

Adeabah, David; Andoh, Charles

Article — Accepted Manuscript (Postprint)

Cost efficiency and welfare performance of banks: Evidence from an emerging economy

International Journal of Managerial Finance

Suggested Citation: Adeabah, David; Andoh, Charles (2019) : Cost efficiency and welfare performance of banks: Evidence from an emerging economy, International Journal of Managerial Finance, ISSN 1743-9132, Emerald, Bingley, Vol. 16, Iss. 5, pp. 549-574, <https://doi.org/10.1108/IJMF-06-2019-0212>

This Version is available at:

<https://hdl.handle.net/10419/209117>

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Cost efficiency and welfare performance of banks: Evidence from an emerging economy

Journal:	<i>International Journal of Managerial Finance</i>
Manuscript ID	IJMF-06-2019-0212.R2
Manuscript Type:	Research Paper
Keywords:	Cost Efficiency, Bank Welfare Performance, Social Cost, Financial Consumer Protection, Quantile Regression, Ghana

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Abstract

Purpose – The study examines the relationship between the consequential social cost of market power (i.e., welfare performance of banks) and cost efficiency using data covering the period 2009 to 2017 from the Ghanaian banking industry.

Design/methodology/approach – The study adopts the Ordinary Least Squares (OLS), Fixed Effect (FE) panel regression and the Quantile regression (QR) approaches to control for heterogeneity and provide increased room for policy relevance. The Two-Stage Least Squares Instrumental Variables (2SLS-IV) regression is used to ensure the robustness of the findings against the problem of possible reverse causality.

Findings – The results indicate a positive relationship between banks' welfare performance and cost efficiency, which suggests that greater cost efficiency hedges welfare losses. In other words, welfare gains and cost-efficient banks are not mutually exclusive. Also, the results show evidence that the sensitivity of welfare gain to cost efficiency depends on the knowledge of local market dynamics. Further, the findings from the QR estimation suggest that, but for welfare loss at low (Q.25) to the median (Q.50) quantiles, cost efficiency is a necessary and sufficient condition to hedge the welfare losses.

Practical/policy implications – The results demonstrate that financial consumer protection cannot be achieved without cost efficiency in the presence of both foreign banks and high market knowledge. Therefore, our paper suggests an integrated cost efficiency policy approach that has the complementary effect of a robust information sharing mechanism and incentives to hedge against welfare losses in the banking sector of emerging economies. Moreover, if welfare gain is synonymous with cost-efficient banks, then the presence of a quiet life is typical of financial consumer protection.

Originality/value – This study provides insight into the importance of cost efficiency to the public policy of financial consumer protection in an era of foreign banks' dominance. From the review of prior literature, this paper is the first to apply the QR estimation technique to examine the effect of cost efficiency throughout the conditional distribution of bank welfare performance rather than just the conditional mean effect of cost efficiency.

Keywords – Cost Efficiency; Bank; Welfare Performance; Social Cost; Financial Consumer Protection; Quantile Regression; Ghana

Paper type – Research paper

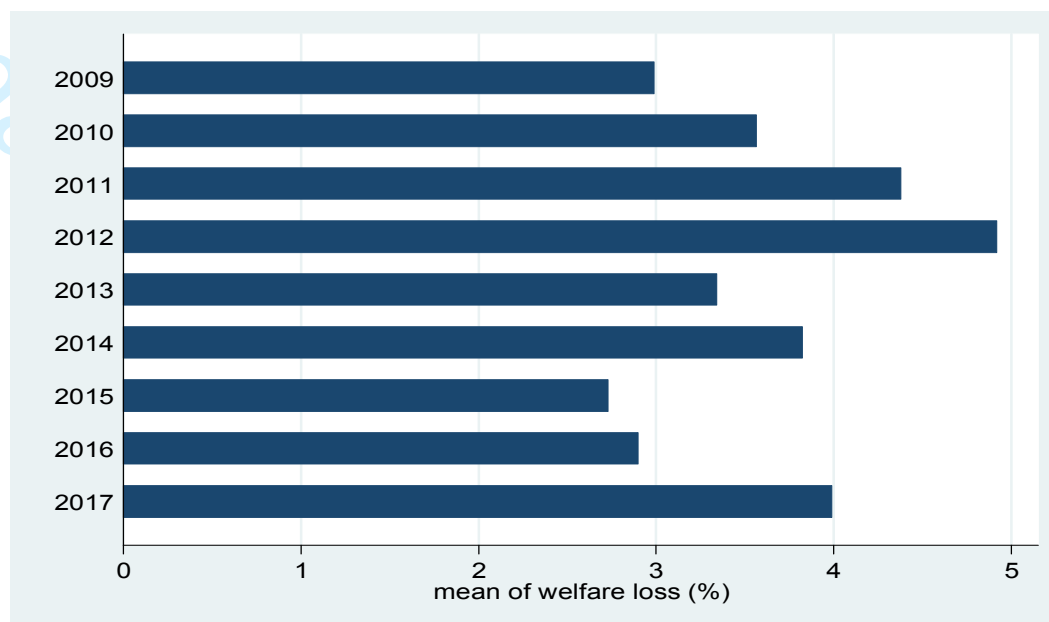
1. INTRODUCTION

A banking system that is not price-competitive has dire consequences for the financial consumer. Prior literature shows that the financial consumer suffers the social cost of the market power of banks in such a system. For example, in Mexico over the period 1993-2005 social cost from market power was estimated at 0.15 percent of gross domestic product (GDP) in 2005 (Solis and Maudos, 2008). Similarly, in the banking sectors of 15 European countries over the period 1993 – 2002 welfare loss from market power was estimated at 0.54 percent of GDP in 2002 (Maudos and De Guevara, 2007). In Saudi Arabia, the social cost associated with market power, using data for the period 2001 – 2012, was estimated at 0.82 percent of GDP in 2012 (Almounsor and Mensi, 2016). For a developing economy like Ghana in Sub-Saharan Africa (SSA), the social cost of market power was estimated at 2.6 percent of GDP in 2008 (Aboagye, 2012). In the same measure, an inefficient banking system exacerbates the plight of the financial consumer. This ranges from 0.021 percent for cost inefficiency to 0.075 percent for profit inefficiency to GDP (Solis and Maudos, 2008).

What most empirical studies have done is to examine the relationship between market power and cost efficiency in a bid to test the validity of four competing hypotheses (i.e., structure-conduct-performance (SCP) hypothesis, the relative market power hypothesis, the quiet life hypothesis, and the X-efficiency hypothesis) to explain this phenomenon (Tu and Chen, 2000; Weill, 2004; Maudos and De Guevara, 2007; Solis and Maudos, 2008; Delis and Tsionas, 2009; Fu and Heffernan, 2009; Ariss, 2010; Aboagye, 2012; Williams, 2012; Alhassan and Ohene-Asare, 2016; Almounsor and Mensi, 2016). We extend and complement this extant literature by examining the relationship between the consequential social cost of market power (i.e., welfare performance of banks) and cost efficiency. Our motivation is that market power in banking systems cannot be done away with completely, and as suggested by Sarpong-Kumankoma *et al.* (2017) banks should be allowed to possess some level of market power to sustain the value-enhancing effect of cost efficiency. Also, Mirzaei *et al.* (2013) are of the view that policymakers should not be excessive in their rollout of competition policy as that may yield unintended consequences by destabilizing the banking

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3 system. Thus, society would have to endure the consequential social cost (welfare loss) of banks' market
4 power. Recent studies have shown that the process of deregulation has had limited success at restraining
5 the prowess of bank market power (Ho, 2012; Williams, 2012; Detragiache *et al.*, 2008). These studies
6 have confirmed, however, the existence and relevance of the concept of mutual exclusivity between welfare
7 gains from reduced market power and cost-efficient banks. The available empirical evidence shows that
8 welfare gains occasion loss of bank cost efficiency at the macro-level (Maudos and De Guevara, 2007).
9 However, it is unclear how welfare gains and cost efficiency relate at bank-level. Extending this link to the
10 bank-level is important because in banking, competition or market power takes place at a much lower level
11 than the macro level^[1].
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23 In order to bridge this gap, this paper investigates the relationship between banks' welfare
24 performance and cost efficiency based on Ghanaian banks. The Ghanaian banking context is suitable mainly
25 because the sector has seen extensive reforms over the period 1988 to 2016^[2]. The net effect of these reforms
26 include: (i) the removal of government control over interest rates, credit rates, and exchange rates; (ii) the
27 liberalization of the Ghanaian banking system resulting in the emergence and operation of a number of
28 locally incorporated banks and foreign banks; (iii) independence to the central bank; (iv) consolidation and
29 (v) closure of the supervisory and regulatory gaps while promoting financial consumer protection,
30 innovation and financial inclusion. However, high interest spread has been a major downside of the
31 numerous changes that have taken place in the Ghanaian banking system. This makes the banking sector
32 uncompetitive due to mispricing from the exercise of market power. The percentage of welfare loss to GDP
33 per year, as shown in Figure 1, has been increasing steadily from an average of 2.99% of GDP in 2009, it
34 reached 4.92% of GDP in 2012. Despite a significant decline in welfare loss to GDP in both 2013 and 2015
35 by 1.58% and 1.09% respectively, there was an increase in welfare loss of 1.26% of GDP between 2015
36 and 2017. Therefore, the continuous limited success with financial liberalization in the area of price
37 competition gives rise to the paramount need for mechanisms to reduce welfare losses from the market
38 power of banks.
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Figure 1: Mean welfare loss as a percentage of GDP per year

Further, the analysis of the Ghanaian banking sector shows supplementary unique features; specifically, the dominance of foreign banks and market knowledge (learning by doing). These unique features enable us to answer the following related questions which have seen limited attention in the extant literature. How do foreign banks affect social welfare in an era of their dominance? How does “learning by doing” affect social welfare? How does the interaction of either foreign banks or market knowledge with cost efficiency affect social welfare?

