Bostanci et al., 2018; Hussainey et al., 2011; Azhagaiah and Sabari, 2008). For instance, Bostanci et al. (2018) observed a positive relationship between dividend payments and efficiency using the return on equity (return), as well as a positive association with previous year's dividend policy ratio which supports the free cash flow hypothesis. Taufik and Bastian (2018) used the panel dataset of listed state banks on the Indonesian stock exchange for the period, 2010–2015. They found a direct relationship between domestic institutions share ownership on efficiency. Previous studies, as discussed above, provide a mixed result on the impact of corporate governance characteristics and dividend pay-out policy on bank efficiency based on the methodological approach they used, in particular, they employed accounting ratios to proxy bank efficiency.

Given the above empirical evidence in the literature, the study hypothesise that:

H2 Board dynamics and dividend pay-out policy independently affect banking efficiency.

Recently, Mai and Syarief (2021) explored the impact of corporate governance on dividend policy in the banking sector indexed in Indonesian Stock Exchange from 2009 to 2019. They found that five criteria of corporate governance (institutional ownership, board size, audit committee size) have a positive impact on banks' propensity to pay dividends and dividend pay-out ratio. Moreover, studies show that the relationship between payment policy and efficiency can be influenced by the dynamics of the board of directors (Ofori-Sasu et al., 2017). For instance, John and Knyazeva (2006) show that board structure affects the dividend policy and may translate into impacting the efficiency of companies. However, there are no empirical studies on this relationship for banks in Ghana. It is noteworthy that there are studies that examine the individual effects of board structure and dividend policy on bank efficiency. Interestingly, inferring from the literature on corporate governance, banking efficiency can be achieved through board dynamics and pay-out policy. However, previous studies have not tested this assertion. Mubaraq et al (2021) determined the moderating effect of corporate governance on the relationship between dividend and firm value. They found that a positive relationship exists between dividend policy and firm value. Further, they show that corporate governance moderates a significant effect on the relationship between dividend policy and firm value. However, the literature is silent on how board dynamics interact with pay-out policy to influence bank efficiency. In view of that, the current study provides a

novel contribution to existing literature by examining the interactive effect of board dynamics on the relationship between dividend pay-out and banking efficiency. Hence the following hypothesis

H3 Board dynamics and dividend pay-out policy of banks jointly affect bank efficiency.

3 Data and methodology

We show the interaction effect of board dynamics in explaining dividend policy-bank efficiency nexus. We use panel dataset from 23 banks in Ghana over the period, 2010–2020.

The baseline model of the study is expressed as:

$$\begin{aligned} &Banking\ efficiency \\ &= f(Board\ dynamics,\ dividend\ pay-out\ policy,\ control\ variables,\ error\ term) \end{aligned} \tag{1}$$

3.1 Measurement of efficiency

In equation (1), the dependent variable is banking efficiency. We employ Data Envelopment Analysis (DEA) approach to generate efficiency scores (see also, Thaker et al., 2022; Blankson et al., 2022; Antunes et al., 2022; Haslem et al., 1999). The efficiency scores generated from the solver reveal how efficient the banks are and the scores tell us how close the banks operate on their optimal capacity.

For each DMU (DMU0, that is, each bank's weight is derived by solving an optimisation problem which involves the maximisation of the efficiency ratio for that DMU, subject to the constraint that the equivalent ratios for every DMU (h_0) in the set is less than or equal to 1.

To express the basic DEA model mathematically, assume that each DMUs (i.e., a bank) use m inputs for production of n outputs in a given technology level.

The frontier efficiency of the banks, DMU (h0) can be written as:

$$Maximize\ h_0 = \frac{\sum_i^s U_i y_i q}{\sum_j^m V_j x_j q};\ Subjectto\ \frac{\sum_i^s U_i y_i k}{\sum_j^m V_j x_j k} \leq 1 \tag{2}$$

where

$k = 1, 2, ..., n$

U_i, $i = 1, 2, \ldots, s$, are weights assigned to i-th output

V_j, $j = 1, 2, \ldots, m$, are weights assigned to j-th input

x_j inputs of the j^{th} bank

y_i output produced by the i^{th} bank

k observed bank (inefficient bank)

q best practice bank (efficient bank).

The 'study adopted an intermediation approach that assumes that the primary purpose of banks is to convert deposits (liabilities) and costs (interest expenses) into loans (assets) and other profits. 'Total cost and total deposits were used as input variables while total loans and other profits were used as output variables'.

The efficiency technique was based on two assumptions, namely; constant return to scale (CRS) and variable return to scale (VRS). The input-oriented CRS model assumes that banks operate in an optimal scale (same size) while the input-oriented VRS model assume that banks operate in an imperfect competitive environment. The DEA efficiency scores range between zero and one and the distribution of efficiency scores are truncated above from unity. The efficiency score index from the DEA adjusts for the assumption of VRS and CRS of banks operating in Ghana. In this case, the observations of the dataset are censored, and we discard the censored observations'.

3.2 Model specification

Prior to estimating the baseline model, we establish the relationship between board dynamics and dividend pay-out policy.

3.2.1 Board dynamics and dividend pay-out policy

First, we find out how board dynamics influence dividend pay-out policy. We specify this relationship using the mixed effect regression model as follows:

$$\begin{aligned} Dividend\ \ payout\ \ policy_{it} = & \sum_{l=1}^{s} \alpha_l\ Board\ \ structure\, dynamics_{it-1} \\ & + \sum_{k=1}^{N} \beta_k X_{ijt} + \lambda_i + \mu_t + \varepsilon_{it} \end{aligned} \tag{3}$$

The dependent variable is dividend pay-out policy. This is measured as the ratio of dividend pay-out to the number of shares outstanding.

The subscript i denotes the cross sectional dimension (bank), $i = 1, \ldots z$; t denotes the time series dimension (time), $t = 1, \ldots, T$; and t–1 denotes a year lag of the time series dimension.

α_l $l = 1, \ldots, s$, represent the regression coefficients of a vector of board dynamics variables

βk $k = 1,\ldots N$ are regression parameters for vector X to be estimated

λi is the bank fixed effect i; and μ_t is the time fixed effect t

ε_{it} is idiosyncratic error term which controls for unit-specific residual in the model for the i^{th} *bank at period t*.

