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# **Market power, efficiency and welfare performance of banks: evidence from the Ghanaian banking industry**

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## **Abstract**

The study analyses the welfare performance of banks' lending services in the Ghanaian banking industry with emphasis on the role of market power and efficiency. We made use of pooled OLS regression with fixed effect model. For robustness, we adopted Prais–Winsten (1954) regression and two-stage least squares (2SLS) instrumental variables procedures on an unbalanced panel data of 24 banks for years 2009 through 2017. The results reveal that during our study period, there was a welfare loss of about 0.433 percent of observed total loans. Encouragingly, cost efficiency in the banking system fits well within the world's mean efficiency but has been decreasing over time. Further, there is evidence that prices have not moved toward a competitive level. Cost efficiency estimates are found to be negatively associated with loss of consumer surplus estimates. Market power is found to be positively related to a loss in consumer surplus. Additional analysis shows that the market power effect is dominant in both domestic and large banks. Overall, the results indicate that market power and bank efficiency are competing interests for policymakers in their consideration of policy reforms geared toward an efficient and well-functioning banking system. An additional implication of these results suggests that antitrust enforcement may be socially beneficial to provide an incentive for competitive pricing in the lending business segment of banking. Other implications are also discussed.

**Keywords** – Welfare Performance; Bank Efficiency; Market Power; DEA; Ghana

**Paper type** – Research Paper

## **1 Introduction**

Banking reforms around the world, particularly developing economies, can be said to have played its part in fostering the opening up of an industry once dominated by the public sector. The role of banks is even more dominant in developing economies where the financial system is underdeveloped resulting in over-reliance on banking institutions. Governments' business in the banking sector was characterized by the provision of social services and not necessarily profit motivated as the private sector (La Porta et al., 2002). Proponents in favor of opening up a country's banking sector to private investors, specifically foreign international banks associate their arguments with the following reasons: first, foreign banks facilitate capital inflows for domestic projects; second, foreign banks improve efficiency and availability of financial products; thirdly, foreign banks improve financial structure of an economy; and finally, foreign banks are not susceptible to political pressures bias (Ghosh, 2016). In sharp contrast to these points, the arguments are that opening up of a country's banking sector to the private sector, particularly foreign banks may intensify income disparity (Detragiache et al., 2008) and that borrowers are better off under government-controlled banks (Karceski et al., 2005).

Following the arguments above, it can be deduced that the welfare effect of banks has been elusive. To date, banks' profit performance and its links with bank-industry-macroeconomic fundamentals have been favored in available empirical literature (Mollah and Zaman, 2015; Sensarma, 2008; Iannotta et al., 2007). But is performance only about profits? The literature mostly has neglected the issue of social welfare performance of banks but for some few recent works of literature (Karceski et al. (2005); Detragiache et al. (2008); Dick (2008); Ho (2012); Almousor and Mensi (2016)). Moreover, the focus of recent literature in this area has broadly been based on both developed and emerging economies. Meanwhile, authors such as Eldomiaty (2008) advance that, owing to the differences in the levels of banking sector development, efficiency, technological innovation, and institutional arrangements between a developed banking sector and a developing banking sector, a one-size-fits-all notion of the results obtained in prior studies could not be assumed. As such, a developing country's perspective is important in understanding a developing country's ability to have both an efficient and well-functioning banking sector to oversee this social contract issue in banking.

Further, competition and efficiency levels among firms in a sector or industry have been observed to underscore the welfare effects generated in an industry. According to Sharma et al. (2013), if profit persists because of efficiency, it goes to benefit households and firms. On the other hand, if profit persists due to non-competition, then the social welfare of households and firms decrease. The associated costs include high borrowing costs, credit restriction and compromised intermediation services (Chortareas et al., 2011). Available empirical studies examining the persistent nature of profits of banks show that the reason is mostly non-competition and not efficiency (Amidu and Harvey, 2016; Fosu, 2013). Against this backdrop, it seems appropriate to pursue a broad assessment of the welfare performance of banks in a developing country context. Specifically, we investigate the welfare performance of banks in Ghana with an emphasis on the role of market power and efficiency.

The Ghanaian context is a suitable environment mainly because the banking sector noticeably has witnessed extensive structural transformation over the periods 1988 to 2016.<sup>1</sup> The net effect of these reforms include: (i) the removal of government control over interest rates, credits rates, and exchange rates; (ii) the liberalization of the Ghanaian banking system resulting in the emergence and operation of a number of locally incorporated banks and foreign banks entry into the banking industry; (iii) independence to the central bank; (iv) consolidation and (v) closure of the supervisory and regulatory gaps whiles promoting financial consumer protection, innovation and financial inclusion. However, the empirical testing of the relation between financial consumer welfare and (i) cost efficiency and (ii) market power, is almost absent in the literature. The limited research in this area is somewhat surprising given the importance of social welfare, cost efficiency and banking competition to the public policy of financial consumer protection, innovation, and financial inclusion, banking supervision, and research.

Our paper makes the following contributions to bank performance literature in general and the Ghanaian banking system in particular. First, the paper contributes to the literature on the welfare performance of banks such that, we show that apart from price, market power and cost efficiency have a role to play in the welfare performance of banks. Our paper documents evidence of the characteristics of powerful banks and shows their detrimental impact on financial

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<sup>1</sup> For brevity, we do not tabulate the summary of key events in the Ghanaian banking industry. However, it is available from the author(s) upon request.

consumer welfare. Moreover, a review of available literature on market power and efficiency of banks show that the size of banks underscores their performance effect (Kwan, 2006; Fu and Heffernan, 2009). In addition to bank size, we extend existing literature by providing evidence that ownership structure drives the market power effect on financial consumer protection in banking. Second, we contribute to information sharing literature in banking. Third, we also contribute to bank capital regulation literature by emphasizing the restraining role played by well-capitalized banks in safeguarding financial consumer welfare. This literature finds that enhanced bank capital base improves pricing competitiveness of a financial system (Oduor et al., 2017). Finally, although, there is a major shift from state commercial banks to private foreign banks and domestic banks in Ghana, yet the available empirical accounts have failed to quantify the welfare implications of this change as a post-policy evaluation; our paper contribute in this direction.

The remainder of the paper is as follows. Section 2 discusses the related literature and hypotheses development. Section 3 sets out the data, empirical models and econometric estimation techniques used. Section 4 details the elements of the outcomes. Finally, section 5 concludes and discusses policy implications.

## **2 Related literature and hypotheses development**

### *2.1 Market power, cost efficiency, and banks' welfare performance*

According to the Structure-Conduct-Performance (hereafter SCP) paradigm, the structure of a banking system dictates how banking firms behave and ultimately performance. Under the *SCP hypothesis* if the profit of banks emanates from the exploitation of market power, then the profitability of banks can be described as a monopoly.