Our paper makes the following contributions to bank performance literature in general and the Ghanaian banking system. First, using a sample of commercial banks from an emerging economy in SSA banking system for the period 2009-2017, which was characterized by foreign banks’ dominance, we extend the previous studies that focused on emerging economies in Europe, Asia and Latin America on the impact of cost efficiency on bank social cost due to mispricing (Maudos and De Guevara, 2007; Fang *et al.*, 2011; Almounsor and Mensi, 2016). Unlike previous studies that confined the estimation of social welfare loss to national level aggregate, the present study computes social welfare loss at the individual bank level scaled by total assets, year on year. Therefore, our test variable, social welfare loss, enables us to examine bank-

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3 level heterogeneity in social welfare loss from market power. Also, the study applies the QR approach to
4 provide an added advantage as welfare performance differs from one bank to another. Thus, we resolve
5 concerns about cross-bank variations in our estimate of welfare performance and provide increased room
6 for policy relevance. From our review of prior literature, this paper is the first to apply the QR estimation
7 technique to examine the effect of cost efficiency throughout the conditional distribution of bank welfare
8 performance rather than just the conditional mean effect of cost efficiency.
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16 Second, our paper provides new empirical evidence by examining the conditioning effect of foreign
17 banks and market knowledge on the relationship between cost efficiency and welfare performance of banks.
18 On one hand, studies like Ghosh (2016) suggests that the banking sector globalization is a precondition for
19 improvement in the cost and profit efficiencies of banks in developing countries. On the other hand, the
20 findings of Asongu and Nwachukwu (2018) suggest that information sharing plays a critical role in
21 safeguarding the financial consumer by reducing loan prices and increasing loan quantities borrowers
22 receive. Thus, the interaction effect of cost efficiency and foreign banks, as well as cost efficiency and
23 market knowledge could have a more apparent impact on welfare losses and provide relevant policy
24 direction in the effort to reduce welfare losses. To the best of our knowledge, this paper is the first to
25 examine the conditioning effect of foreign banks (in an era of their dominance) and market knowledge on
26 the social welfare of banking firms in SSA^[3]. Additionally, although there is a major shift from state
27 commercial banks to private foreign banks and domestic banks in Ghana, the available empirical accounts
28 have failed to quantify the welfare implications of this change as a post-policy evaluation; our paper
29 contributes in this direction.
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46 The remainder of the paper is organized as follows: Section 2 discusses the related literature and
47 develops the hypotheses; Section 3 discusses the data, empirical models and econometric estimation
48 techniques used; Section 4 details the findings; and Section 5 concludes and discusses the implications of
49 the study.
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2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. *Theoretical Underpinning and Related Literature*

Intuitively, banking competition is expected to bring about welfare gains. This ultimately should be done through the reduction of monopoly rents and cost inefficiencies (Pruteanu-Podpiera *et al.*, 2008). Prior studies suggest that banks generate welfare losses on two fronts, namely market power and inefficiency emanating from the management of banking firms. According to Berger and Hannan (1998), loss in cost efficiency associated with market power is several times larger than social loss due to mispricing as a result of the exercise of market power. On the contrary, Solis and Maudos (2008) assert that welfare loss from the exercise of market power outweighs that from the cost and/or profit inefficiency of banking firms. Thus, our theoretical framing is grounded in the *quiet life* hypothesis. Evidence from the literature shows that either the presence (see Rhoades and Rutz, 1982) or absence (see Solis and Maudos, 2008; Maudos and De Guevara, 2007) of a quiet life in a banking system is a fertile ground for welfare loss. When banks live a *quiet life*, their practice deviates from the average fairly competitive behavior (Delis and Tsionas, 2009). The associated costs include high borrowing costs, credit restriction and compromised intermediation services (Chortareas *et al.*, 2011). However, the quantum of the loss is differentiated based on whether there is a quiet life or not. In other words, the difference between welfare loss with and without a quiet life represents a saving, which should be of interest to financial consumers and policymakers. Therefore, the question of whether banking systems need to maintain a quiet life or not in the hedging process of welfare loss is critical as that affects the quantum of welfare loss that may be tolerated.

2.2. *Mechanisms to Mitigate Welfare Losses from the Market Power of Banks*

The literature on the mechanisms to mitigate welfare losses from bank market power is immense. However, in this literature review, we dwell on the following mechanisms: (1) cost efficiency, and (2) the moderating role of foreign banks and market knowledge.

2.2.1. Cost Efficiency and Welfare Gain

The empirical evidence concerning cost efficiency as a mechanism to mitigate welfare losses from bank market power is complex and mixed. One school of thought suggests that market power and cost efficiency co-evolve while the other school of thought suggests that market power and cost efficiency compete. The two schools of thought constitute competing views concerning how social welfare loss and cost efficiency relate.

On the one hand, Koetter *et al.* (2012) examined the quiet life hypothesis for cost and profit inefficiencies among US commercial banks. The results showed that a quiet life does not exist for cost inefficiencies. In other words, the market power of banks does not exacerbate their cost efficiency but rather confines management to their comfort zone about their growth strategies. Maudos and De Guevara (2007) studied the relationship between market power and efficiency in the EU-15 countries over the period 1993-2002. The results revealed that there exists a positive relationship between market power and cost X-efficiency, suggesting that banks in the EU-15 do not operate a quiet life. It must be noted that the estimated welfare loss due to market power was 0.54 percent of the GDP of the EU-15 countries in 2002. Also, welfare gain was associated with reduced market power and loss of bank cost efficiency. On the other hand, Berger and Hannan (1998) have shown that banks operating in more concentrated markets exhibit lower cost efficiency, which implies the presence of a quiet life in the US banking system. Using the European Economic and Monetary Union (EMU) bank data, Delis and Tsionas (2009) demonstrated that efficiency and market power were negatively related, which is in line with the quiet life hypothesis. Coccoresse and Pellecchia (2010) investigated the quiet life hypothesis in the Italian banking industry using data for the period 1992–2007. Their findings established that banking firms with market power are less efficient. In other words, a quiet life exists in the Italian banking system. From the above literature, the scholarly emphasis has been inconclusive and mixed, at least, in developed economies. Färe *et al.* (2015) pointed out that these variations were due to the level of market power, the component of efficiency evaluated (cost,