Board dynamics is decomposed into four namely; independent directors, board size, CEO duality and CEO tenure. Independent directors is measured as dummy, which takes value of '1' if the number of non-executive members is greater than the number of executive members,, and zero otherwise. The size of the board is the total number of members of the board. The CEO duality is constructed as dummy, which takes value of 1 if CEO is also the chairperson or vice chairperson of the board, otherwise 0. CEO tenure is measured as the number of years a CEO has been in office. Data on board dynamics was obtained from Bankscope database and individual banks' annual report. We expect either

a positive or a negative relationship between independent directors and dividend pay-out policy. A positive relationship suggests that independent directors fight for higher dividend pay-out policy. A negative relationship suggests that banks with greater independent directors reduce dividend pay-out. This may be due to the residual theory where directors prefer ploughing back profits (retained earnings) after identifying growth opportunities from positive NPV projects, rather than distributing profits or paying out dividends (Baker et al., 2002). We expect board size and dividend pay-out policy to be positively related indicating that 'larger board size is good for dividend pay-out policy.' We expect positive relationship between CEO duality and dividend pay-out policy. This implies that CEOs who double as chairperson on the board avoid conflict of interest and fight for higher dividend payments to shareholders. We expect negative impact of CEO tenure on dividend pay-out. This supports the agency theory and implies that banks with 'longer stay of a CEO in office' may reduce dividend pay-out in order to seek for their own interest.

Next we introduce the lags of board structure variables into the model. We assume that previous years' board dynamics may influence the next dividend pay-out since the decision to pay dividend by the board may not happen immediately. Thus, we expect an interesting relationship between the lead-lags of board structure and dividend pay-out.

3.2.2 Board dynamics, dividend pay-out policy and banking efficiency

From earlier discussion, we expect the dynamics of board structure to influence dividend pay-out policy. Next, we specify a model that explains the effect of board dynamics and dividend pay-out policy on banking efficiency. We also examine 'the interaction effect of board dynamics and dividend pay-out on banking efficiency.' The nature of the dependent variable allows us to use the truncated panel regression, which is specified as follows:

$$\begin{aligned} &Banking\ efficiency_{it} = \\ &\sum_{l=1}^{s} \beta_l Board\ structure\ dynamics_{it-1} \\ &+\sum_{l=1}^{m} \lambda_l Dividend\ \ payout\ policy_{it} \\ &+\sum_{q=1}^{p} \delta_q (Board\ \ structure\ dynamics_{it} * Dividend\ \ payout\ policy_{it}) \\ &+\sum_{k=1}^{N} \beta_k C_{ijt} + \phi_i + \theta_t + \mu_{it} \end{aligned} \tag{4}$$

where

δ_q $q = 1, \ldots .p$ denote the interaction term coefficients.

βl $l = 1, \ldots, s$, represent the regression coefficients of a vector of board dynamics variables

βk $k = 1, \ldots, N$ are the coefficients of the control variables (for vector X)

λ_l $l = 1, \ldots, m$, represent the coefficients of dividend pay-out policy

ϕ_i is individual bank effect

θ_t is the time fixed effects and μ_{it} is the composite error term.

The interactive effect of dividend pay-out policy can be estimated using the net effect given as:

$$Net\ effect\ \Rightarrow\ \frac{\partial Banking\ efficiency_{i,t}}{\partial Board\ structure\ dynamics} = \alpha_1 + \delta_q Dividend\ payout\ policy_{i,t} = 0 \tag{5}$$

Panel dataset of the truncated regression model was achieved by regressing the efficiency scores (generated from the DEA-model) on the regressors (board dynamics and dividend pay-out policy ratio).

In what follows, we discuss the expectations of our models. In terms of board dynamics, we expect a negative relationship between board independent directors and banking efficiency. This suggests that independent directors are less likely to increase banking efficiency due to high information asymmetry between insiders and outsiders (see, Adams and Ferreira, 2007). We also expect a negative relationship between board size and banking efficiency. This is because agency costs from large board size may result in a negative relation (Pathan and Faff, 2013). We expect a negative effect of CEO duality on banking efficiency. This implies that conflict of interest may result into a negative impact. We expect either a positive or a negative relationship between CEO tenure and banking efficiency. A positive impact because CEOs who stay longer in their position may understand the business environment and put pressure on management to drive the bank to their optimal efficiency. A negative impact suggests that longer CEO tenure of office may reduce banking efficiency due to agency problems.

On the other hand, we expect dividend pay-out policy to have an indirect relationship but a negative impact on banking efficiency. The indirect impact implies the diverse channel through which dividend pay-out policy affect banking efficiency. The negative impact supports the free cash flow theory where efficient banks endowed with free cash flows may invest in less growth opportunities rather than pay it out to shareholders. Thus, reducing banking efficiency.

In equation 4, C is a vector of control variables. These include; directors' incentives (ratio of remuneration/compensation pay to operation income), bank size (natural logarithm of total asset), bank age (the number of years in banking operation), bank risk (standard deviation of ROA), tangibility (ratio of fixed asset to total asset of a bank), GDP per capita (the ratio of total GDP to population), tax (the annual corporate tax). Data was obtained from the Bank of Ghana database website. We do not discuss the expectations of the signs associated with the control variables because of space.

Next, we are interested in whether the board dynamics amplifies, reduce or alters the relationship between dividend pay-out policy and banking efficiency. A positive interaction coefficient suggests that the individual board dynamic variables alter the negative impact of dividend pay-out policy and banking efficiency. On the contrary, negative coefficients suggest that the individual board structure variables amplify the negative impact of dividend pay-out policy and banking efficiency.

3.3 Estimation technique

To enhance reliability, efficiency and accuracy of the result, the study employs a number of techniques to test cross-sectional dependence, normality and multicollinearity. First, using the statistic table, the study screens for outliers in order to reduce the biases caused

by outliers. Hence, no evidence of outliers was identified. Second, normality of each variable is assessed by using SWILK normality test. Third, the study employs the Pearson's correlation to screen for multicollinearity. Similarly, cross-sectional dependence is tested using the Pesaran (2015) approach because our panel is unbalanced. With a null hypothesis of weak cross-sectional dependence, the Pesaran (2015) results fail to reject the null hypo of weak cross-sectional dependence, implying that the severity of and presence of cross-sectional dependence can be ignored for the models. On the issue of autocorrelation, no evidence of first order autocorrelation is found. The error term of the model was tested for its assumptions of normality, autocorrelation and homoscedasticity. This also allows us to accommodate different levels of change in the data-generating mechanism at different times. The lag of the dependent variable also helps us to control for omitted variable biases. In equation 3, we employ the pooled OLS, random effect and mixed effect to examine the effect of board dynamics on dividend pay-out policy. These models were applied for robustness checks. In terms of the effect of dividend policy and board dynamic on bank efficiency, the study used the truncated panel regression model. The limited dependent variable model is more appropriate for this kind of analysis because the technical efficiency scores (dependent variables) ranges between zero and one (a mixture of continuous and discrete distribution). After performing robustness tests, the study employed the truncated regression model, as used by Antunes et al. (2022), Simar and Wilson (2007, 2020a, 2000b) and Eling and Luhnen (2010a, 2010b). This is because, there exist original normal distribution of dependent variables that accounts for truncated efficiency scores, based on the DEA technical efficiency, range between zero and one and the distribution of efficiency is truncated above from unity.