Consistent with this, Amidu and Harvey (2016) examine the level of profit persistence and the speed of convergence in the African banking system and show the existence of high level of profit persistence but low speed of convergence. The implication is that the high level of bank's profit persistence has a decreasing effect on financial consumer protection as the banking environment would incentivize exploitation based on market power. Similarly, Almounsor and

Mensi (2016) investigate what market structure and bank efficiency meant for financial consumer welfare within an emerging market. The authors find welfare loss of approximately 0.82 percent of GDP attributable to unwholesome market power practices, evidence of the detrimental impact of a banking system which is not price-competitive (See also Maudos and De Guevara (2007), Solis and Maudos, 2008)). The implication is that improved competition in banking dissipates the market power effect on welfare losses.

Recent literature developed into *the relative market power hypothesis* posits that the structure of the market is a non-issue in the relationship between market power and performance. In the presence of relative market power, improved competition has a decreasing effect on economic rent, as such policymakers should not be excessive in their rollout of competition policy as that may yield unintended consequences by throwing the stability of the banking system out of gear (Mirzaei et al., 2013). Thus, reduced competition (relative market power) is not an entirely bad thing (Jiménez et al., 2013; Ariss, 2010). Indeed, Sarpong-Kumankoma et al. (2017) show that to sustain the benefits accruing from greater cost efficiency, banks may be allowed to possess some level of market power.

Further, Maudos and De Guevara (2007) show that greater market power leads to greater cost efficiency but a reduction in market power is associated with welfare gains and loss of bank cost efficiency. The result that greater market power is related to greater bank cost efficiency suggests that powerful banks are cost-efficient and vice versa. Meanwhile, less powerful banks are critical to ensuring greater financial consumer protection. But, because they are not powerful, they have piping issues in their cost structure. Overall, the results indicate that financial consumer protection and bank efficiency are competing interests for policymakers in their consideration of policy reforms geared toward greater competition in banking.

Thus, prior literature shows that there exists an inter-temporal relationship between bank cost efficiency and market power, as such suggest that a developed banking system should be one that has a perfect balance between cost efficiency and market power. On the one hand, a reduction in cost efficiency estimates jeopardizes financial consumer welfare but enhances management use of their privileges for private gains (Berger and DeYoung, 1997). On the other hand, a reduction in cost efficiency is related to welfare gains and this is driven by a reduction in

the market power of banking firms (Maudos and De Guevara, 2007). This makes cost efficiency a prevalent factor of banks' welfare performance.

On the factors enhancing bank efficiency, Ghosh (2016) shows that *banking globalization* may be a precondition for improved efficiency of banking firms, suggesting that greater foreign investment in the banking system of developing economies has an increasing effect on the financial consumer welfare possibly because of a significant reduction in both profit and cost inefficiency. Further, Al-khasawneh (2013) shows that *mergers and acquisitions* provide incentives for improved future efficiency. Intuitively, the efficiency-enhancing benefit of mergers and acquisitions should provide an improved mechanism to safeguard financial consumer welfare. Similarly, Delis (2012) is of the view that developing countries should take into consideration the *quality of institutions* in order to drive enhanced competition and efficiency of banking firms from a financial reform perspective. Thus, suggesting that institutional quality moderates the financial liberalization policies impact on market power.

In a concentrated market, Almounsor and Mensi (2016) argue that banking efficiency can result in a reverse effect on consumer social welfare (consumer surplus). As such in the presence of market power, the managements of banks have little motivation to bring cost under control. Hence X-inefficiency increases and adversely affects the consumer surplus received.

Based on the discussions above, our testable hypotheses are stated as follow:

*H1*: In a concentrated market, market power is positively associated with a loss in consumer welfare estimates.

*H2*: In the presence of relative market power, cost efficiency is negatively associated with a loss in consumer welfare estimates.

### **3 Data and Methods**

#### *3.1 Data*

The structure of the banking system in Ghana is relatively small consisting of 33 banks at the year-end December 31, 2017. Out of this, 16 are Ghanaian banks (banks with majority Ghanaian ownership) and 17 non-Ghanaian (foreign) banks. Data used in this study is year-end financial

characteristics of banks extracted from the annual bank report actual filings with Bank of Ghana (BoG). We complement this data with a unique hand-collected dataset on banks' board structure compiled from annual reports of banks sourced from each banks website. The sample period spans nine years, from 2009 to 2017. Given that the board size framework of a bank is a critical input variable in the estimated cost efficiency score used in this study; our final sample is restricted to banks that have their full annual report available on their websites for our sample period. This limited the sample banks to 24. An observation is characterized by a combination of bank-year. Thus, there are 157 bank-year observations. Logging of the variable *knowledge of local market dynamics* resulted in two missing variables that reduced the number of observations to 155. Further, the use of lag one values of the independent variables reduced the final observations to 131 for all banks included in our sample. For model 2 in Table 5, the use lag one and two values of cost efficiency and market power estimate as instruments reduced the observations to 109. Data on banking sector development and GDP per capita growth are sourced from the World Bank's World Development Indicators database.

### 3.2 *Proxy for actual price of loan and deposit*

We compute the price of a loan - *PLOAN*- to customers (household and firms) as a ratio of the change in interest income to changes in interest-bearing assets. The price of deposit, *PDEPOSIT* was computed as a ratio of the change in interest expense to change in interest-bearing liabilities. Computing price of loans and deposits based on change differential (i.e. the difference between new minus old) provides an appropriate approximation of the prices charged in a particular year by a bank. Any changes in pricing generally have an effect on fresh contracts (Gischer et al., 2015). This is because loans and deposits in the previous year have agreed on prices set in the previous years; thus, not helpful to include in the estimation of current prices. By doing so, we limit the problem of double counting which is more likely to result in underestimation bias in the price. We recognize that the price charged can be floating or fixed rate. Therefore, there is a portion of the observed change in the current year that can be attributed to prices set in prior loan or deposit contract. We argue that since the price adjustment is not driven by the cost of input (deposit); therefore, excluding this should have only minimal or no consequences for the measurement of the prices of loan and deposit.



### 3.3 *Econometric estimation of the demand for bank's loan and price*

For the purpose of analyzing the demand for bank's lending services, we assume that banks are aggregate producers of one single product (loan) and estimate for loan services demand. First, we estimate the demand equation for loan services offering of banks using the log of loan quantity -  $QLOAN$ , which is measured as interest-bearing assets. We assume a log-log functional form that is explained by the price of a loan ( $PLOAN$ ) and the lag values of loans  $lnQLOAN_{i,t-1}$ . The demand function for loan services is given as:

$$ln QLOAN_{(it)} = \alpha_0 + \alpha_1 ln PLOAN_{(it)} + \alpha_2 ln QLOAN_{(it-1)} + \varepsilon_{(it)} \quad (Eq. 1)$$

where  $i$  begins from bank 1 to bank 24 and year starts from 2009 to 2017.  $ln$  is the natural logarithm;  $PLOAN_{i,t}$  represents the actual price of a loan to customers (household and firms) of bank  $i$  at year  $t$ ; while  $\varepsilon_{(it)}$  is the stochastic error term. We preferred fixed effect specification since the Hausman specification test is 65.09 with  $p$ -value of 0.0000. The results are tabled in Appendix.