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3 technical or allocative) and the type of banking firm (commercial bank or savings bank), suggesting that
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5 the quiet life might be a reality only for some financial institutions.
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8 There appears to be a wide recognition of a *no quiet life* in the banking systems of emerging
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10 economies. According to Fu and Heffernan (2009), there was no evidence of the quiet life hypothesis from
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12 1985 to 2002 in China's banking system. Using quarterly data over the period 1994 to 2005, Pruteanu-
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14 Podpiera *et al.* (2008) provided empirical evidence of the relationship and causality between competition
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16 and efficiency in the Czech banking system. Their study rejected the quiet life hypothesis as there existed
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18 a negative causality from competition to efficiency between 1994 and 2005. Phan *et al.* (2016) examined
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20 the efficiency of banking firms in six emerging economies in Asia and found that market concentration has
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22 a positive effect on X-efficiency, whereas competition has a negative effect on X-efficiency. Thus, they
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24 rejected the quiet life hypothesis from 2005 to 2012 in emerging economies in Asia. Williams (2012)
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26 examined the relationship between efficiency and market power for a sample of 419 Latin American
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28 commercial banks using data for the period 1985 to 2010. Results from the two-stage least squares
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30 instrumental variables estimation strongly rejected the quiet life in the banking system. In an era of foreign
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32 banks' dominance in six transition economies, Fang *et al.* (2011) showed that the market power of a bank
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34 has a positive association with both cost and profit efficiency; thus, rejecting the quiet life for both cost and
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36 profit inefficiency in southeast Europe banking systems between 1998 and 2008.
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40 Evidence from the African banking systems largely confirms the *no quiet life hypothesis*. Kouki
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42 and Al-Nasser (2017) investigated the implications of banking competition and reported that a higher
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44 degree of market power is related to a higher level of efficiency. Therefore, the findings rejected the
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46 existence of a quiet life in the African banking system. Similarly, Sarpong-Kumankoma *et al.* (2017)
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48 demonstrated that increase in market power leads to greater bank cost efficiency in 11 SSA countries,
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50 suggesting that relative market power is not an entirely bad thing because that ensures banking system
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52 efficiency. Abel and Le Roux (2016) studied the relationship between cost and revenue efficiency, and
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54 competition in the Zimbabwe banking system. Using data from 2009 to 2014, the authors applied the
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Granger causality method and showed that revenue and cost efficiency positively Granger causes market power, suggesting a trade-off between revenue and cost efficiency and competition in the application of pro-competitive policies. Aboagye (2012) reported that bank concentration is positively correlated with efficiency in both deposit and loan markets in the Ghanaian banking industry. Similarly, Alhassan and Ohene-Asare (2016) have provided empirical evidence of the relationship between competition and efficiency using data on 26 banks over the 2004-2011 period in the Ghanaian banking industry. Using the Boone indicator as proxy for bank competition, the results showed that competition exerts a positive influence on bank cost efficiency. In a related study, Adjei-Frimpong *et al.* (2013) examined the causal link between bank efficiency and competition in the Ghanaian banking system. Using system generalized method of moments technique on data for the period 2001-2010, the findings suggested that bank cost efficiency positively Granger-causes market power. The results revealed that an increase in bank cost efficiency leads to an increase in bank market power, which implies that regulators face a trade-off between financial consumer protection (social welfare) and cost efficiency if the *quiet life* for cost inefficiency is rejected in a banking system.

Mutual Exclusivity Hypothesis: Given the positive relationship between market power and cost efficiency, on the one hand, increased market power leads to increased cost efficiency. By implication, powerful banks are cost-efficient. On the other hand, decreased market power, which necessitates welfare gains, results in decreased cost efficiency. Therefore, less powerful banks are less cost-efficient. The implication is that welfare gains occur in the presence of less cost-efficient banks, which shows that welfare gains from reduced market power and cost-efficient banks are mutually exclusive. Accordingly, consistent with the wide recognition of the existence and relevance of the concept of mutual exclusivity between welfare gain and cost-efficient banks in emerging economies and the African banking system, our first testable hypothesis is stated as follows.

Hypothesis 1 (H1): *There is a negative and significant relationship between cost efficiency and bank welfare performance (an inverse form of social welfare loss).*

2.2.2. Moderating Role of Foreign Banks and Market Knowledge

Foreign banks are believed to prompt competition (Demirgüç-Kunt *et al.*, 1998). Nonetheless, the empirical findings are mixed on the direct relationship between foreign banks, and bank market power and competition (e.g. Yeyati and Micco, 2007; Jeon *et al.*, 2011). From the perspective of Claessens and Laeven (2004), the entry of foreign banks enhances the competitiveness of banking systems. Although, at other times, foreign banks may also induce undue competition (Chen *et al.*, 2019), which increases financial fragility (Wu *et al.*, 2017), the penetration of foreign banks appears to have led to a less competitive banking industry in Latin America (Yeyati and Micco, 2007). Foreign banks are a precondition for improved efficiency of the banking system of developing economies (Ghosh, 2016) and deregulated environment (Sturm and Williams, 2004). Foreign banks are also important as they increase firms' access to long term credit (Lin, 2011), improve capital allocation (Giannetti and Ongena, 2009) and ensure superior cost efficiency (Poghosyan and Poghosyan, 2010). Evidently, increase in foreign bank penetration enhances competition (reduced market power) in the banking sectors of host countries (Jeon *et al.*, 2011). But foreign banks are also characterized by lower cost efficiency (Fang *et al.*, 2011; Lensink *et al.*, 2008).

Whereas the foreign bank entry, presence and ownership effect has been mixed and inconclusive, the interaction of the cost efficiency and foreign banks presents a case for efficient foreign bank participation. Indeed, it has been observed that efficient foreign banks increase competitive pressures in banking systems (Hauner and Peiris, 2008; and Mulyaningsih *et al.*, 2015). Hence, the second hypothesis is stated as follows:

Hypothesis 2 (H2): *Foreign banks have a positive effect on the relationship between cost efficiency and bank welfare performance.*

Regarding market knowledge ("learning by doing" as proxied by bank age), Mester (1996) made the case that learning by doing enhances the cost efficiency of banks as measured by stochastic cost frontier

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3 approach while considering risk preferences in the US banking system. Contrary to this finding, the results
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5 from emerging economies in Africa have been distinctive. Adeabah *et al.* (2019) used the data envelopment
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7 analysis approach to compute the technical efficiency of commercial banks in Ghana and argued that
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9 “learning by doing” leads to technically inefficient banks. The empirical evidence from non-financial firms
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11 also confirms that the firm age effect is less efficient and is insignificant (Lundvall and Battese, 2000).
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13 Whereas earlier studies, in developed economies, confirm the existence and relevance of learning by doing
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15 on bank performance, several other contemporary studies in developing economies do not support the
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17 learning by doing hypothesis.
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21 We explain this variation as due to the level of development of the information sharing environment
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23 between developed and developing economies. Theoretically, developed financial markets have a robust
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25 information sharing environment and therefore, there exists little or no bank-level heterogeneity in market
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27 knowledge in the banking system. This implies that banks cannot use market knowledge as a competitive
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29 advantage and private privilege for self-interest monopoly rent extraction. However, in an opaque and
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31 underdeveloped information sharing environment such as in the banking systems of developing economies,
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33 banks generate knowledge of local market dynamics at their own cost, instead of working with credit
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35 reference bureaus. Therefore, market knowledge is held in “secret” and used as a competitive advantage
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37 tool and a private privilege to extract more in welfare loss.
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41 The interaction of cost efficiency and market knowledge (i.e., efficient market knowledge) seems
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43 to mimic the equivalence of a robust information sharing mechanism, which gives credence to little or no
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45 bank-level heterogeneity in market knowledge in the banking system. Asongu and Nwachukwu (2018)
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47 suggest that information sharing plays a critical role in safeguarding the financial consumer by reducing
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49 loan prices and increasing loan quantities borrowers receive. Therefore, we expect that an efficient market
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51 knowledge should ensure welfare gains. Hence, the third hypothesis is stated as follows:
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54 ***Hypothesis 3 (H3):*** *Market knowledge has a positive effect on the relationship between cost efficiency and*
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56 *bank welfare performance.*
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3. DATA AND METHODS

3.1. *Data and Sample Selection*

The structure of the banking system in Ghana is relatively small consisting of 33 banks at 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 are year-end financial characteristics of banks extracted from the annual bank report actual filings with the Bank of Ghana (BoG). We complemented this data with a unique hand-collected dataset on banks' board structure compiled from annual reports of banks sourced from each bank's website. The sample period spans nine years, from 2009 to 2017.

Our choice of the 2009-2017 sample period is based on the significant prudent regulations passed post-Financial Structural Adjustment Programme (FINSAP) to align the banking system in Ghana with international standards. Some of these regulations are the establishment of a credit reference bureau, the implementation of International Financial Reporting Standards (IFRS) for all banks, increase in the minimum stated capital of banks twice in both 2009 and 2012 to strengthen the capital base of banks, and the risk-based supervision of banks. Also, the sample period represents a level playing field as all banks operated the Universal Banking License. Furthermore, it represents a period where financial consumer protection, innovation and financial inclusion are core policy drivers in the banking system. In this respect, the sample period represents a banking system that is vibrant compared to other banking systems in the sub-region. Therefore, the sample period for this study presents immense importance to several stakeholders in the process of ensuring an efficient and well-functioning system.

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 for the period 2009-2017, yielding 157 bank-year observations. Data for institutional quality is sourced from Heritage Foundation (HF), while that of GDP per capita is sourced from the World Development Indicators (WDI)

database. To control for outliers, variables such as welfare loss as a percentage of total assets ($WelfareLoss\%TA$), Z -score and $Capitalization$ were winsorized at 1th and 99th percentiles.

3.2. Proxy for actual price of loan and deposit

We computed the price of a loan, r_L^* , to customers (households and firms) as a ratio of the change in interest income to changes in interest-bearing assets. The price of deposit, r_D^* was computed as a ratio of the change in interest expense to change in interest-bearing liabilities. Computing the 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 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 been agreed on prices set in the previous year; thus, it is not helpful to include them 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 the input (deposit), excluding the effect of floating or fixed rate should have only minimal or no consequences for the measurement of the prices of loan and deposit.