4 Results and discussion

The study examines how board dynamics and dividend pay-out policy decisions drive the banks to their frontier efficiencies. First, we present the descriptive statistics, correlation matrix and regression results.

4.1 Descriptive statistics

4.1.1 Banking efficiency

The study used data envelopment analysis (DEA) technique to generate banking efficiency index, comprising of both CRS and VRS efficiency scores. 'A unit index value (1) represents the industry efficiency, while a value of zero indicates that the bank was not operating at that period. In addition, efficiency scores less than one indicate that such banks are operating below the optimal efficiency and such banks are considered inefficient. 'Banks that operate on the efficient frontier have an efficiency score index of one and are considered the best banks that optimally use a specific combination of inputs and outputs. Table 1 shows its descriptive statistics efficiency indicators generated from DEA.'

From Table 1, the average (standard deviation) of banks operating under CRS assumption, was 0.491 (0.192), indicating that on the average, banks operate below their efficiency for optimal to scale. Further, under the assumption of VRS, banks recorded an

average (standard deviation) efficiency score of 0.57 (0.241). This indicates that on average banks operate below their optimal efficiency in a competitive environment (VRS framework). Thus, banks perform quite well for efficiencies under VRS compared to CRS, which confirms Banker et al. (1978).

Table 1 Summary statistics of banking efficiency

Variable	*Obs.*	*Mean*	*Std. dev.*	*Min*	*Max*
CRS eff.	176	0.491	0.192	0	1
VRS eff.	175	0.57	0.241	0	1
Banking eff. index	159	0.91	0.131	0.501	1

Notes: CRS Eff. is measured as the efficiency scores generated under the DEA constant to scale; VRS Eff. is measured as the efficiency scores generated under the DEA variable return to scale; banking eff. index is the aggregate efficiency scores generated under the DEA constant and variable return to scale.

Given, an efficiency score of 1, 'banking efficiency index recorded mean (standard deviation) of 0.91 (0.131), with a minimum value of 0.501 and maximum value of 1.' It can be deduced that banks operate a little close to their efficiency under both assumptions of CRS and VRS. The implication is that banks in Ghana are inefficient and are not able to operate at their optimal efficiency.

4.1.2 Levels of banking inefficiencies

The level of inefficiencies is the value of inefficiency scores (specific mix of input-output) needed to move a bank to their frontier efficiency. The study computes the inefficiency levels of banks in Ghana by finding the difference between the input-oriented efficiency score of 1 and the industry average efficiency scores.

Table 2 Levels of Inefficiencies among banks in Ghana

Year	*CRS-inefficiency score (InEff_CRS)*	*VRS-inefficiency scores (InEff_VRS)*	*Inefficiency index score (B_InEffIndex)*
2010	0.49244	0.418329	0.043928
2011	0.507359	0.442172	0.097802
2012	0.465973	0.380474	0.08848
2013	0.458692	0.392392	0.109836
2014	0.419074	0.297832	0.114795
2015	0.440067	0.321747	0.103316
2016	0.449681	0.340789	0.079932
2017	0.461898	0.370534	0.091156
2018	0.488591	0.413658	0.076737
Average inefficiencies	0.464864	0.375325	0.089554

Notes: InEff_CRS is measured as the difference between the efficient score and the efficiency scores generated under the CRS; InEff_VRS is measured as the difference between the efficient score and the efficiency scores generated under the VRS; B_InEffIndex is measured as the difference between the efficient score and the aggregate efficiency scores generated under both the CRS and the VRS.

From Table 2, given the overall average inefficiency scores ($InEff\_{CRS}$ = 0.4649; $InEff\_{VRS}$ = 0.3753; and BInEffIndex = 0.0896), banks in Ghana are said to be marginally inefficient. The high level of inefficiency scores for the banking system in Ghana imply a managerial failure to fully exploit potential technology available to them. Thus, banks in Ghana did not fully utilise their inputs to operate on their optimal efficiency.

4.1.3 Explanatory variables

From Table 3, 'dividend pay-out policy recorded a mean of 0.089 indicating that banks in Ghana pay low dividend.' In terms of board dynamics, banks in Ghana recorded an average value of 74% of independent directors. Banks in Ghana seem to have large board size of 8, ranging between 3 and 13. CEO duality is almost non-existent among banks in Ghana and this recorded a mean of 0.063. CEO tenure of office has an average of 2.94.

Director's incentives recorded an average of 17.3% of total operation income. Bank size recorded an average of 18.12. The average bank age is 36 years. Bank's risk recorded and average of 0.15. The average tangibility was 68.2% of total asset. In terms of macroeconomic variables, GDP per capita recorded as average of 5.44. Corporate tax rate recorded an average of 16.2%.

Table 3 Summary statistics of explanatory variables

Variable	*Obs.*	*Mean*	*Std. dev.*	*Min*	*Max*	*VIF*	*SWILK*
Dividend pay-out policy	246	0.089	0.341	0.000	1.000	1.230	0.000***
Independent directors	249	0.736	0.450	0.000	1.000	3.980	0.000***
Board size	246	8.045	2.203	3.000	13.000	3.530	0.000***
CEO duality	246	0.063	0.243	0.000	1.000	3.470	0.000***
CEO tenure	246	2.943	1.713	1.000	7.000	1.680	0.000***
Director's incentives	246	0.173	0.324	–0.173	3.577	1.440	0.000***
Bank size	246	18.121	2.301	12.544	22.255	4.260	0.000***
Bank age	246	36.028	21.80	5.000	104.00	1.710	0.000***
Bank risk	246	0.148	0.378	0.006	2.540	3.290	0.000***
Tangibility	253	0.682	3.312	0.000	41.487	1.180	0.000***
GDP per capita	246	5.443	3.022	1.680	11.250	1.430	0.000***
TAX	245	0.162	0.443	–3.326	1.711	1.190	0.000***
Mean VIF	2.28						

Notes: 'Dividend pay-out policy is measured as the ratio of dividend pay-out to the number of shares outstanding; Independent directors is a dummy variable that captures the value 1, it the proportion of non-executive directors to total board size is more than inside directors, 0 otherwise; board size is total number of board members; CEO Duality is a dummy variable taking the values of 1 if CEO is also the chairperson/vice chairperson of the board, otherwise 0; CEO tenure is measured as the number of years a CEO has been in office; Director's Incentive is measured as the ratio of board compensation pay to operation income; Band Size is the natural logarithm of bank total assets; bank age is the number of years in banking operation; bank risk is the exposure to risk by banks (standard deviation of ROA); tangibility is the ratio of fixed asset to total asset of a bank; GDP per capita is measured as the ratio of total GDP to population; tax is measured as the annual corporate tax'.
SWILK, p value = 0.000***