For the price of a loan, we estimated Eq. (2) below. The explained variable is the logarithm of the price that bank  $i$  charges on loan at year  $t$  -  $lnPLOAN_{(i,t)}$ . We assume a log-log functional form that is explained by the log of the price that banks pay on deposit -  $lnPDEPOSIT_{(i,t)}$  and trend as given below:

$$lnPLOAN_{(i,t)} = \beta_0 + \beta_1 lnPDEPOSIT_{(i,t)} + \beta_2 TREND + \beta_3 TREND^2 + \varepsilon_{(i,t)} \quad (Eq. 2)$$

We used a random effect specification since the Hausman specification test is 3.48 with  $p$ -value of 0.3230. The Breusch and Pagan LM test for random effects is 30.69 with  $p$ -value of 0.0000, so the use of pooled OLS is rejected. We do not table the results for brevity.

### 3.4 *Proxy for bank's welfare performance*

Following prior studies (e.g. Hausman and Ros (2013), Hausman (2003)), we estimate consumer surplus as a proxy for banks' welfare performance. According to the Marshallian demand curve, consumer surplus is the excess of the maximum price a customer of a bank willingly pays for a service over the actual price for that service. Estimating consumer surplus can be done using a parametric approach, nonparametric approach and the theory of index numbers. In this study, we use the nonparametric approach. The advantage is that we do not have to worry about the

appropriate functional form of the demand curve (Hausman and Newey, 1995). Thus in the spirit of Hausman and Ros (2013) and Hausman (2003), change in consumer welfare is derived as:

$$\Delta C_{S(it)} = \frac{([ \ln \widehat{PLOAN}_{(it)} \cdot \ln \widehat{QLOAN}_{(it)} ] - [ \ln PLOAN_{(it)} \cdot \ln QLOAN_{(it)} ])}{(1 - \alpha_1)} \quad (\text{Eq. 3})$$

where  $i$  is bank beginning from 1 to 24 and  $t$  is year beginning from 2009 to 2017.  $\Delta C_{S(it)}$  is the change in consumer surplus for bank  $i$  at year  $t$ ;  $\alpha_1$  is the price elasticity of demand for loan estimated from equation (1),  $\ln PLOAN_{(it)}$  and  $\ln QLOAN_{(it)}$  are referred to as actual loan price and quantity respectively for bank  $i$  at year  $t$ , and  $\ln \widehat{PLOAN}_{(it)}$  and  $\ln \widehat{QLOAN}_{(it)}$  are referred to as predicted loan price and quantity respectively for bank  $i$  at year  $t$ . The predicted quantity of loan demanded is derived as:

$$\ln \widehat{QLOAN}_{(it)} = \left[ \frac{\ln \widehat{PLOAN}_{(it)} \cdot \ln QLOAN_{(it)}}{\ln PLOAN_{(it)} \cdot \ln QLOAN_{(it)}} \right]^{-\alpha_1} \quad (\text{Eq. 4})$$

Thus, given Eq. 4 then rearranging Eq. 3 above, change in consumer surplus is formalized as:

$$\Delta C_{S(it)} = \left( \frac{[ \ln PLOAN_{(it)} \cdot \ln QLOAN_{(it)} ]}{1 - \alpha_1} \right) \left[ \left( \frac{\ln \widehat{PLOAN}_{(it)}}{\ln PLOAN_{(it)}} \right)^{-\alpha_1} - 1 \right] \quad (\text{Eq. 5})$$

We estimate the change in consumer surplus as a percentage of total loans. Given a log-log demand model, this ratio is derived by rearranging Eq. 5 as:

$$\frac{\Delta C_{S(it)}}{\text{Total Loan}} = \frac{1}{1 - \alpha_1} \left[ \left( \frac{\ln \widehat{PLOAN}_{(it)}}{\ln PLOAN_{(it)}} \right)^{-\alpha_1} - 1 \right] \quad (\text{Eq. 6})$$

### 3.5 Estimating market power: adjusted Lerner index

Following available empirical accounts (e.g. Almounsor and Mensi (2016); Coccoresse (2014); Gischer et al., (2015)) we use Lerner index to capture the markup factor that customers pay on their loan facility over the associated marginal cost. It is computed as the differential between the price of loan and marginal cost and expressing it as a ratio of loan price. This computation has two advantages: (1) it allows for a bank-level measure of competition and (2) between time

measures of competition. Thus, the Lerner index helps to detect a behavioral pattern within an industry or market as well as across time (Coccoresse, 2014).

Again, the Lerner index has been found to be directly and significantly related to other measures of competition – market share or concentration measures (Beck et al., 2013). Delis (2012) further shows that Lerner index is significantly related to Boone indicator, calculated for a wide array of banking institutions across many jurisdictions; as such, arguing that Lerner index provides a reasonable premise of a bank's market power.

For the purpose of estimating the market power of banks, we assume the intermediation approach; hence, bank  $i$  uses deposit (input) in the production of loans (output) at time  $t$  and aims to maximize profit; as such has standard Lerner Index ( $LI$ ) as follows:

$$LI_{i,t} = \frac{P_{LOAN_{i,t}} - MC(Q)_{i,t}}{P_{LOAN_{i,t}}} \quad (\text{Eq. 7})$$

where  $P_{LOAN_{i,t}}$  represents the price of loan charged by bank  $i$  in year  $t$  included in the sample and  $MC(Q)_{i,t}$  represents the marginal cost incurred by bank  $i$  in year  $t$  to acquire deposit. Eq. 7 above can be adjusted following Gischer et al. (2015) and thus gives:

$$LI_{(i,t)} = \frac{\frac{\sum_{k=1}^n \Delta IY_{(i,t)}^k}{\sum_{k=1}^n \Delta IBA_{(i,t)}^k} - \frac{\sum_{j=1}^m \Delta IEX_{(i,t)}^j}{\sum_{j=1}^m \Delta IBL_{(i,t)}^j}}{\frac{\sum_{k=1}^n \Delta IY_{(i,t)}^k}{\sum_{k=1}^n \Delta IBA_{(i,t)}^k}} \quad (\text{Eq. 8})$$

where  $LI_{(i,t)}$  is the market power of bank  $i$  in year  $t$ .  $\Delta IY_{(i,t)}^k$  is the change in the value of interest income for bank  $i$  accruing from  $k = 1, \dots, n$  interest bearing assets at year  $t$ ;  $\Delta IBA_{(i,t)}^k$  indicates change in the value of interest-bearing assets of bank  $i$  at year  $t$ .  $\Delta IEX_{(i,t)}^j$  indicates change in the value of interest expenses of bank  $i$  incurred on  $j = 1, \dots, m$  interest bearing liabilities at year  $t$  and  $\Delta IBL_{(i,t)}^j$  represents change in the value of interest-bearing liabilities of bank  $i$  at year  $t$ .