3.4. Proxy for bank's welfare performance

Following prior studies (e.g., Solis and Maudos, 2008; Aboagye, 2012), welfare loss is used as a proxy for the welfare performance of banks. With a monopoly, profit-maximization level of loans is L^* and of deposit is D^* with a loan rate of r_L^* and deposit rate of r_D^* per unit respectively.

The welfare loss may be expressed as a fraction of total assets, TA , thus:

$$\frac{Welfare\ Loss_{it}}{TA_{it}} = \frac{1}{2TA_{it}} \left[\frac{r_{Lit}^* - r_t - mc_{Lit}}{r_{Lit}^*} r_L^* L^* + \frac{r_t - r_{Dit}^* - mc_{Dit}}{r_{Dit}^*} r_D^* D^* \right] \quad Eq. 1$$

where r_{Lit}^* and r_{Dit}^* are the average lending and deposit rates of bank i in year t . L^* and D^* are loans and deposits outstanding on the books of bank i in year t . r_t is the average rate of Government of Ghana (GoG) one-year treasury note in year t ⁴. mc_{Lit} and mc_{Dit} are the average of the marginal costs of lending and of mobilizing deposit for bank i at year t . To maximize profit, the i th bank in year t sets $r_D^* < r < r_L^*$.

Following prior studies that demonstrate that the Lerner index offers a proxy for the welfare loss due to market power (e.g., Maudos and De Guevara, 2007; Solis and Maudos, 2008; Aboagye, 2012) and for simplicity, and given the nature of our dataset which is an unbalanced panel, we do not calculate the $mc_{L(it)}$ and $mc_{D(it)}$ from a trans-log cost function as is commonly done in the literature, but given a profit-maximizing rule, marginal revenue (MR) = marginal cost (MC), and a reasonable assumption that banking firms engage in the third-degree price discrimination strategy, the average marginal cost of loans and deposits for the i th bank in year t can be formalized as:

$$mc_{Lit} = \frac{r_{Lit}^*(1 + \alpha_2)}{\alpha_2} \quad \text{and} \quad mc_{Dit} = \frac{r_{Dit}^*(1 + \beta_2)}{\beta_2} \quad \text{Eq. 2}$$

where banking firms maximize profit at the point $\alpha_2 < \beta_2 < 0$. α_2 is the elasticity of demand for loans in the banking industry over the 9 year sample period (2009 – 2017) from the financial consumer perspective derived from Eq. 3 and β_2 is the elasticity of demand for deposit in the banking industry over the 9 year sample period from banking firms derived from Eq. 4.

To analyze the demand for the i th bank loan, we assume a log-log functional form that is explained by the price of a loan R_{Lit} and the lag values of total loans $L_{i(t-1)}$ similar to Hausman and Ros (2013). Thus, the demand function for loan services is given as:

$$\ln L_{it} = \alpha_0 + \alpha_1 \ln L_{i(t-1)} + \alpha_2 \ln R_{Lit} + \gamma_t + \varepsilon_{it} \quad \text{Eq.3}$$

From the perspective of banking firms, the demand for deposits is assumed as a log-log functional form that is explained by the price of deposits R_{Dit} and the lag values of the total deposit $D_{i(t-1)}$.

$$\ln D_{it} = \beta_0 + \beta_1 \ln D_{i(t-1)} + \beta_2 \ln R_{Dit} + \gamma_t + \varepsilon_{it} \quad \text{Eq.4}$$

where i begins from bank 1 to bank 24 and t starts from the year 2009 to 2017. \ln is the natural logarithm; γ_t is a vector of year dummies starting from 2010 to 2017 while ε_{it} is the stochastic error term.

For Equations 3 and 4 above, we employed the bias-corrected Least Squares Dummy Variables (LSDVC) dynamic regression. Bias correction up to order $O(1/NT^2)$ initialized through the implementation of Blundell and Bond (1998) estimator and implemented in Stata using the user-written command *xtabond2* by Roodman (2009)^[5]. The results are tabled in Appendix A1.

3.5 **Bank cost efficiency: Data Envelopment Analysis (DEA)**

In this paper, we follow prior studies such as Almousor 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 Almousor 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 is no different (Ho, 2010; Kwan, 2006). 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 highlight 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. In this regard, for n firms ($i = 1, \dots, n$) with cost minimizing

objective, uses a vector of p inputs $x_i = (x_{i1}, \dots, x_{ip}) \in (\mathbb{R}^+)^p$ given the price of the inputs $w_i = (w_{i1}, \dots, w_{ip}) \in (\mathbb{R}^+)^p$ to produce a vector of q outputs $y_i = (y_{i1}, \dots, y_{iq}) \in (\mathbb{R}^+)^q$. Thus, cost efficiency for i th bank is computed as below:

$$\min_{\lambda, x_i^*} w_i' x_i^*, \text{ subject to: } -y_i + Y\lambda \geq 0, x_i^* - X\lambda \geq 0, N1'\lambda = 1, \lambda \geq 0 \quad \text{Eq.5}$$

where w_i is a vector input price for the i th bank and x_i^* is the cost-minimizing vector of input quantities for the i th bank, given the vector of input prices w_i and the vector of output quantities y_i , λ is an $N \times 1$ vector of constants, $N1$ is an $N \times 1$ vector of ones to account for VRS assumption, Y is a $Q \times N$ output matrix and X is a $P \times N$ input matrix (Coelli, 1996). We obtained the i th bank's total cost efficiency estimates by the ratio of the minimum cost to observed cost, in Eq. 6 below:

$$\text{Cost Efficiency}_i = \frac{w_i' x_i^*}{w_i' x_i} \quad \text{Eq. 6}$$

Input and output factors are pre-requisite in bank efficiency analysis using DEA. We use as input variables: (i) lendable funds ($X1$); (ii) labor ($X2$); (iii) capital ($X3$); and (iv) board size ($X4$). The prices of these inputs are as follows: price of lendable funds is measured as the ratio of interest expense to total deposits ($W1$); the price of labor is measured as the ratio of 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) are motivated by prior studies such as Sathye (2001) and Adeabah *et al.* (2019). In particular, the board size framework of board structure is included because bank efficiency measurement benefits from the inclusion of non-financial variables (Adeabah *et al.*, 2019). As output variables, 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.

3.6 Empirical methods

Consistent with prior studies and the need to control for several heterogeneities in our data set, we employed the (i) baseline Ordinary Least Squares (OLS), (ii) the Quantile Regression (QR) estimation technique, and (iii) Fixed Effect (FE) regression. The use of multiple estimation strategies was motivated by the need to ensure the robustness of our findings, provide increased room for policy relevance and consistency with recent studies (Dick, 2008). As an additional test of robustness to further possible endogeneity concern in reverse causality, the Two-Stage Least Squares Instrumental Variable (2SLS-IV) regression technique was adopted. Our instruments for cost efficiency in the 2SLS-IV regression included *tangibility* (proxied as the natural logarithm of fixed assets) and *directors fees* in natural logarithm. We conducted a specification test to ensure the validity of instruments and endogeneity of the variable. The Wooldridge's over-identifying restriction test (Wooldridge's OIR) was employed to assess the validity of instruments. For the potential endogeneity of the variables, we conducted Wooldridge's robust score test for exogeneity and robust regression exogeneity test. The null hypothesis in both tests was that the variables are exogenous.

3.6.1 Ordinary Least Squares and Fixed Effects regressions

Following prior studies (e.g., Kwan, 2006; Dick, 2008; Petersen, 2009), the baseline OLS specification with heteroscedasticity robust standard errors clustered at bank level is presented as follows:

$$WelfareLoss\%TA_{i,t} = \alpha + \beta_1 Avg. Cost Efficiency_t + \sum_{j=2}^8 \beta_j W_{j,i,t} + \varepsilon_{i,t} \quad Eq.7$$

where $WelfareLoss\%TA_{i,t}$ is the inverse form of welfare performance of bank i in year t ; α is an intercept, $Avg. Cost Efficiency_t$ is the average cost efficiency of the sample banks in year t , W is a vector of seven control variables (foreign bank, market knowledge, liquidity, Z-score, capitalization, institutional quality, GDP per capita) and $\varepsilon_{i,t}$ is the error term.

The baseline OLS regression specification above accounts for observed bank characteristics but not the unobserved bank-specific fixed effect. Therefore, the error term $\varepsilon_{i,t}$ includes the unobserved bank-

specific fixed effect. To account for this unobserved heterogeneity, the alternative panel fixed effect regression is specified as follows:

$$WelfareLoss\%TA_{i,t} = \alpha + \beta_1 Avg. Cost Efficiency_t + \sum_{j=2}^8 \beta_j W_{j,i,t} + \eta_i + \varepsilon_{i,t} \quad Eq.8$$

where $WelfareLoss\%TA_{i,t}$ is the inverse form of welfare performance of bank i at year t ; α is an intercept, $Avg. Cost Efficiency_t$ is the average cost efficiency of the sample banks in year t , W is a vector of seven control variables (foreign bank, market knowledge, liquidity, Z-score, capitalization, institutional quality, GDP per capita), η_i is the unobserved bank-specific effect and $\varepsilon_{i,t}$ is the error term.