Table 4 Correlation matrix

	Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
(1)	Dividend pay-out	1.000											
(2)	Independent directors	–0.124	1.000										
(3)	Board size	0.167	0.675	1.000									
(4)	CEO duality	–0.051	–0.189	–0.087	1.000								
(5)	CEO tenure	–0.192	–0.011	–0.071	0.074	1.000							
(6)	Director's incentives	0.163	0.498	0.411	–0.474	0.209	1.000						
(7)	Bank size	–0.056	–0.050	0.050	0.338	–0.091	–0.441	1.000					
(8)	Bank age	–0.227	–0.161	–0.135	–0.095	0.051	–0.374	0.055	1.000				
(9)	Bank risk	–0.153	–0.131	–0.073	0.750	–0.088	–0.584	0.331	0.119	1.000			
(10)	Tangibility	0.049	–0.009	–0.074	–0.008	0.359	0.116	–0.120	0.070	–0.010	1.000		
(11)	GDP per capita	0.077	0.172	0.103	0.169	–0.098	0.102	0.052	–0.253	0.104	–0.103	1.000	
(12)	Tax	–0.018	0.162	0.122	–0.010	–0.068	0.119	–0.034	0.098	–0.054	0.081	–0.018	1.000

Notes: 'Dividend pay-out policy is measured as the ratio of dividend pay-out to the number of shares outstanding; independent directors is a dummy variable that captures the value 1, it the proportion of non-executive directors to total board size is more than inside directors, 0 otherwise; board size is total number of board members; CEO duality is a dummy variable taking the values of 1 if CEO is also the chairperson/vice chairperson of the board, otherwise 0; CEO tenure is measured as the number of years a CEO has been in office; director's Incentive is measured as the ratio of board compensation pay to operation income; band size is the natural logarithm of bank total assets; Bank age is the number of years in banking operation; bank risk is the exposure to risk by banks (standard deviation of ROA); Tangibility is the ratio of fixed asset to total asset of a bank; GDP per capita is measured as the ratio of total GDP to population; tax is measured as the annual corporate tax'.

Table 5 Board dynamics and dividend pay-out policy

Variables	*Pooled OLS panel*	*Random effect*	*Mixed effect*
	Model 1	*Model 2*	*Model 3*
Independent directors	*–0.157***	*–0.157***	*–0.157***
	(0.0509)	*(0.0509)*	*(0.0243)*
Board size	*0.125***	*0.125***	*0.125***
	(0.0364)	*(0.0364)*	*(0.0221)*
CEO duality	0.0779	0.0779	0.0779
	(0.126)	(0.126)	(0.249)
CEO tenure	*–0.0609***	*–0.0609***	*–0.0609****
	(0.0249)	*(0.0249)*	*(0.0185)*
Director's incentive	–0.0220	–0.0220	–0.0220
	(0.0327)	(0.0327)	(0.0907)
Bank size	0.0242**	0.0242**	0.0242
	(0.0112)	(0.0112)	(0.0241)
Bank age	–0.00321**	–0.00321**	–0.00321*
	(0.00163)	(0.00163)	(0.00174)
Bank risk	–0.637***	–0.637***	–0.637
	(0.236)	(0.236)	(0.479)
Tangibility	–0.000795	–0.000795	–0.000795
	(0.00149)	(0.00149)	(0.00751)
GDP per capita	0.0195***	0.0195***	0.0195*
	(0.00526)	(0.00526)	(0.0100)
Tax	0.0711**	0.0711**	0.0711
	(0.0319)	(0.0319)	(0.0630)
Time effect	Yes	Yes	Yes
Constant	–0.439***	–0.439***	–0.439
	(0.167)	(0.167)	(0.409)
sd(constant)			–28.19
			(20.70)
sd(residual)			–1.196***
			(0.0604)
Observations	237	237	237
R-squared	0.3542	0.3542	0.3542
Wald chi^2	68.00***	68.00***	68.00***
Breusch-Pagan/Cook-Weisberg test	382.39***		
Hausman Test		1.10	

Notes: This table shows the pooled OLS panel, random effect and mixed effect regression results. It presents the effect of board dynamics on dividend pay-out policy (models 1–3). Dependent Variable is dividend pay-out policy: robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.2 Correlation matrix

Table 4 presents the Pearson correlation coefficient matrix to check for multicollinearity. From Table 4, we do not observe 'multicollinearity problem among the variables as confirmed by a mean variance inflation factor (VIF) of 2.28.'

4.3 Regression results

First, we present the effect of board dynamics on dividend pay-out. Second, we show the independent impact of 'board dynamics and dividend pay-out policy on banking efficiency.' Finally, we analyse the interaction effect of board dynamics and dividend pay-out policy on banking efficiency.

From Table 5, board independent directors was found to negatively and significantly linked to dividend pay-out policy. This indicates that large independent board members predicts low dividend pay-outs. This is probably due to agency costs that arise as a result of differences in individual opinions during decision making. Moreover, difficulties in complying with monitoring roles that come from large outside directors, may lead to a negative relation between independent board directors and dividend pay-out policy. The effectiveness of outside directors may depend on bank information environment and they may be limited by their inferior information compared to corporate insiders. The implication for our negative relation depicts that small proportion of independent directors on the board is good for dividend pay-out policy. This is because banks operate in high information asymmetry environment, thus, maintaining more insiders than outsiders with firm-specific information is beneficial to the bank when paying out dividend. Our findings disagree with studies that found that independent board directors, in firms with investor protection objectives, fight for higher and increased dividend pay-outs (La Porta et al., 2000; Renneboog et al., 2015). However it agrees with the empirical findings in the literature that claim that a robust independent board directors acts as a catalyst for higher and increased dividend pay-outs (Jo and Pan, 2009; Nielsen, 2005).

Our results confirm a positive and significant relationship between board size and dividend pay-out policy. This suggests that large board size increases board diversity, which is good for higher dividend pay-out policy. Our findings agree with the work of Saliya and Dogukanli (2022), who employed a Tobit regression on a dataset for listed companies in Turkey over the period, 2011–2019. They found that board size has a positive and significant effect on dividend pay-out policy. The implication is that larger board size fight for a common goal in paying out high dividend to shareholders. We observe that CEO tenure of office shows an inverse link with dividend pay-out, indicating that CEOs who stay longer in office may reduce dividend pay-out. This supports the residual theory in the sense CEOs who stay longer in office understand the business environment and may plough back profits into the business. This may lead to lower dividend pay-out. We do not report on the controls as determinants of dividend policy because of space.