### 3.6 Bank cost efficiency: Data Envelopment Analysis (DEA)

In this paper, we follow prior studies such as Almounsor and Mensi (2016), Al-khasawneh (2013), Sharma et al. (2013), Chortareas et al. (2011) and Sathye (2001) and make use of DEA

techniques to compute the cost efficiency of banks. This approach is motivated by (i) the small size of the sample used in this paper (Al-khasawneh, 2013) and (ii) the array of reforms that the Ghanaian banking industry has witnessed which enables the assumption of a variable return to scale (VRS) by Banker et al. (1984). Indeed Almounsor and Mensi (2016) estimated cost efficiency for a sample of 9 banks over a 12 year period (nearly 108 bank-year observations) for the Saudi Arabian banking system, which equally had undergone extensive reforms in an attempt to increase efficiency and competition. The case of Hong Kong (Ho, 2010; Kwan, 2006) is no different. Further, cost efficiency is appropriate for the Ghanaian banking sector because it helps to measure differences in managerial ability to control cost as well as highlights the major sources of risk factors preventing an efficient and well-functioning banking system for bank supervision and research.

DEA draws a piecewise frontier (or surface) involving best performing banks using a non-parametric approach. Efficiency scores are computed in relation to this frontier. Decision-making units (DMUs) on the frontier are considered efficient. The opposite is true (Coelli, 1996). DEA cost efficiency is based on the assumption that the minimum cost possible should be incurred on input while the price of input and quantities of output remain constant. As such, for  $m$  firms ( $i = 1, \dots, m$ ) with cost minimizing objective uses a vector of  $p$  inputs  $x_i = (x_{i1}, \dots, x_{ip}) \in R_{p++}$  given the price of the inputs  $w_i = (w_{i1}, \dots, w_{ip}) \in R_{p++}$  to produce a vector of  $q$  inputs  $y_i = (y_{i1}, \dots, y_{iq}) \in R_{q++}$ . Thus, cost efficiency for  $j$ th bank is computed as below:

$$\begin{aligned}
 & \text{Min } \sum_p w_{pj} x_{pj} \\
 & \text{Subject to:} \\
 & \sum_i \lambda_i y_{iq} \geq y_{jq} \quad \forall q \\
 & \sum_i \lambda_i x_{ip} \geq x_{jp} \quad \forall p \\
 & \sum_i \lambda_i = 1; \lambda_i \geq 0; i = 1, \dots, m
 \end{aligned} \tag{Eq. 9}$$

The cost efficiency for the  $j$ th bank is given by the ratio of minimum costs to actual costs, as defined by Eq. 10 below:

$$Cost\ Efficiency_j = \frac{\sum_p w_{pj} x_{pj}^*}{\sum_p w_{pj} x_{pj}} \quad (Eq. 10)$$

Input and output factors are pre-requisite in bank efficiency analysis using DEA. We estimate the cost efficiency of banks using as input variables: (i) lendable funds ( $X1$ ); (ii) labour ( $X2$ ); (iii) capital ( $X3$ ); and (iv) board size ( $X4$ ). The prices of these inputs are as follow: price of lendable funds is measured as the ratio of interest expense to total deposits ( $W1$ ); the price of labour is measured as the ratio personnel expense to the number of staff ( $W2$ ); the price of physical capital is measured as the ratio of operating expense less personnel expense to fixed asset ( $W3$ ); and the price of a bank's board is measured as the ratio of directors fees, including board-related expenses (if any), to the number of directors on the board ( $W4$ ). Input variables (i) to (iv) is motivated by prior studies such as Sathye (2001) and Adeabah et al. (2018). In particular, the board size framework of board structure is included because bank efficiency measurement benefits from the inclusion non-financial variables (Adeabah et al., 2018). As output variable, we use interest-bearing assets (i.e. loans and advances to customers, due from other banks and financial institutions) ( $Y1$ ), interest income ( $Y2$ ) and trading income ( $Y3$ ). The selection of the output variables is also motivated by studies such as Fu and Heffernan (2009) and others.

### 3.7 Control variables

Following prior studies (e.g. Adeabah et al. (2018); Ghosh (2016); García-Herrero et al. (2009); Jaffee and Levonian, (2001)), we include: (i) knowledge of local market dynamics ( $lnKLMD$ ), (ii) loan to total assets ratio (LTA), (iii) equity to total assets ratio (CAP) (iv) bank size (BNKSIZE), (v) ownership structure (OWN), (vi) banking sector development, (vii) GDP per capita growth, (viii) bank dummies (Bank\_Dummies) and (ix) year dummies (Year\_Dummies) to control for omitted variables bias.

#### 3.7.1 Knowledge of local market dynamics

Knowledge of local market dynamics ( $lnKLMD$ ), as proxied by bank age (i.e. the number of years since the incorporation of each bank) reflects the effect of an underdeveloped information

sharing environment. We posit that if banks are allowed to generate knowledge of local market dynamics at their own cost, which is generally the case, instead of working with credit referencing bureaus, the financial consumer becomes worse off.

### *3.7.2 Liquidity risk*

Liquidity risk (LTA) is measured as the loan to total assets ratio. Greater loans to total assets denote that banking firms are aggressively engaged in intermediation activities, as such may incur additional costs in the form of insurance etc. Thus, we might expect that greater loans to total assets ratio is related to greater loss in consumer surplus, as borrowers will have to pay for the insurance premium, for example; as such financial consumer take a haircut in the total loan received.

### *3.7.3 Degree of capitalization*

Degree of capitalization (CAP) is measured as equity to total assets ratio. For the purpose of this study, two major predictions are made. The first stems from evidence that well-capitalized banks are relatively safer and less risky (Ghosh, 2016), and have high franchise value which incentivizes prudent lending (García-Herrero et al., 2009). Thus, from this literature we expect well-capitalized banks to serve as a constraining mechanism on loss welfare in banking. The second expectation is motivated by the Basel Accord on the maintenance of minimum capital of banks as the ratio of risk-weighted assets. Thus, banking firms hold more capital because they have a high level of riskier assets in their loan portfolio. Following the thinking of the Basel Accord, we expect more capitalized banks to be related to greater loss in consumer surplus estimates.