3.6.2 Quantile Regressions

The baseline OLS and FE estimation approaches are based on the mean values of bank welfare performance. Though these approaches are relevant for policy implications, the QR provides the added advantage in cases where welfare performance differs from one bank to another. The univariate results reported in Table 2 reveal significant differences in the welfare performance of different bank subgroups. Therefore, to resolve concerns about cross-bank variations in our estimate of welfare performance, we adopted the QR as a complement to our baseline OLS and FE regressions to provide increased room for policy relevance (Okada and Samreth, 2012). Notable among the complementary features of the QR estimation technique is the determination of conditional quantiles, robustness to outliers, its agnostic distribution, and computational intensity.

The suitability of quantile regression is justified in data samples where the distribution function of the dependent variable is asymmetric around the mean value. We employed several formal tests of distributional heterogeneity. These include the Shapiro-Wilk test (Shapiro and Wilk, 1965), Shapiro-Francia test (Shapiro and Francia, 1972) and Chen-Shapiro test (Chen and Shapiro, 1995). The test results show that we can reject the hypothesis that $WelfareLoss\%TA$ is normally distributed at a 1 percent significance level (see Appendix A2). Consequently, the application of quantile regression is appropriate to meet the test requirement as the OLS results may not be adequate and reliable. A normal quantile plot

for *WelfareLoss%TA* is shown in Appendix A3. There are noticeable deviations from normality in the lower and upper tail of the distribution, which may justify why all three tests of normality are rejected at the 1% significance level.

Below is the optimization problem we solved to obtain the q^{th} quantile estimator of welfare performance.

$$\min_{\beta \in R^k} \left[\sum_{i \in \{i: y_i \geq x_i' \beta\}} q |y_i - x_i' \beta| + \sum_{i \in \{i: y_i < x_i' \beta\}} (1 - q) |y_i - x_i' \beta| \right] \quad \text{Eq.9}$$

where $0 < q < 1$. Contrary to OLS which results in the sum of squared residuals minimization, the QR is based on the weighted sum of absolute deviations minimization. The conditional quantile of welfare performance or y_i given x_i is:

$$Q_y(q|x_i) = x_i' \beta \eta \quad \text{Eq.10}$$

where unique slope parameters are estimated for each q^{th} specific quantile. This formulation is analogous to $E(y|x) = x_i' \beta$ in the OLS slope where parameters are examined only at the mean of the conditional distribution of welfare performance. In Eq. 10, the dependent variable y_i is welfare performance whereas x_i contains a constant term, average cost efficiency, foreign bank, market knowledge, liquidity, Z-score, capitalization, institutional quality and GDP per capita.

In light of the above, we estimate separate regression equations for the OLS and QR for the research question being investigated as follows.

$$WelfareLoss\%TA_{i,t} = \beta_0 + \beta_1 Avg. Cost Efficiency_t + \sum_{j=2}^8 \beta_j X_{j,i,t} + \varepsilon_{i,t} \quad \text{Eq. 11}$$

$$WelfareLoss\%TA_{i,t} = \beta_0^{(p)} + \beta_1^{(p)} Avg. Cost Efficiency_t + \sum_{j=2}^8 \beta_j^{(p)} X_{j,i,t} + \varepsilon_{i,t}^{(p)} \quad \text{Eq. 12}$$

Eq. 11 and Eq. 12 above are the OLS and QR respectively with focus on the role of cost efficiency on bank welfare performance, where *WelfareLoss%TA_{it}* is the inverse form of welfare performance of bank *i* in year *t*; β_0 is an intercept, *Avg. Cost Efficiency* is the average cost efficiency of the sample banks in year *t*,

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3 X is a vector of seven control variables (foreign bank, market knowledge, liquidity, Z-score, capitalization,
4 institutional quality, GDP per capita) and $\varepsilon_{i,t}$ is the error term.
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7 **3.6.3 Variables Measurement**

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9 The dependent variable *WelfareLoss%TA* in Eqs. 7, 8, 11 and 12 are in the inverse form. We use
10 the inverse form of welfare loss as a percentage of total assets as a dependent variable to be able to provide
11 consistency in the interpretation of the regression results. Thus, a positive sign on a regressor is indicative
12 of a welfare gain effect and a negative sign on a regressor is indicative of a welfare loss effect.
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18 Our main independent variable *Avg. Cost Efficiency* is the sample average cost efficiency in year t
19 estimated from Eq. 5 through to Eq. 6 in section 3.5. Following prior studies (e.g. Adeabah *et al.*, 2019;
20 Ghosh, 2016; García-Herrero *et al.*, 2009; Jaffee and Levonian 2001) we include: (i) foreign banks, (ii)
21 market knowledge, (iii) capitalization, (iv) liquidity, (v) bank Z-score, (vi) institutional quality and (vii)
22 GDP per capita growth to control for omitted variables bias.
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28 *A foreign bank* is measured as a dummy variable that takes the value of 1 to represent a foreign
29 bank if 50% or more controlling interest in a bank is foreign-owned at a financial year-end and 0 otherwise.
30 Evidence from Ghosh (2016) suggests that greater foreign investment in the banking system of developing
31 economies has an increasing effect on financial consumer welfare. Thus, we might expect foreign banks to
32 have a hedging effect on loss of consumer welfare.
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39 *Market Knowledge*, as proxied by bank age (i.e., the number of years since the incorporation of
40 each bank), reflects the effect of an underdeveloped information sharing environment. It is measured as a
41 dummy variable that takes the value of 1 to represent banks with above the 75th percentile market knowledge
42 and 0 otherwise. We posit that if banks can generate knowledge of local market dynamics at their own cost,
43 which is generally the case, instead of working with credit referencing bureaus, the financial consumer
44 becomes worse off.
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51 *Capitalization* is measured as equity to total assets ratio in natural logarithm. For the purpose of
52 this study, two major predictions are made. The first stems from evidence that well-capitalized banks are
53 relatively safer and less risky (Ghosh, 2016), and have high franchise value which incentivizes prudent
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lending (García-Herrero *et al.*, 2009). In this regard, we expect well-capitalized banks to serve as a constraining mechanism on the loss of 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 portfolios. Following the thinking of the Basel Accord, we expect more capitalized banks to be related to greater loss in consumer surplus estimates.

Liquidity is measured as the loan to total assets ratio in natural logarithm. Greater loans to total assets denote that banking firms are aggressively engaged in intermediation activities. Ariss (2010) suggests that higher credit exposure is a necessary condition for lower overall bank risk. The author explains that banking firms in developing economies may engage in aggressive lending because they are more likely to hedge their loan portfolio position. For this reason, greater lending by banking firms would necessitate additional cost. Thus, we might expect that greater loans to total assets ratio is related to greater welfare loss, as borrowers will have to pay for the insurance premium; for example, as such financial consumers suffer losses in the total loan received.

Bank Z-score measures the risk of insolvency and is defined as a summation of return on assets (ROA) and return on equity (ROE) expressed as a ratio of the standard deviation (*sd*) of return on assets, $[(ROA + ROE)/sd(ROA)]$. It is an indication of how many standard deviation profits must fall below its mean to bankruptcy. A lower value indicates heightened bank risk and higher value indicates a stable banking environment. Prior literature suggests that a stable banking sector would come at an additional cost (Ariss, 2010; Berger and Humphrey, 1997). Hence, the financial consumer may pay the premium either in higher loan prices or lower loan quantities or both. Our expectation is that greater bank Z-score is negatively related to welfare losses.

Institutional Quality is measured using the HF index of Economic Freedom in natural logarithm^[6]. From the literature on bank activity restriction (Chortareas *et al.*, 2013) and financial liberalization (Delis, 2012), a higher level of institutional quality should provide an improved constraint mechanism against loss of financial consumer welfare. *GDP per capita* 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 positive effect on the loss of consumer welfare.

4 RESULTS AND DISCUSSION

4.1 *Summary statistics and univariate results*

The summary statistics on key indicators are presented in Table 1. The mean (median) welfare loss as a percentage of total assets is 2.299% (2.064%). This is evidence that the Ghanaian banking sector does not price competitively. The mean (median) cost efficiency is 78% (81%). These efficiency scores are consistent with other recent studies. For instance, the mean efficiency score fits well within the world's mean efficiency of between 55% (UK) to 95% (France)^[7]. It is also 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.