Next, we show the lag effect of board dynamic variables on dividend pay-out. From Table 6, the lag of independent directors was positively and significantly linked to dividend pay-out policy. This suggests that previous year's independent director's increases next dividend pay-out. The positive impact between last year's independent directors and dividend supports the proposed dividend concept where dividend are proposed to be distributed among the shareholders during a financial year which will be

paid in the next financial year. Previous year's size of the board and CEO duality reduce current dividend pay-out policy. This supports the dividend irrelevant theory where managers including CEOs who double as chairperson, decide to cut dividend and reinvest extra retained earnings for a future gains. This may lead to a negative impact of board size and CEO duality on dividend pay-out. The direction and magnitude of the coefficients were consistent across the models (model 1–6).

Table 6 Lag effect of board dynamics on dividend pay-out policy

Variables	*(Pooled OLS)*	*(Random effect)*	*(Mixed effect)*
	Model 4	*Model 5*	*Model 6*
Independent directors $_{t-1}$	0.0481**	0.0481**	0.0481
	(0.0215)	(0.0215)	(0.0310)
Board size $_{t-1}$	–0.0505***	–0.0505***	–0.0505*
	(0.0192)	(0.0192)	(0.0262)
CEO duality $_{t-1}$	–0.259*	–0.259*	–0.259
	(0.143)	(0.143)	(0.180)
CEO tenure $_{t-1}$	–0.00504	–0.00504	–0.00504
	(0.0196)	(0.0196)	(0.0259)
Director's incentive	0.0310	0.0310	0.0310
	(0.0418)	(0.0418)	(0.0970)
Bank size	0.0395**	0.0395**	0.0395**
	(0.0191)	(0.0191)	(0.0193)
Bank age	–0.00333*	–0.00333*	–0.00333**
	(0.00198)	(0.00198)	(0.00158)
Bank risk	–0.0794**	–0.0794**	–0.0794
	(0.0377)	(0.0377)	(0.0899)
Tangibility	–0.00576***	–0.00576***	–0.00576
	(0.00208)	(0.00208)	(0.00848)
GDP per capita	0.0166**	0.0166**	0.0166
	(0.00781)	(0.00781)	(0.0124)
Tax	0.0463	0.0463	0.0463
	(0.0352)	(0.0352)	(0.0656)
Time effect	Yes	Yes	Yes
Constant	–0.214	–0.214	–0.214
	(0.180)	(0.180)	(0.389)
sd(constant)			–28.44
			(21.82)
sd(residual)			–1.056***
			(0.0638)
Observations	223	223	223

Notes: This table shows the pooled OLS panel, random effect and mixed effect regression results. It presents the effect of the lags of board dynamics on dividend pay-out policy (models 4-6). Dependent Variable is dividend pay-out policy robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7 Independent effect of board dynamics and dividend pay-out policy on banking efficiency

Variables	*Model 7*	*Model 8*	*Model 9*
Dividend pay-out policy	*–0.0468**	*–0.0655****	*–0.06547*
	(0.0252)	*(0.0185)*	*(0.01849)*
Dividend pay-out policy $_{t-1}$		*–0.0523****	
		(0.0167)	
Δ Dividend pay-out policy			*–1.45e-05***
			(6.37e-06)
Independent directors	–0.0136*	–0.0177**	–0.0144
	(0.00755)	(0.00754)	(0.0107)
Board size	–0.0134**	–0.0174***	–0.0231**
	(0.00565)	(0.00563)	(0.0101)
CEO duality	–0.233***	–0.308***	–0.416***
	(0.0799)	(0.0953)	(0.144)
CEO tenure	0.0136**	0.0134**	0.000401
	(0.00658)	(0.00667)	(0.0147)
Director's incentive	–0.0128	–0.0216	–0.0262
	(0.0233)	(0.0267)	(0.0253)
Bank size	–0.0165*	–0.0178**	–0.0283**
	(0.00884)	(0.00875)	(0.0131)
Bank age	–0.00352***	–0.00365***	–0.00482***
	(0.000891)	(0.000898)	(0.00122)
Bank risk	0.341**	0.479**	0.543*
	(0.170)	(0.202)	(0.326)
Tangibility	–0.00177	–0.000910	0.00110
	(0.00208)	(0.00190)	(0.00192)
GDP per capita	–0.00339	–0.00408	–0.00703
	(0.00397)	(0.00402)	(0.00645)

Notes: This table shows the truncated estimation results of how dividend pay-out policy and board dynamics independently influence banking efficiency. 'Dividend pay-out policy is measured as the ratio of dividend pay-out to the number of shares outstanding; independent directors is a dummy variable that captures the value 1, it the proportion of non-executive directors to total board size is more than inside directors, 0 otherwise; board size is total number of board members; CEO duality is a dummy variable taking the values of 1 if CEO is also the chairperson/vice chairperson of the board, otherwise 0; CEO tenure is measured as the number of years a CEO has been in office; director's Incentive is measured as the ratio of board compensation pay to operation income; band size is the natural logarithm of bank total assets; bank age is the number of years in banking operation; bank risk is the exposure to risk by banks (standard deviation of ROA); Tangibility is the ratio of fixed asset to total asset of a bank; GDP per capita is measured as the ratio of total GDP to population; tax is measured as the annual corporate tax'. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7 Independent effect of board dynamics and dividend pay-out policy on banking efficiency (continued)

Variables	*Model 7*	*Model 8*	*Model 9*
Tax	–0.0245	–0.0250	–0.0163
	(0.0167)	(0.0163)	(0.0252)
Time effect	Yes	Yes	Yes
Constant	1.404***	1.436***	1.606***
	(0.158)	(0.156)	(0.228)
sigma	0.111***	0.107***	0.114***
	(0.00685)	(0.00690)	(0.0110)
Observations	226	217	205

Notes: This table shows the truncated estimation results of how dividend pay-out policy and board dynamics independently influence banking efficiency. 'Dividend pay-out policy is measured as the ratio of dividend pay-out to the number of shares outstanding; independent directors is a dummy variable that captures the value 1, it the proportion of non-executive directors to total board size is more than inside directors, 0 otherwise; board size is total number of board members; CEO duality is a dummy variable taking the values of 1 if CEO is also the chairperson/vice chairperson of the board, otherwise 0; CEO tenure is measured as the number of years a CEO has been in office; director's Incentive is measured as the ratio of board compensation pay to operation income; band size is the natural logarithm of bank total assets; bank age is the number of years in banking operation; bank risk is the exposure to risk by banks (standard deviation of ROA); Tangibility is the ratio of fixed asset to total asset of a bank; GDP per capita is measured as the ratio of total GDP to population; tax is measured as the annual corporate tax'. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3.1 Independent impacts on banking efficiency

The above empirical discussion reveals that banks in Ghana are inefficient. The study finds out whether board dynamics and dividend pay-out policy are important in explaining the banking efficiencies in Ghana. Table 7 shows the independent effect of board dynamics and dividend pay-out on banking efficiency.