### *3.7.4 Bank size*

Bank size (BNKSIZE) is measured as a dummy variable that takes the value of 1 to represent large banks and 0 for small banks.<sup>2</sup> To classify a bank as large or small, we use median values of total assets. If a bank's total asset value is greater than the median value, define as a large bank, while those banks with total assets less than the median value are termed as small banks.

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<sup>2</sup> Although in prior studies, bank size is generally measured as the natural logarithm value of bank's total assets, we deviate due to the relatively high correlation between our dependent variable (*loss consumer surplus estimate*) and the log of bank total assets. Thus, the dummy representation of bank size enables us to accommodate other key policy variables in our model.

Consistent with the *quiet life hypothesis*, we expect the coefficient on BNKSIZE to be positive for loss in consumer surplus as managers in large banks will use their privileges for private gains, to the detriment of more accessible financial services (Asongu and Nwachukwu, 2018).

### 3.7.5 Ownership structure

Ownership structure (OWN) is measured as a dummy variable that takes the value of 1 to represent foreign bank if 50% or more controlling interest in a bank is foreign owned at a financial year-end and 0 otherwise. Ghosh (2016) evidence suggests that greater foreign investment in the banking system of developing economies has an increasing effect on financial consumer welfare. Thus, we might expect foreign banks to have a hedging effect on loss of consumer welfare.

### 3.7.6 Bank sector development

A higher level of banking sector development (BSD) should provide an improved constraint mechanism against loss of financial consumer welfare as it indicates a developed banking system. Private sector credit to GDP is used as a proxy for BSD as in Ghosh (2016).

### 3.7.7 GDP per capita

GDP per capita (GDPpc) is controlled to account for information about a country's development process. Jaffee and Levonian (2001) show that the benchmarks of an efficient and well-functioning banking system in Europe are positively related to GDP per capita. Thus, we might expect GDP per capita to have a hedging effect on loss of consumer welfare.

## 3.8 Empirical model

To determine the association between consumer surplus and (i) cost efficiency and (ii) market power, we formulate our model in the form:

$$Y = X\beta + \varepsilon$$

where  $Y$  is an  $n \times 1$  vector,  $X$  is an  $n \times (k+1)$  design matrix of cost efficiency, market power, and control variables,  $\beta$  is a  $(k+1) \times 1$  vector of parameters and  $\varepsilon$  is an  $n \times 1$  vector of residuals for  $n, k \in \mathbb{Z}^+$ . Specifically, we examine the determinants of consumer surplus estimates in the lending business segment of banks by specifying the model:

$$\begin{aligned}
\ln C_{S_{i,t}} = & \alpha_0 + \beta_1(XEFF)_{i,t-1} + \beta_2(LI)_{i,t-1} + \beta_3(\ln KLMD)_{i,t-1} + \beta_4(\ln LTA)_{i,t-1} \\
& + \beta_5(\ln CAP)_{i,t-1} + \beta_6(\ln BNKSIZE)_{i,t-1} + \beta_7(OWN)_{i,t} + \beta_8(BSD)_{t-1} \\
& + \beta_9(GDPpc)_{t-1} + \gamma_i(\text{Bank\_Dummies})_i + \omega_t(\text{Year\_Dummies})_t + \varepsilon_{i,t} \quad (\text{Eq. 11})
\end{aligned}$$

for  $i$  starting from bank 1 up to bank 24 and  $t$  starting from year 2009 to 2017.  $\ln$  is the natural logarithm. The dependent variable  $C_{S_{i,t}}$  is the loss consumer surplus estimates of total loans derived from Eq. 6 in Section 3.4.  $\varepsilon$  denotes the remaining disturbance term.  $XEFF$  is the cost efficiency computed from DEA in Section 3.6.  $LI$  is the adjusted Lerner index computed using Eq. 8 in Section 3.5. The remaining independent variables controlled for are, as defined in Section 3.7.

### 3.9 Estimation method

Following prior studies (e.g. Kwan, 2006; Dick, 2008; Berger and DeYoung, 1997)) Eq. 11 is estimated using pooled ordinary least squares (Pooled OLS) procedures with fixed effect model (i.e. clustered observations by both banks and years) to resolve random unobserved serial and cross-sectional correlation respectively (if any) in residuals (Petersen, 2009). To ensure robustness of the estimates to the presence of heteroskedasticity, we adjust the variance-covariance matrix with Huber (1964) or White (1980) estimators. We recognize the potential endogeneity concern about reverse causality; as such lagged values of independent variables are used for the statistical analysis. For robustness, we adopted Prais–Winsten (1954) regression and two-stage least squares (2SLS) instrumental variables procedures on an unbalanced panel data of 24 banks for years 2009 through 2017.

## 4 Main results and discussions

### 4.1 Banks' welfare performance

Following Hausman and Ros (2013), we made use of the estimated coefficient of own price elasticity demand from Eq. (1) and the predicted price from Eq. (2) to estimate how much better off or worse off financial consumers are in Ghana. Thus, we compare the mean predicted price of



bank loan to our proxy for the actual price of bank loan in Section 3.2. We observed that actual prices of bank loans were 1.09 percent higher than predicted, so  $\widehat{P\text{LOAN}} = P\text{LOAN} / (1+0.0109)$  and price elasticity of loan demand of  $-0.782$  (in absolute terms). This resulted in a loss in consumer surplus of approximately 0.433 percent of observed total loans.

From Table 1 row (5), the mean total loan of banks was GHS 979.46 million (US\$ 221.70 million)<sup>3</sup> for our sample period. As such, the mean loss of consumer surplus was approximately GHS4,239,860 (US\$959,700) annually. We also find that in terms of ownership structure, customers with foreign banks lost an average of GHS3,848,250 (US\$913,785) annually; whereas customers with domestic banks lost an average of GHS4,772,610 (US\$1,080,289). From this result, it can be observed that customers who took loans from foreign banks received at least GHS924,360 (US\$209,231) more in consumer surplus relative to what a domestic bank customer received on yearly basis. Similarly, customers of large banks lost an average of GHS6,898,480 (US\$1,561,484) in consumer surplus annually. However, customers of small banks lost an average of GHS1,547,150 (US\$350,200) in consumer surplus annually. This makes customers of small-sized banks relatively better off.

Table 2 Panel A reports the evolution of welfare performance in the Ghanaian banking system over the 9 year sample period (2009-2017) for all banks and the four subsample of foreign, domestic, large and small banks. For all banks, the mean welfare performance was a loss of GHS1,767,250 (US\$422,362) in 2009 and increased to GHS9,195,440 (US\$2,190,423) in 2017. Three subsamples of foreign, domestic and large banks had the loss of welfare estimates increase over the 9 year sample period; while the subsample of small banks had the loss welfare estimates decreasing over time. The observed increase in the loss of consumer surplus implies that financial consumer protection is weak in the Ghanaian banking system. This has implication for antitrust enforcement policy.