[Insert Table 1 about here]

Further, the mean (median) Z-score of banks in Ghana is 5.13 (6.00). Compared with banks in other countries, the risk of insolvency of banks in Ghana was 19.7 percent higher [the mean (median) Z-score of Chinese banks is 6.39 (6.46)] than Chinese banks over the period 2007 to 2014 (Hung *et al.*, 2017) and 44.3 percent higher than the average of 48 banking sectors in Africa for the period 1996-2015 (Ozili, 2018). The average bank in Ghana has approximately 27 years of knowledge of local market dynamics. Foreign banks average 57 percent of the Ghanaian banking industry, which is approximately a 47 percent increase over the mean of 39 percent for foreign banks reported for the period 1999-2007 (Bokpin, 2013). Thus, the banking sector in Ghana is dominated by foreign banks. The mean (median) liquidity position of banks in

Ghana is 0.564 (0.580). Comparably, Ghanaian banks are 16.3 percent more liquid than Chinese banks^[8] but quantitatively similar to other banking sectors in 55 emerging markets (Amidu and Wolfe, 2013). The degree of capitalization was at the mean (median) of 16.05 (13.83) for our sampled banks. The average bank size was GHS1,787 million (US\$0.4045 million) in total assets^[9]. Over the nine-year sample period, the mean (median) institutional quality score for Ghana was 61.02 (60.30), which is reflective of restriction on banking activities to some extent (Sarpong-Kumankoma *et al.*, 2017). Lastly, GDP per capita averaged 4.30 with a median value of 4.81.

[Insert Table 2 about here]

Table 2 presents the univariate results which shed some light on the differences in the welfare performance and cost efficiency for sub-samples of banks grouped by ownership structure, bank size and level of market knowledge. The results indicate that welfare losses and the cost efficiency of foreign banks are quantitatively similar to domestic banks. Meanwhile, the results show that welfare losses of large banks are about 22.53% larger compared to welfare losses of small banks (2.534 versus 2.068, the difference is significant at 1 percent). Thus, customers of small banks are relatively better off than customers of large banks. Further, on average small banks are as efficient as large banks, which is evidence of rejection of diseconomies of scale in the banking system. Compared to banks that have below the 75th percentile of knowledge of local market dynamics, banks with above the 75th percentile knowledge of local market dynamics have 33.69% larger welfare losses (2.837 versus 2.122). This difference is significant at 1 percent. This result generally confirms that if banks generate knowledge of the local market dynamics at their cost instead of working with public or private credit referencing bureaus, the financial consumer becomes worse off.

4.2 Empirical Results

4.2.1 The Role of Cost Efficiency

Table 3 presents the baseline OLS and FE results of our inquiry with endogeneity robust 2SLS-IV regression results. From the OLS result, we find that there is a positive but insignificant relationship between cost efficiency and bank welfare performance. This weak evidence of the hedging effect of cost efficiency does not imply that cost efficiency is unimportant in mitigating welfare losses. A potential explanation of the OLS results may be due to omitted variables (i.e., unobserved bank-specific fixed effect) and/or simultaneity problem with cost efficiency not adequately controlled for. Applying the FE and 2SLS-IV estimation techniques, we find that contrary to hypothesis *H1*, cost efficiency is positively related to bank welfare performance, suggesting that greater cost efficiency is associated with gains in welfare estimates. In other words, welfare gains and cost-efficient banks may not be mutually exclusive contrary to contemporary literature on the existence and relevance of the concept of mutual exclusivity between welfare gains from reduced market power and cost-efficient banks (Maudos and De Guevara, 2007; Pruteanu-Podpiera *et al.*, 2008; Koetter *et al.*, 2012; William, 2012). Rather, it is reflective of the X-efficiency hypothesis (Sathye, 2001; Kwan, 2006). The positive effect is consistent across the OLS, FE and 2SLS-IV specifications. The significant positive coefficients on *Avg. Cost Efficiency* also indicates that the cost efficiency of banks is a necessary precondition for an efficient and well-functioning banking system. Thus, the worsening technological innovations in the banking system of Ghana should be of great concern to all stakeholders. The result also has economic significance. For example, an increase in *Avg. Cost Efficiency* of banks by one sample standard deviation would result in about 2.50% $[(0.116)*0.2367/1.100=0.0249]$ and 6.18% $[(0.116)*0.5858/1.100=0.0618]$ welfare gains using the FE and 2SLS-IV estimates in Table 3. Wang *et al.* (2014) show that cost-efficient banks are less powerful. If welfare gain is synonymous with cost-efficient banks, then the assumption of welfare gain may imply that the presence of a quiet life is typical of financial consumer protection. This is because, increased competitive pricing leads to increased

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3 cost efficiency of banking firms as the potential systematic slack incurred for unrealized monopoly rents
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5 are eliminated from the banking system (Koetter *et al.*, 2008).
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8 [Insert Table 3 about here]
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10 Table 4 reports the QR results of our inquiry. Regarding the interpretation of the results based on
11 the QR estimation technique, it is worth noting that the Q.10 model indicates banks with the least welfare
12 loss while the Q.90 model indicates banks with the greatest welfare loss. The findings show that at the
13 lowest quantile (Q.10), greater cost efficiency of banking firms is negatively related to welfare losses.
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15 Meanwhile, results from the Q.25 and Q.50 show a positive impact of cost efficiency on welfare losses in
16 banking. The results from the Q.75 and Q.90 estimations reveal that the sensitivity of welfare performance
17 to the cost efficiency of banks is positive and significant. The implication is that where welfare loss is low
18 (Q.25) to the median (Q.50), cost efficiency is a necessary but not a sufficient condition to hedge the losses
19 from the market power of banks. But, where a bank's welfare performance is at 75th – 90th quantiles, the
20 evidence affirms that cost efficiency is a necessary and sufficient condition for hedging welfare losses.
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22 Therefore, the results suggest that the cost efficiency effect on bank welfare performance is conditioned on
23 the level of welfare losses in the banking sector.
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36 [Insert Table 4 about here]
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39 **4.2.2 Moderating Role of Foreign Banks and Market Knowledge**

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42 To gain further insight into how welfare losses and cost efficiency related in different bank
43 subgroups, we estimate OLS and FE regression models with a two-way interaction effect and a three-way
44 interaction effect of *Cost Efficiency* and the following policy variables: *Foreign Banks* and *Market*
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49 *Knowledge*.
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51 [Insert Table 5 about here]
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3 Table 5 reports the results. We sum the coefficient of *Cost Efficiency* and the coefficient of the
4 interaction terms for the total effect of cost efficiency on bank welfare losses. From the findings, the
5 established positive effect of *Cost Efficiency* on bank welfare performance is consistent across different
6 specifications. From the two-way interaction effect perspective, the coefficient on the interaction term *Cost*
7 *Efficiency*Foreign* is negative in the OLS model, indicating that the positive effect of cost efficiency is
8 offset to some extent in foreign banks, but it is not significant. On the other hand, with the FE panel model
9 that controls for unobserved heterogeneity, the coefficient on the interaction term *Cost Efficiency*Foreign*
10 is positive. The results in both the OLS and FE regressions show that the interaction term *Cost*
11 *Efficiency*Foreign* has no significant effect. This is contrary to our hypothesis *H2* and provides no evidence
12 that the impact of cost efficiency on banks' welfare performance is dependent on foreign banks. One
13 possible explanation is that, although foreign banks dominate the Ghanaian banking sector, their dominance
14 does not translate into superior efficiency over domestic banks. Therefore, foreign banks do not have the
15 efficiency advantage as reported by Hauner and Peiris (2008) and Mulyaningsih *et al.* (2015) to induce
16 competitive pressures for the benefit of financial consumers.
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33 On the other hand, the coefficient on the interaction term *Cost Efficiency*Knowledge* is positive
34 and significant at 5 percent. This provides evidence to support our hypothesis *H3* that, the impact of cost
35 efficiency on the welfare performance of banks depends on knowledge of local market dynamics in the
36 banking sector. This significant result is in line with other findings in the literature (Mester, 1996). The
37 result implies that the sensitivity of welfare performance estimates to cost efficiency is more pronounced
38 in banks with efficient market knowledge. The fact that the moderating role of market knowledge effect is
39 positive on banks' welfare performance is an indication of the critical role of information sharing in the
40 financial sector towards financial consumer protection (Asongu and Nwachukwu, 2018). From the three-
41 way interaction effect perspectives, the findings show that welfare performance-cost efficiency sensitivity
42 increases for foreign banks with efficient market knowledge.
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4.2.3 Control Variables

The discussions of the control variables are as per the results presented in Table 3. The coefficients on foreign banks' dominance also offer some important insights. *Foreign* is negatively and statistically significant for bank welfare performance in both the OLS and 2SLS-IV specifications, which show that foreign banks' dominance reduces the welfare gains enjoyed by financial consumers. In other words, the increased dominance of foreign banks exacerbates the social cost of bank market power. Consistent with Detragiache *et al.* (2008), the negative coefficient indicates that banking globalization worsens welfare loss in developing countries.