From Table 7, dividend pay-out policy (model 7), the lag of dividend pay-out policy (model 8) and% change in dividend pay-out policy (model 9) have significant and negative relationship with banks' efficiency. This means that banks reduce dividend distribution policies, whether short-term or long-term, in order to increase banking efficiency. Past year's and short term decision of dividend pay-out reduces banking efficiency. This shows that owners who receive more dividend payments do not invest in growth opportunities that increase market wealth. Our findings disagree with the findings of Eryomin et al. (2021), who show that dividends have a positive effect on capitalization only if the policy is based on the residual principle. This supports the residual theory as the company prefers to preserve its profits for the sake of goodwill or gains in the future. In light of this, banks may prefer to hold last year's earnings for capital appreciation or investment growth opportunities, which will affect previous year's dividend policy decision as well as current banking efficiency. Thus, short term and long term dividend pay-out policy significantly reduces banking efficiency. From the perspective of the free

cash flow hypothesis, managers with free cash flow will invest in negative NPV projects rather than pay it out to shareholders, thus, leading to lower banking efficiency. Similarly, the rate of change in dividend pay-out (% change in dividend) shows an inverse impact on the efficiency of banks.

In relation to board dynamics Table 7, we find that independent board directors was negatively and significantly linked to banking efficiency (model 7–9). This indicates that banks that have more independent directors tend to decrease banking efficiency. Our findings disagree with the fact that good independent directors on the board protect the interest of shareholders by increasing their wealth and efficiency of the firm, which is in line with Guluma (2021) and Ramirez and Ferrer (2021), whose findings support the hypothesis that governance creates value for companies and that investments to implement effective governance systems give net positive benefit and should be pursued. However, our findings support the theory of information asymmetry because outside directors may be limited by relevant bank-specific information and may be less likely to assess the associated risks banks may be exposed to, which will lead to banking inefficiencies. Consistent with the view of Pathan and Faff (2013), inclusion of more independent directors decrease bank's performance, given the complexity of the banking business operating in a high information asymmetry environment.

Board size is inversely related to banking efficiency, thus drawing the banks away from the frontier (model 7–9). This shows that higher board size decreases banking efficiency. Although larger board size is expected to bring more human capital to advice and facilitate manager supervision, boards with too many members may lead to problems of cohesiveness, control and flexibility in decision making. This may lead to lower banking efficiency. Thus, our results affirm a negative relationship that is consistent with the work by Raheja (2005). He claim that larger board size may impair banking efficiency due to complexity of banking activities, inefficiencies and increased agency costs

Based on the efficiency theory, the combination of CEO functions and board responsibilities ensure effective board monitoring and oversight of managers, in order to achieve a common interest of attaining optimal capacity. However, our results found a negative and significant relationship between CEO duality and banking efficiency (models 7–9). The ability for CEOs to supervise is reduced due to higher agency costs which may occur when the CEO is also the chairman. This reduction in board oversight fosters the pursuance of CEO's interest, and may diverge from shareholders' value maximization goals, and thus, reduce banking efficiency. CEO tenure in office has a positive and significant relationship with banking efficiency. The result indicates that CEOs who stay longer in their position become effective in monitoring and may have the incentive to increase banking efficiency.' This is because longer stay in office addresses issues of information asymmetry which supports the view of Abor (2007).

Although our results reveal interesting findings that support existing theories, they disagree with recent work by Thaker et al. (2022). For instance, we show that information asymmetry and agency problems induce a negative effect of independent board directors, board size and CEO duality on bank efficiency in the long term. This indicates that independent board directors, board size and CEO duality reduce bank efficiency in the long term. From the empirical findings of Thaker et al. (2022), there are evidence of a positive impact of board size board independence and CEO duality on new profit efficiency. Our results have policy implication, in the sense that regulators and

policymakers should adopt robust economic and methodological approach in building a framework that could benchmark the board dynamics-efficiency nexus.

In relation to the control variables, we observe that bank size tends to decrease banking efficiency. 'Bank age has a negative and significant effect on banking efficiency. This suggests that older banks reduce banking efficiency. The study found a positive and significant relationship between bank risk and banking efficiency'.

4.3.2 Estimation of interaction effects

In this section, we find out the role of board dynamics in explaining the relationship between dividend pay-out policy and banking efficiency. In the earlier findings, we have established that current initiatives of board dynamics and dividend pay-out policy affect banking efficiency in the immediate term. Further, short term (immediate) dividend pay-out, long term dividend pay-out (lag of dividend pay-out) and rate of change of dividend pay-out have a negative and significant relationship with banking efficiency', The implication is that banks that pay-out dividend now and those who propose dividend pay-out in the future may reduce banking efficiency due to free cash flow hypothesis. Table 8 shows the interaction results.

Table 8 Interaction effect of board dynamics and dividend policy on banking efficiency

Variables	*Model 10*	*Model 11*	*Model 12*	*Model 13*
Dividend pay-out policy	0.396*	–0.0358	–0.0461*	–0.112***
	(0.237)	(0.217)	(0.0240)	(0.0394)
Independent directors	–0.0113			
	(0.00765)			
Board size		–0.0135**		
		(0.00591)		
CEO duality			0.0694	
			(0.0426)	
CEO tenure				0.00906
				(0.00612)
Dividend pay-out policy*independent directors	*–0.116**			
	(0.0598)			
Dividend pay-out policy*board size		–0.000750		
		(0.0224)		
Dividend pay-out policy*CEO duality			*–5.869**	
			(3.518)	
Dividend pay-out policy*CEO tenure				*0.0642**
				(0.0353)

Notes: This table shows the interaction 'effect of how board dynamics influence the relationship between dividend pay-out policy and banking efficiency. The interaction terms are introduced in the baseline model and rerun'. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 8 Interaction effect of board dynamics and dividend policy on banking efficiency (continued)