#### 4.2 *Efficiency in the Ghanaian banking sector*

Using DEA, we estimate the cost efficiency of banks in Ghana on a year on year basis. Table 1 Row 3 holds the results. Overall, the efficiency score fits well within the world's mean efficiency

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<sup>3</sup> Conversion of GHS to US\$ was done using daily interbank foreign exchange rate, sourced from Bank of Ghana website 'www.bog.gov.gh', as at December 29, 2017 at GHS4.4179/US\$1.

at an average of 78 percent.<sup>4</sup> This is consistent with the range of efficiency reported for Hong Kong banks (Kwan, 2006) and US banks (Berger and Humphrey, 1997). This implies that banks operating in Ghana are now at the efficiency point where the world was some two decades ago. Thus, government policy environment geared towards promoting an efficient and well-functioning banking system in Ghana is yielding the right results. Regarding the classification based on the ownership structure, we observe the cost efficiency of domestic banks to be quantitatively similar to foreign banks. Meanwhile, on average small banks are more efficient than large banks, evidence of diseconomies of scale in the banking system.

**Table 1**  
**Summary statistics**

This table reports the mean, median and standard deviation (Std. Dev.) of consumer surplus, cost efficiency, and Lerner index of the sample banks as of the end of the year between 2009 and 2017.

Variables		All Banks	Foreign Banks	Domestic Banks	Large Banks	Small Banks
<b>Loss Consumer Surplus (GHS'000)</b>	Mean	4239.86	3843.25	4772.61	6898.48	1547.15
	Median	3033.98	2404.41	3604.88	5235.41	1419.10
	Std. Dev.	4283.63	4105.98	4487.16	4631.43	921.99
<b>Cost Efficiency (%)</b>	Mean	78.35	77.77	79.12	76.43	80.29
	Median	83.90	82.00	83.90	87.10	82.50
	Std. Dev.	23.43	24.45	22.15	27.24	18.78
<b>Lerner Index</b>	Mean	0.710	0.760	0.643	0.750	0.669
	Median	0.716	0.786	0.646	0.790	0.670
	Std. Dev.	0.160	0.116	0.185	0.149	0.161
<b>Total Loans (GHS Million)</b>	Mean	979.46	887.84	1102.53	1593.64	357.41
	Median	700.79	555.45	832.77	1209.45	327.83
	Std. Dev.	989.57	948.53	1036.59	1069.92	212.99
<b>Total Assets (GHS Million)</b>	Mean	1,789.76	1,669.29	1,951.59	2,961.99	602.50
	Median	1,298.97	1,140.38	1,391.96	2,448.84	559.79
	Std. Dev.	1,703.96	1,730.59	1,666.66	1,702.68	328.44

*Source:* Based on research data, 2018

Table 2 Panel B reports the evolution of cost efficiency in the Ghanaian banking system over the 9 year sample period (2009-2017) for all banks and the four subsample of foreign, domestic, large and small banks. For all banks, mean cost efficiency was 91.40% in 2009 and decreased to 57.96% in 2017. Three subsamples of foreign, domestic and large banks had their

<sup>4</sup> Berger and Humphrey (1997) show that the mean bank cost efficiency of the world ranged between 55% (UK) to 95% (France).

cost efficiency estimates decline over the 9 year sample period; while the subsample of small banks had their cost efficiency increasing over time. The observed decrease in cost efficiency implies worsening technological innovations in the banking system of Ghana.

#### *4.3 Market power of banks' lending services*

Table 1 Row 4 shows the bank level estimates of Lerner index averaging over the period of 2009 to 2017. The industry reports average Lerner index of 71 percent; evidence that prices have not moved toward a competitive level. The results equally show that foreign banks exert more market power (0.76 Lerner index) than domestic banks (0.64 Lerner index). We suspect global competitive advantage to be behind the higher market power of foreign banks. Foreign banks have the advantage of being associated with financial holding companies operating in developed economies; thus they can leverage this relationship to create greater market power. For large banks, the market power is 0.75 Lerner index while small banks have an average of 0.67 Lerner index. The implication of this result is that large banks rely on their size advantage in the lending business segment of the Ghanaian banking industry.

Table 2 Panel C reports the evolution of market power in the Ghanaian banking system over the 9 year sample period (2009-2017) for all banks and the four subsamples of foreign banks, domestic banks, large banks, and small banks. For all banks, the mean market power was 0.592 Lerner index in 2009 and increased to 0.725 Lerner index in 2017. The four subsamples of foreign banks, domestic banks, large banks, and small banks had their market power estimates increase over the 9 year sample period.

#### *4.4 The role of market power and efficiency on bank welfare performance*

Table 3 reports the pooled OLS regression with fixed effect model estimation results of Eq. (11) where bank welfare performance is regressed against cost efficiency and market power while controlling for the set of bank-specific characteristics and macroeconomic variables. The analysis is repeated for all banks (full sample), foreign banks, domestic banks, large banks, and small banks.

**Table 2**  
**Evolution of loss consumer welfare, cost efficiency and market power in the Ghanaian banking system**

This table reports the mean of loss consumer surplus, cost efficiency and market power of the sample banks over the 9 years sample period (2009-2017).

Variable	Obs	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average
<b><i>Panel A: Loss Consumer Surplus (GHS'000)</i></b>											
All Banks	157	1,767.25	1,799.56	2,125.82	2,782.13	3,536.52	4,869.35	5,460.06	5,489.71	9,195.44	4,239.86
Foreign Banks	90	1,565.21	1,528.09	1,840.87	2,590.67	3,614.83	4,318.96	4,848.14	6,131.19	6,553.48	3,848.25
Domestic Banks	67	2,002.95	2,206.77	2,492.19	3,055.63	3,438.62	5,694.94	6,194.38	4,634.39	13,158.37	4,772.61
Large Banks	79	4,169.35	4,165.88	4,298.19	5,092.97	5,241.98	6,588.06	7,117.51	7,479.89	9,807.94	6,898.48
Small Banks	78	1,046.61	1,207.98	1,624.50	1,819.28	1,831.05	1,677.45	1,908.39	1,509.33	620.33	1,547.15
<b><i>Panel B: Cost Efficiency (%)</i></b>											
All Banks	157	91.40	89.58	85.02	88.21	80.92	78.91	80.33	58.93	57.96	78.35
Foreign Banks	90	94.43	91.38	85.13	87.16	83.46	79.63	79.11	58.41	48.66	77.77
Domestic Banks	67	87.87	86.88	84.87	89.71	77.71	77.82	81.80	59.62	71.92	79.12
Large Banks	79	98.83	94.73	100.00	97.84	86.30	83.35	82.47	57.24	54.96	76.43
Small Banks	78	89.17	88.29	81.56	84.20	75.54	70.64	75.76	62.30	100.00	80.29
<b><i>Panel C: Market Power</i></b>											
All Banks	157	0.592	0.712	0.731	0.739	0.732	0.723	0.676	0.737	0.725	0.710
Foreign Banks	90	0.677	0.743	0.771	0.770	0.767	0.769	0.748	0.773	0.802	0.760
Domestic Banks	67	0.494	0.665	0.679	0.696	0.687	0.655	0.589	0.690	0.609	0.643
Large Banks	79	0.646	0.822	0.872	0.822	0.765	0.764	0.721	0.755	0.711	0.750
Small Banks	78	0.576	0.684	0.698	0.705	0.698	0.648	0.578	0.703	0.923	0.669