We posit that if banks 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. Consistent with this theoretical prediction, *Market Knowledge* is also negative and significant in both OLS and 2SLS-IV specifications. Because market knowledge is entirely gained at the bank's cost and learning, it is held in "secret" and used as a competitive advantage tool and a private privilege to extract more in welfare loss. Hence, "learning by doing" exacerbates welfare losses in banking. 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 coefficient on *Ln_Liquidity* is positive in all three specifications. The significant positive effect of liquidity on the welfare performance of banks suggests that greater liquidity is associated with greater welfare gain. Consistent with this, Nguyen *et al.* (2017) report that banks that lack market power hold more liquid assets. By extension, if welfare gains come from a lack of market power, then for banking firms to generate welfare gains, they may hold more liquid assets. *Z-score* is negative and significant only in the OLS specification. The result that greater stability leads to greater welfare loss is evidence of the premium that financial consumers would have to pay to ensure a stable financial sector in emerging economies (Tabak *et al.*, 2015). This implies that regulators face risking the stability of the financial sector if they are not moderate at their pro-financial consumer protection policies. Further, the coefficient on

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3 *Ln_Capitalization* is positive and significant in both the OLS and 2SLS-IV specifications, indicating that
4 well-capitalized banks serve as an effective constraint mechanism on welfare losses in the banking sector
5 because they are safe and less risky.
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10 On the macroeconomic variables, the statistically significant negative coefficient on
11 *Ln_Institutional Quality* in all specifications implies that a high level of institutional quality incentivizes
12 welfare losses in the banking systems of developing countries. Although the established negative sign is
13 counterintuitive, it would be due to the low level of institutional quality which is suggestive of some
14 restrictions on banking activities. GDP per capita affects welfare performance negatively. This is
15 statistically significant at 1 percent across all three specifications. The significant negative coefficient on
16 *Ln_GDP per capita* suggests that, as income level improves, the appetite for credit by households and firms
17 increases because they are well-positioned to payback. Therefore, the bigger the income, the bigger the
18 credit that can be accessed, and the greater the welfare loss extracted by banking firms.
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32 **5. SUMMARY, CONCLUSION AND IMPLICATIONS**

33 **5.1 Summary**

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38 The study examined the relationship between the consequential social cost of market power (i.e.,
39 welfare performance of banks) and cost efficiency using data covering the periods 2009 to 2017 from the
40 Ghanaian banking industry. The results reveal that there was a welfare loss of about 2.3 percent of observed
41 total assets. Encouragingly, cost efficiency in the banking system fits well within the world's mean
42 efficiency. Applying the OLS regression and FE regression procedures, we find that greater cost efficiency
43 hedges welfare losses. Also, we find evidence that the sensitivity of welfare loss estimates to cost efficiency
44 is more pronounced in banks with high market knowledge. Further, findings from the QR estimation
45 suggests that where welfare loss is low (Q.25) to the median (Q.50), cost efficiency is a necessary but not
46 a sufficient condition to hedge the losses from the market power of banks. Results on the other control
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3 variables shed some important insights. On the one hand, both foreign banks and market knowledge
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5 exacerbate welfare losses in banking. On the other hand, we observed that both highly liquid banks and
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7 well-capitalized banks serve as effective constraint mechanisms on bank welfare losses. Interestingly,
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9 greater bank stability is paid for by financial consumers through increased welfare losses. Further, the
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11 results suggest that greater institutional quality worsens welfare losses in banking. Also, the negative impact
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13 of GDP per capita suggests that the bigger the income, the bigger the credit that can be accessed, and the
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15 greater the welfare losses extracted by banking firms.
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18 **5.2 Conclusions**

21 The issue of welfare loss from mispricing due to the exercise of market power of banking firms can
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23 be minimized. It should, however, take into consideration the advent of cost-efficient banks and efficient
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25 knowledge about local market dynamics. In other words, banks with the highest market knowledge and are
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27 cost-efficient are better placed to protect financial consumers. Further, there is heterogeneity in the impact
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29 of cost efficiency on banks' welfare performance. Specifically, cost efficiency has a significantly larger
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31 hedging impact on welfare losses in banks with extreme losses to financial consumers. Therefore, cost
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33 efficiency effect on banks' welfare performance is conditioned on the level of welfare losses in the banking
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35 sector. Additionally, if welfare gain is synonymous with cost-efficient banks, then the presence of a quiet
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37 life is typical of financial consumer protection.
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41 **5.3 Implications**

44 The results presented in this paper have important theoretical and policy implications. The
45
46 theoretical implications of this study relate to literature on the existence and relevance of the concept of
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48 mutual exclusivity between welfare gains from reduced market power and cost-efficient banks. This debate
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50 revolves around the view that welfare gains from reduced market power occasion loss of bank cost
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52 efficiency. Our results regarding the welfare gain effect of cost-efficient banks suggest that welfare gains
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54 and cost-efficient banks may not be mutually exclusive, and it is conditioned on the level of welfare losses
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3 in the banking system. For the financial sector (i.e., regulators and bank management), our results have
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5 shown that financial consumer protection cannot be achieved without cost-efficient banks in the presence
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7 of both foreign banks' dominance and high market knowledge. This result suggests an integrated cost
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9 efficiency policy approach that has the complementary effect of a robust information sharing mechanism
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11 to hedge against welfare losses in the banking sector of developing countries.
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APPENDIX

A1: Econometric estimation of price elasticity of loan (deposit) demand

Variables	(1) <i>lnqloan</i>	(2) <i>lnqdeposit</i>
<i>lnqloan</i> (-1)	0.864*** (0.054)	
<i>lnrL</i>	-0.908*** (0.133)	
<i>lnqdeposit</i> (-1)		0.957*** (0.044)
<i>lnrD</i>		-0.260*** (0.076)
Year effect	Yes	Yes
Observations	132	132
Number of banks	23	23

Bootstrapped standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

A2: Tests of normal distribution hypothesis

. swilk sociallossta

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
sociallossta	157	0.73352	32.244	7.893	0.00000

. sfrancia sociallossta

Shapiro-Francia W' test for normal data

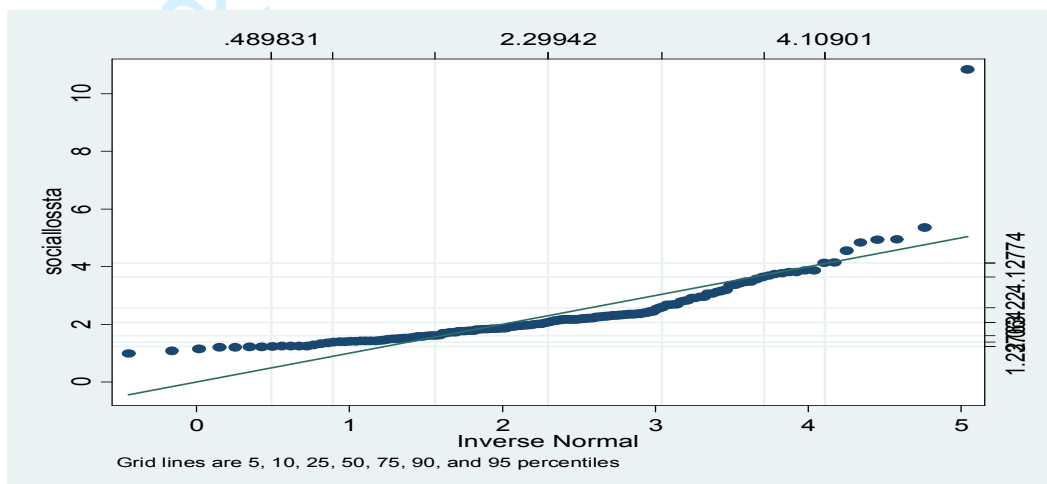
Variable	Obs	W'	V'	z	Prob>z
sociallossta	157	0.72330	36.683	7.332	0.00001

. chens sociallossta

Chen-Shapiro QH* test for normal data

Variable	Obs	QH	QH*	P-value
sociallossta	157	0.86483	1.69362	< 0.0001

A3: Normal quantile plot for Bank Welfare Performance



Notes

1. Although Maudos and De Guevara (2007) use bank-level data, the analysis was more of cross-country comparison; therefore, they scaled the estimated welfare loss by GDP. The authors also recognize that, in banking, competition takes place at a much lower level than the macro level.
2. See Adeabah (2019) for Summary of Major Events in the Ghanaian Banking Industry from 1988 to 2016.
3. Fang, Hasan, and Marton (2011) also use data from an era of foreign banks' dominance in transitional economies and show that the market power of a bank has a positive association with both cost and profit efficiency; thus, rejecting the quiet life for both cost and profit inefficiency. The current study is different in the following respect: (i) the purpose of the study, (ii) the sample period, (iii) the context of the study, (iv) the measurement of efficiency, (v) the cost efficiency status of foreign banks, (vi) how endogeneity is accounted for in the empirical models, and (vii) the moderating effect tested.
4. Source: <https://www.bog.gov.gh/markets/weekly-publication-of-gog-treasury-bill-auction-results>
5. The following reasons motivated the use of the LSDVC dynamic regression: (1) There is evidence of persistence between the dependent variable and its first lag values. This is shown by a high and significant correlate above the 0.80 threshold. Asongu *et al.* (2018) show that the 0.80 threshold is essential to ascertain persistence in a dependent variable. (2) The $N(24) > T(9)$ criterion. The number of cross-sections should be higher than the number of time series. (3) The nature of the dataset which is unbalanced with limited number of observations.
6. The index is comprised of 10 components with equal weights namely fiscal burden, banking and finance, trade policy, government intervention, black market, monetary policy, property rights, capital flows and foreign investment, wages and prices, and regulation. Also, it ranges from 0 to 100 where a higher value is indicative of a higher level of institutional quality.
7. See Berger and Humphrey (1997) for a detailed review of bank efficiency round the world.
8. Hung *et al.* (2017) report a mean (median) loan to total assets ratio of 0.4722 (0.4877) for a sample of Chinese banks over the period 2007-2014.
9. 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.