Variables	*Model 10*	*Model 11*	*Model 12*	*Model 13*
Director's incentive	–0.0142	0.00744	–0.0205	–0.0189
	(0.0317)	(0.0209)	(0.0299)	(0.0270)
Bank size	–0.00565	–0.00161	–0.00710	–0.0111*
	(0.00852)	(0.00602)	(0.00682)	(0.00650)
Bank age	–0.00285***	–0.00149**	–0.00170***	–0.00155**
	(0.000840)	(0.000641)	(0.000615)	(0.000668)
Bank risk	0.0977	0.0115	0.0158	0.00755
	(0.128)	(0.0161)	(0.0168)	(0.0171)
Tangibility	–0.00296*	–0.00495*	–0.00544**	–0.00501**
	(0.00172)	(0.00269)	(0.00263)	(0.00251)
GDP per capita	–0.000302	–0.00367	–0.00334	–0.00514
	(0.00378)	(0.00344)	(0.00346)	(0.00362)
Tax	–0.0339*	–0.0371**	–0.0432**	–0.0367**
	(0.0173)	(0.0167)	(0.0177)	(0.0171)
Time effect	Yes	Yes	Yes	Yes
Constant	1.220***	1.167***	1.163***	1.233***
	(0.157)	(0.121)	(0.127)	(0.124)
_sigma	0.114***	0.115***	0.117***	0.116***
	(0.00725)	(0.00787)	(0.00763)	(0.00761)
Observations	226	255	255	255
Net effect	*0.3106*	*na*	*–0.4158*	*0.0769*

Notes: This table shows the interaction 'effect of how board dynamics influence the relationship between dividend pay-out policy and banking efficiency. The interaction terms are introduced in the baseline model and rerun'. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

From Table 8, the conditional effect of dividend pay-out policy is positive in model 10 but was negative in models 12 and 13. We interpret our results on the interactions between board dynamics and dividend pay-out based on the net effects. For instance, in model 10, the net effect of dividend pay-out policy is computed as: 0.3106 [0.396 + (–0.116*Independent directors)], when independent directors take an average of 0.736. Thus, the net effect is positive and can be interpreted that independent directors magnify the positive effect of dividend pay-out on banking efficiency. In the same vein, the net effect of dividend pay-out policy is negative (see model 12). This suggests that CEO duality magnifies the negative effect of dividend pay-out on banking efficiency. In model 13, the net effect of dividend pay-out is positive; which gives the indication that CEO tenure alters the negative impact of dividend pay-out on banking efficiency.

Also, we observe that if board's decisions to dividend pay-out affect banking efficiency, then it is expected that there are lags between establishing these decisions (new policy initiatives) and the time these initiatives are implemented in order to drive greater efficiency. In what follows, we interact one year lag of board dynamic variables

and the lag of dividend pay-out. We interpret the behaviour of the interaction effects (see Table 9). We observe a negative and significant conditional effect of past year's dividend pay-out on banking efficiency (models 15 and 16) except model 17. For instance, the net effect of the lag of dividend pay-out is estimated as: –0.0769[–0.233 + (0.0194* board size $_{t-1}$)], when the average lag value of board size is 8.0738. This negative net effect implies that past year's average board size magnifies the negative effect of previous year's dividend pay-out on banking efficiency. Similarly, the net effect of past year's dividend pay-out is positive (see model 16), implying that past year's average CEO duality alters or reduces the negative effect of previous year's dividend pay-out on banking efficiency. In model 17, the net effect is negative; which suggests that past year's average CEO tenure in office reduces the positive effect of previous year's dividend pay-out on banking efficiency.

Table 9 Interaction effect of board dynamics and the lag of dividend pay-out policy on banking efficiency

Variables	*Model 14*	*Model 15*	*Model 16*	*Model 17*
Dividend pay-out policy $_{t-1}$	0.311	–0.233*	–0.0216*	0.111**
	(0.327)	(0.124)	(0.0117)	(0.0436)
Independent directors $_{t-1}$	–0.0139			
	(0.00993)			
Board size $_{t-1}$		–0.0185***		
		(0.00584)		
CEO duality $_{t-1}$			0.0480	
			(0.0403)	
CEO tenure $_{t-1}$				0.0145**
				(0.00602)
Dividend pay-out policy $_{t-1}$*Independent directors $_{t-1}$	–0.0866			
	(0.0822)			
Dividend pay-out policy $_{t-1}$* board size $_{t-1}$		0.0194*		
		(0.0112)		
Dividend pay-out policy $_{t-1}$* CEO duality $_{t-1}$			6.681***	
			(1.810)	
Dividend pay-out policy $_{t-1}$* CEO tenure $_{t-1}$				–0.118***
				(0.0439)
Director's incentive	–0.0281	0.00865	–0.0235	–0.0191
	(0.0391)	(0.0235)	(0.0329)	(0.0297)
Bank size	–0.0157	–0.000443	–0.00853	–0.0117*
	(0.0106)	(0.00603)	(0.00703)	(0.00662)
Bank age	–0.00221**	–0.00130**	–0.00145**	–0.00120*
	(0.000867)	(0.000621)	(0.000625)	(0.000614)

Notes: This table shows the interaction effect of how the lags of board dynamics and the lag of dividend pay-out policy interact to affect banking efficiency. Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 9 Interaction effect of board dynamics and the lag of dividend pay-out policy on banking efficiency (continued)

Variables	*Model 14*	*Model 15*	*Model 16*	*Model 17*
Bank risk	0.124	0.0101	0.0172	0.00799
	(0.144)	(0.0167)	(0.0172)	(0.0174)
Tangibility	–0.00276	–0.00426	–0.00515**	–0.00448**
	(0.00225)	(0.00261)	(0.00259)	(0.00226)
GDP per capita	–0.00330	–0.00531	–0.00480	–0.00464
	(0.00505)	(0.00364)	(0.00370)	(0.00373)
Tax	–0.0410**	–0.0426**	–0.0463**	–0.0347**
	(0.0183)	(0.0173)	(0.0180)	(0.0167)
Time effect	Yes	Yes	Yes	Yes
Constant	1.387***	1.167***	1.171***	1.202***
	(0.171)	(0.126)	(0.131)	(0.126)
_sigma	0.118***	0.114***	0.118***	0.115***
	(0.00729)	(0.00808)	(0.00800)	(0.00805)
Observations	195	243	243	243
Net Effect	na	–0.07633	0.4268	–0.1993

Notes: This table shows the interaction effect of how the lags of board dynamics and the lag of dividend pay-out policy interact to affect banking efficiency. Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 10 Interaction effect of board dynamics and% changes in dividend pay-out on banking efficiency

Variables	*Model 18*	*Model 19*	*Model 20*	*Model 21*
Δ Dividend pay-out policy	6.23e-05**	3.20e-05	-9.21e-06*	–2.03e-05***
	(3.03e-05)	(2.42e-05)	(5.21e-06)	(5.76e-06)
Independent Directors	–0.0135			
	(0.0104)			
Board Size		–0.0230**		
		(0.0104)		
CEO Duality			0.789	
			(0.509)	
CEO tenure				–0.000536
				(0.0143)
Δ Dividend pay-out policy*independent directors	*–2.05e-05***			
	(7.98e-06)			

Notes: This table shows the interaction effect of the rate of change of dividend pay-out policy and board dynamics on banking efficiency. Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 10 Interaction effect of board dynamics and% changes in dividend pay-out on banking efficiency (continued)