The statistically significant test statistics across all estimation models for Wooldridge test for first-order autocorrelation (Wooldridge AR(1)) indicates the presence of first-order serial correlation problem in the panel data, suggesting the presence of an ‘*unobserved bank-fixed effect*’ (Wooldridge, 2002; p.176), thus motivating the inclusion of bank effect and year fixed-effect. In Table 3, the regression equations are well fitted with adjusted *R*-squared ranging from 64.6 percent to 91.0 percent with statistically significant *F*-statistics.

In Table 3, market power is found to be positively related to loss in consumer surplus, suggesting that powerful banks are detrimental for financial consumer welfare and consistent with Maudos and De Guevara (2007). With this result, the study support hypothesis *H1* that in a concentrated market, market power is positively associated with a loss in consumer welfare estimates. This finding challenges the argument put forth by Sarpong-Kumankoma et al. (2017) that banks should be allowed to maintain some level of market power. We document evidence of the characteristics of powerful banks and show their detrimental impact on consumer welfare. For foreign banks and small banks sub-samples, market power losses its significance. Meanwhile, the market power effect is significant at 1 percent and 5 percent for domestic banks and large banks respectively, evidence that the welfare performance of the average domestic bank and/or large bank are characterized by unwholesome market power practices. Cost efficiency estimates enter negatively, suggesting that greater cost efficiency is associated with gains in consumer surplus estimates but is only marginally significant for the all banks sample. Thus, with respect to hypothesis *H2* that in the presence of relative market power, cost efficiency is negatively associated with a loss in consumer welfare estimates. The result that greater cost efficiency is related to gains in consumer welfare is consistent with the *X-efficiency hypothesis* wherein more efficient banks have lower costs (Kwan, 2006; Sathye, 2001).

**Table 3**  
**Regression of loss consumer welfare estimate on cost efficiency and market power**

This table reports the estimation results of Eq. (11) examining the determinants of loss consumer welfare estimate. Coefficients for the bank dummies and year-effect dummies are not reported for brevity. Robust standard errors are in parenthesis. *p*-values are in brackets.

Variables	All Banks (1)	Foreign Banks (2)	Domestic Banks (3)	Large Banks (4)	Small Banks (5)
Cost Efficiency (t-1)	<b>-0.147*</b> (0.084)	-0.123 (0.081)	-0.219 (0.145)	-0.076 (0.142)	-0.238 (0.238)
Lerner Index (t-1)	<b>0.324**</b> (0.150)	0.010 (0.207)	<b>0.707***</b> (0.198)	<b>0.693**</b> (0.298)	0.253 (0.228)
Knowledge of Local Market Dynamics (t-1)	<b>0.507***</b> (0.187)	<b>0.554**</b> (0.222)	<b>0.407*</b> (0.231)	0.911 (0.612)	<b>0.478*</b> (0.278)
Loan Total Assets Ratio (t-1)	-0.205 (0.216)	-0.103 (0.325)	0.116 (0.271)	-0.271 (0.284)	<b>-0.630*</b> (0.340)
Equity Total Assets Ratio (t-1)	0.049 (0.087)	-0.028 (0.086)	0.342 (0.204)	0.339 (0.281)	-0.084 (0.059)
Bank Size (Large Bank=1)	<b>0.247***</b> (0.092)	<b>0.358**</b> (0.134)	0.005 (0.114)	----	----
Ownership Structure (Foreign=1)	<b>-1.470***</b> (0.478)	----	----	0.224 (0.505)	<b>-1.794**</b> (0.748)
Banking Sector Development (t-1)	<b>-19.591*</b> (10.086)	-6.386 (12.498)	<b>-48.645***</b> (12.703)	-10.153 (13.315)	-13.251 (10.400)
GDP per capita growth (t-1)	-4.042 (3.463)	-0.940 (5.018)	<b>-9.465**</b> (3.909)	0.146 (4.046)	<b>-12.777**</b> (4.775)
Constant	<b>17.020***</b> (2.977)	<b>14.037***</b> (4.000)	<b>23.135***</b> (3.390)	<b>12.204**</b> (4.846)	<b>22.643***</b> (3.798)
<i>F</i> -statistics	32.97 [0.00]	31.44 [0.00]	16.80 [0.00]	5.60 [0.00]	19.11 [0.00]
Wooldridge AR(1)	54.96 [0.00]	25.15 [0.00]	28.75 [0.00]	37.37 [0.00]	24.90 [0.00]
Adjusted R-squared	0.896	0.910	0.866	0.646	0.901
Observations	131	76	55	74	57

\*\*\*, \*\*, and \* indicate significance at 1%, 5% and 10% respectively

#### 4.5 The role of the bank-specific and macroeconomic variables

On bank-specific characteristics: first, knowledge of local market dynamics enters positively in all models, suggesting that greater knowledge of local market dynamics is associated with a greater loss in consumer surplus estimates. Moreover, KLMD effect is more pronounced for foreign banks. Second, loss of consumer surplus estimates is found to increase with bank size significantly, suggesting that size drive the welfare performance of banks in Ghana. The result that large banks are related to greater loss consumer welfare estimates is consistent with the *quiet life hypothesis* wherein managers of large banks use their privileges for private gains, to the detriment of more accessible financial services (Asongu and Nwachukwu, 2018; Chortareas et al., 2011). Further, the bank size effect is prevalent in foreign banks. Third, the ownership structure coefficient is negative and statistically significant for the welfare performance of banks. This is consistent with the banking globalization hypothesis (Ghosh, 2016). Further, we find the prevalence of the ownership structure effect in small banks.

On the macroeconomic factors, banking sector development has a decreasing effect on loss consumer welfare, evidence that a developing country's level of financial development is a critical precondition for financial consumer welfare and this is predominant in domestic banks. Finally, greater GDP per capita is negatively related to loss of consumer welfare and this is significant in both domestic banks and small banks.

#### 4.5 Robustness tests

As a test of robustness, the estimation process was repeated using Prais-Winsten (1954) regression and the instrumental variable two-stage least squares (IV-2SLS) procedures as alternative estimation techniques.