Variables	*Model 18*	*Model 19*	*Model 20*	*Model 21*
Δ Dividend pay-out policy*board size		*–4.49e-06**		
		(2.48e-06)		
Δ Dividend pay-out policy*CEO duality			0.00763	
			(0.00585)	
Δ Dividend pay-out policy*CEO tenure				*7.90e-06***
				(3.69e-06)
Director's incentive	–0.0233	0.00950	–0.0267	–0.0235
	(0.0340)	(0.0237)	(0.0272)	(0.0239)
Bank size	–0.0166	–0.00450	–0.0189**	–0.0181**
	(0.0132)	(0.00757)	(0.00859)	(0.00773)
Bank age	–0.00386***	–0.00143	–0.00219**	–0.00162
	(0.00117)	(0.000946)	(0.00101)	(0.000994)
Bank risk	–0.0272	0.000464	–0.000711	0.00382
	(0.241)	(0.0171)	(0.0206)	(0.0191)
Tangibility	–0.00130	–0.00254	–0.00288	–0.00314
	(0.00192)	(0.00212)	(0.00210)	(0.00212)
GDP per capita	–0.00599	–0.00692	–0.00649	–0.00793
	(0.00639)	(0.00546)	(0.00593)	(0.00612)
Tax	–0.0172	–0.0221	–0.0231	–0.0173
	(0.0235)	(0.0183)	(0.0216)	(0.0223)
Time effect	Yes	Yes	Yes	Yes
Constant	1.438***	1.268***	1.361***	1.333***
	(0.236)	(0.138)	(0.156)	(0.150)
_sigma	0.117***	0.116***	0.121***	0.122***
	(0.0118)	(0.0103)	(0.0103)	(0.0104)
Observations	57	70	70	70
Net effect	*0.000047*	*–0.00000412*	*na*	*0.0000029*

Notes: This table shows the interaction effect of the rate of change of dividend pay-out policy and board dynamics on banking efficiency. Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Finally, we analyse the interaction effect between board dynamics and the rate of change in dividend pay-out policy in explaining banking efficiency Table 10. We observe that the conditional effect of the rate of change in dividend pay-out policy is positively and significantly linked to banking efficiency in model 18. However, in models 20 and 21, the conditional effect of the rate of change of dividend pay-out was negatively and significantly linked to banking efficiency. In terms of net effect, for instance, in model 18, the net effect of rate of change of dividend pay-out is estimated as: 0.000047 [0.0000623 + (–0.0000205*Independent directors)], when independent directors take an average of 0.736 (see model 18). This shows that independent directors magnify the

positive effect of change in dividend pay-out on banking efficiency. The net effect is negative in model 19, which suggests that board size magnifies the negative effect of rate of change of dividend pay-out on banking efficiency. In model 21, the net effect is positive, implying that CEO tenure alters the negative impact of the rate of change of dividend pay-out on banking efficiency.

5 Policy implication, conclusions and limitation

5.1 Policy implication

Based on the research findings, the study has many policy implications. First, managers with free cash flow (dividend pay-out) should have the financial discipline to invest in positive NPV projects that will generate higher capital gains and future dividend. This may increase banking efficiency. Secondly, managers expecting free cash flow (dividend pay-out) in the future should have the discipline to reduce agency costs of firms by investing in positive growth opportunities in order to drive the banks to their optimal capacity. Thirdly, CEOs should have the power to effectively monitor the firm as long as they remain in office in order to improve proposed dividend pay-out policy and drive the banks to their optimal capacity. The tenure of office of directors and independent directors enhance the positive effect of the rate of change of dividend payment on banking efficiency, while the size of the board enhances the negative effect of the rate of change of dividend payment on banking efficiency. In addition, regulators and investors should provide effective board dynamics that may modulate a prudent dividend policy and improve the efficiency of banks in both short and long-term. Finally, regulators and policymakers should adopt robust economic and methodological approach in building a framework that could benchmark the board dynamics-efficiency nexus.

5.2 Conclusions

This paper investigates the role of board dynamics in explaining the effect of dividend pay-out on banking efficiency. The mixed effect regression was employed to examine the relationship between board dynamics and dividend pay-out policy. We find that independent directors decrease dividend pay-out policy; board size increases dividend pay-out policy; and CEO tenure of office decreases dividend pay-out policy. On the other hand, previous year's independent directors increase dividend pay-out while the previous year's board size and CEO duality reduce dividend pay-out. We found that the banks did not fully utilize their inputs to be able to operate on the frontier efficiency. The findings show that short term dividend pay-out, long term dividend pay-out and the rate of change of dividend pay-out decrease banking efficiency. This can be explained in support of the free cash flow hypothesis that managers endowed with free cash flow would invest in negative NPV projects rather than paying out dividend to shareholders. Our results suggest that banks that guarantee a lot of free cash flow or expect both short term and long term dividend pay-out may have less financial discipline with its spending. This may result in lower returns and inefficiencies.

We find evidence to support that inclusion of more independent directors, appointing more board members and CEO duality decrease banking efficiency. The implication is that policy makers should be firm in maintaining optimal board size, ensure smaller non-

executive members, and advocate for separation of power – in order to foster cohesiveness that may help reduce inefficiencies in the banking system. Moreover, we explained that the behaviour of board dynamics and dividend pay-out policy in relation to driving the banks to their efficiency, do not happen immediately and the extent to which these mechanisms affect banking efficiency takes time. We find evidence to support that independent directors increase the negative effect of dividend policy on banking efficiency.

CEO duality magnifies the negative effect of dividend pay-out on banking efficiency while CEO tenure alters the negative effect of dividend pay-out on banking efficiency. We find that previous year's board size enhances the negative impact of the lag of dividend pay-out on banking efficiency. Previous year's CEO duality reduces the negative impact of previous year's dividend pay-out on banking efficiency. It implies that CEOs should be maintained as board chair to resolve agency costs and address information asymmetry. This offers CEOs the incentive to have financial discipline for investing in positive NPVs which will probably enhance banking efficiency. Also, CEO tenure reduces the positive effect of previous year's dividend pay-out on banking efficiency.

In conclusion, the novelty of the study is that it provides evidence to support that board dynamics have a varying impact on dividend pay-out policies, and interestingly board dynamics interact with dividend pay-out policies in past periods to achieve the best banking efficiency.

5.3 Limitations and future direction

The study is limited to a single country study due to availability of data. Therefore, future studies should extend data to include different regions in Africa and observe the interrelationship between board dynamics, dividend policy and banking efficiency. The study did not explore alternative measures of dividend policy and efficiency techniques. Again, the empirical framework presented in the study does not allow to interpret the estimates (interaction coefficients) as causal effects. Future studies should employ alternative measures of dividend policy and efficiency, and also models that can allow the estimates to be interpreted as causal effects.

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