##### 4.5.1 Alternative estimation techniques - Prais-Winsten (PW) regression and IV-2SLS

We adopt Prais–Winsten (1954) to test the robustness of our findings to panel heteroskedasticity, cross-sectional dependence and first-order serial correlation similar to studies by Adeabah et al. (2018). Table 5 Model (1) reports Prais–Winsten (1954) regression estimates for our sample. Very consistent results in terms of the direction and significance of the variables of interest (XEFF and LI) and the overall predictive power of the model was found. In particular, we find a

negative relation between consumer surplus and cost efficiency, and between consumer surplus and market power.

**Table 4**  
**Robustness tests – PW Regression and Instrumental Variables (2SLS) Regression**

This table reports the estimation results of Eq. (11) examining the determinants of loss consumer welfare estimate using Prais-Winsten regression and instrumental variables (2SLS) regression. Coefficients for the bank dummies and year-effect dummies are not reported for brevity. Robust standard errors are in parenthesis. *p*-values are in brackets.

<b>Variables</b>	<b>PW-Regression</b> <b>(1)</b>	<b>IV-2SLS</b> <b>(2)</b>
Cost Efficiency (t-1)	<b>-0.176**</b> <b>(0.086)</b>	<b>-0.178***</b> <b>(0.043)</b>
Lerner Index (t-1)	0.294 (0.487)	<b>2.241***</b> <b>(0.683)</b>
Knowledge of Local Market Dynamics (t-1)	<b>0.245***</b> <b>(0.058)</b>	<b>0.138**</b> <b>(0.064)</b>
Loan Total Assets Ratio (t-1)	0.127 (0.259)	<b>1.342***</b> <b>(0.266)</b>
Equity Total Assets Ratio (t-1)	-0.136 (0.110)	<b>-0.881***</b> <b>(0.140)</b>
Bank Size (Large Bank=1)	<b>0.965***</b> <b>(0.113)</b>	<b>0.827***</b> <b>(0.099)</b>
Ownership Structure (Foreign=1)	<b>-0.308***</b> <b>(0.117)</b>	-0.127 (0.094)
Banking Sector Development (t-1)	<b>-17.279***</b> <b>(4.881)</b>	-5.266 (4.905)
GDP per capita growth (t-1)	0.020 (0.017)	<b>-0.873***</b> <b>(0.323)</b>
Constant	<b>14.762***</b> <b>(0.461)</b>	<b>13.039***</b> <b>(0.548)</b>
Observations	131	109
R-squared	0.887	0.837
Adjusted R-squared	----	0.815
Wald $\chi^2$ (9) / <i>F</i> -statistics	<b>230.82 [0.00]</b>	<b>38.74 [0.00]</b>
Wooldridge Robust Score $\chi^2$ (2)	----	<b>8.203 [0.02]</b>
Wooldridge Robust Regression F (2, 93)	----	<b>2.804 [0.07]</b>
Test of Overidentifying Restrictions	----	3.753 [0.15]
Number of banks	23	----

\*\*\*, \*\*, and \* indicate significance at 1%, 5% and 10% respectively



Further, we recognize that endogeneity is generally a concern in the literature concerning efficiency and market power of banks. Following prior studies (e.g. Dick (2008)), we implement the two-stage least squares (2SLS) instrumental variables procedure for Eq. (10) in Section 3.8. We use lag one and two values of cost efficiency and market power estimate as instruments. We conduct a specification test to ensure the validity of instruments and endogeneity of cost efficiency and market power. Wooldridge's over-identifying restriction test is employed to assess the validity of the instruments. The null hypothesis is that instruments are valid. For the potential endogeneity of cost efficiency and market power, we conduct Wooldridge robust score test for exogeneity and robust regression exogeneity test. The null hypothesis in both tests is that cost efficiency and market power are exogenous.

Table 5 Model (2) reports the results for all banks. The results generally confirm the findings from the pooled OLS regression with a fixed model in Table 3 with a number of differences revealed. First, the negative relationship between loss of consumer surplus and cost efficiency is statistically significant at 1 percent level. Second, the liquidity position of banks is positively and significantly related to loss consumer surplus; evidence that highly liquid banks charge a premium in the lending business segment. Third, the degree of capitalization is negatively and significantly related to loss of consumer surplus, suggesting that well-capitalized banks serve as effective constraint mechanism against loss of consumer surplus.

## **5 Conclusion and policy implication**

The study analyses the welfare performance of banks' lending services in the Ghanaian banking industry with emphasis on the role of market power and efficiency. The factors examined can be grouped into hedge factors and enablers of loss of consumer welfare. The hedge factors include: greater cost efficiency, well-capitalized banks and improved per capita income. The enablers are greater market power, greater knowledge of local market dynamics, highly liquid banks as well as large banks.

The result that greater cost efficiency is related to gains in consumer surplus estimates, and greater market power is associated with higher loss consumer surplus suggests that banking supervision and research ascertaining financial consumer protection, innovation, and financial

inclusion should take into consideration cost efficiency and market power at the individual banks level. An additional implication of these results suggests that antitrust enforcement may be socially beneficial to provide an incentive for competitive pricing in the lending business segment of banking.

At this point, it is noteworthy to state that the relationship evident in this paper does not indicate causality but then it shows how prevalent these factors are in the generation of bank's welfare performance. The result that greater knowledge of local market dynamics is associated with a greater loss in consumer surplus estimates has implication for information sharing. The result suggests that if banks are allowed to generate knowledge of local market dynamics at their own cost, which is generally the case, instead of working with credit referencing bureaus, the financial consumer becomes worse off. Indeed, Asongu and Nwachukwu (2018) show that information sharing has a decreasing effect on loan price which enhances the loan quantity received by borrowers, thus increasing the level of gains in the welfare of banks in Africa. The result that well-capitalized hedge against loss consumer welfare suggests that bank supervisors should keep a close eye on capital ratios and enforce capital requirement as banking firms may insulate low capital with greater loss of consumer welfare. Overall, the results indicate that market power and bank efficiency are competing interests for policymakers in their consideration of policy reforms geared toward an efficient and well-functioning banking system.

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## Appendix

### Estimated demand for bank loan services

Variables	Fixed Effect <i>lnQLOAN</i>	Random Effect <i>lnQLOAN</i>
Constant	0.607 (0.904)	0.899 (0.788)
$\ln\text{PLOAN}_{i,t}$	-0.782*** (0.113)	-0.455*** (0.101)
$\ln\text{QLOAN}_{i,t-1}$	0.926*** (0.042)	0.935*** (0.036)
<i>Diagnostics</i>		
Observations	132	132
R-squared (within)	0.816	0.796
F-statistics (2,107) / Wald $\chi^2(2)$	237.85***	1050.87***
Hausman test $\chi^2(2)$	65.09***	----
Number of banks	23	23

Notes: Robust standard errors in parentheses.

\*\*\*, \*\*, and \* indicate significance at 1%, 5% and 10% respectively

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