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Table 1.
Summary Statistics

This table reports the mean, standard deviation (Std. Dev.), median, 25th percentile and 75th percentile of key indicators of the sample banks as of the end of the year between 2009 and 2017.

Variable	Mean	Std. Dev.	Median	25 th Percentile	75 th Percentile
WelfareLoss%TA	2.299	1.100	2.064	0.910	2.000
Cost Efficiency	0.783	0.116	0.810	0.790	0.880
Z-Score	5.130	7.878	6.000	4.110	7.650
Market Knowledge (Years)	26.57	27.90	19.00	8.000	37.00
Ownership	0.570	0.496	1.000	0.000	1.000
Liquidity	0.564	0.140	0.580	0.470	0.660
Capitalization	16.05	8.442	13.83	11.36	17.60
Total Assets (GHS' Million)	1,789	1,703	1,300	560.0	2,400
Institutional Quality (%)	61.02	2.382	60.30	59.40	63.00
GDP per capita (%)	4.301	3.095	4.810	1.500	6.150

Table 2.
Univariate Results

The means of welfare loss and cost efficiency for different subgroups of banks are reported. *p*-value is based on a test of difference in means.

Variable	Welfare Loss	Cost Efficiency
Foreign banks	2.410	0.778
Domestic banks	2.151	0.791
<i>p-value</i>	(0.144)	(0.723)
Large banks	2.534	0.764
Small banks	2.068	0.803
<i>p-value</i>	(0.008)	(0.301)
Below 75 th percentile market knowledge	2.122	0.785
Above 75 th percentile market knowledge	2.837	0.780
<i>p-value</i>	(0.000)	(0.910)

Table 3.
Cost Efficiency Effect on Bank Welfare Performance

Variables	OLS	FE	2SLS-IV
Intercept	4.4737** (2.1128)	5.4863*** (1.4359)	6.0553*** (2.0625)
Avg. Cost Efficiency	0.1806 (0.1296)	0.2367** (0.0937)	0.5858** (0.2492)
Foreign	-0.0890** (0.0369)	---	-0.0928*** (0.0225)
Market Knowledge	-0.1036*** (0.0256)	0.1087 (0.0776)	-0.1070*** (0.0227)
Ln_Liquidity	0.1090 (0.0640)	0.1188*** (0.0449)	0.0727 (0.0478)
Z-Score	-0.0101* (0.0049)	-0.0010 (0.0037)	-0.0100 (0.0063)
Ln_Capitalization	0.0966*** (0.0322)	0.0030 (0.0382)	0.0983*** (0.0347)
Ln_Institutional Quality	-1.1093** (0.5101)	-1.3519*** (0.3409)	-1.5271*** (0.5064)
Ln_GDP per capita	-0.0960*** (0.0234)	-0.0991*** (0.0184)	-0.1283*** (0.0314)
<i>F</i> -value	23.48***	6.45***	12.37***
<i>R</i> -squared	0.3420	0.2638	0.2784
Adj. <i>R</i> -squared	0.3064	---	0.2394
Robust score χ^2 [<i>p</i> -value]	---	---	3.143[0.076]
Robust regression <i>F</i> stats [<i>p</i> -value]	---	---	3.031[0.084]
Wooldridge OIR χ^2 [<i>p</i> -value]	---	---	1.047[0.306]
Observations	157	157	157

Values in parentheses are robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4.
Quantile Regressions of Cost Efficiency Effect on Bank Welfare Performance

Variables	Quantile Regression				
	Q.10	Q.25	Q.50	Q.75	Q.90
Intercept	1.1772 (3.0061)	2.5806 (1.8161)	4.5736** (2.1334)	6.4611** (2.4858)	8.4868*** (3.0361)
Avg. Cost Efficiency	-0.0688 (0.1940)	0.1361 (0.1172)	0.2024 (0.1377)	0.3822** (0.1604)	0.4285** (0.1959)
Foreign	-0.1117** (0.0453)	-0.0951*** (0.0274)	-0.1002*** (0.0322)	-0.0630* (0.0375)	-0.0473 (0.0458)
Market Knowledge	-0.1053** (0.0503)	-0.0725** (0.0304)	-0.0683* (0.0357)	-0.0888** (0.0416)	-0.1296** (0.0508)
Ln_Liquidity	0.1260 (0.0796)	0.1123** (0.0481)	0.1247** (0.0565)	0.1216* (0.0658)	0.0466 (0.0804)
Z-Score	-0.0055 (0.0058)	-0.0113*** (0.0035)	-0.0166*** (0.0041)	-0.0160*** (0.0048)	-0.0204*** (0.0058)
Ln_Capitalization	0.0710 (0.0503)	0.0999*** (0.0304)	0.1175*** (0.0357)	0.1335*** (0.0416)	0.0862* (0.0508)
Ln_Institutional Quality	-0.3111 (0.7216)	-0.6753 (0.4359)	-1.1571** (0.5121)	-1.6310*** (0.5967)	-1.9873*** (0.7288)
Ln_GDP per capita	-0.0559 (0.0400)	-0.0641*** (0.0242)	-0.1119*** (0.0284)	-0.1373*** (0.0331)	-0.1758*** (0.0404)
Pseudo R2	0.2189	0.2490	0.2310	0.2480	0.2402
Observations	157	157	157	157	157

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.
Cost efficiency effect in foreign banks and banks with greater market knowledge

Variables	OLS Regression			Fixed Effect Regression		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A</i>						
Intercept	4.4501*	4.5501**	4.4776**	5.4966***	5.4157***	5.5117***
	(2.1708)	(2.0877)	(2.1184)	(1.4552)	(1.4155)	(1.4392)
Cost Efficiency	β_1 0.1953	0.0469	0.1813	0.2313	0.1216	0.2138**
	(0.1855)	(0.1573)	(0.1309)	(0.1403)	(0.1064)	(0.0992)
Cost Efficiency*Foreign	β_2 -0.0252	---	---	0.0094	---	---
	(0.2319)			(0.1808)		
Cost Efficiency*Knowledge	β_3 ---	0.5264**	---	---	0.4227**	---
		(0.2260)			(0.1945)	
Cost Efficiency*Foreign*Knowledge	β_4 ---	---	0.0151	---	---	0.2037
			(0.0738)			(0.2868)
Foreign Banks	-0.0694	-0.0848**	-0.0924*	---	---	---
	(0.1798)	(0.0347)	(0.0450)			
Knowledge	-0.1037***	-0.5118**	-0.1087***	0.1093	-0.2107	-0.0399
	(0.0260)	(0.1844)	(0.0252)	(0.0788)	(0.1657)	(0.2231)
Ln_Liquidty	0.1087	0.1218*	0.1069	0.1188***	0.1298***	0.1237***
	(0.0641)	(0.0631)	(0.0663)	(0.0451)	(0.0445)	(0.0455)
Z-Score	-0.0102*	-0.0104**	-0.0102*	-0.0009	-0.0020	-0.0012
	(0.0050)	(0.0048)	(0.0051)	(0.0039)	(0.0037)	(0.0037)
Ln_Capitalization	0.0971***	0.0999***	0.0978***	0.0025	0.0172	0.0072
	(0.0319)	(0.0330)	(0.0342)	(0.0393)	(0.0382)	(0.0387)
Ln_Institutional Quality	-1.1064**	-1.1174**	-1.1085**	-1.3542***	-1.3323***	-1.3554***
	(0.5175)	(0.5023)	(0.5105)	(0.3451)	(0.3361)	(0.3416)
Ln_GDP per capita	-0.0958***	-0.0956***	-0.0958***	-0.0992***	-0.0979***	-0.0989***
	(0.0237)	(0.0238)	(0.0234)	(0.0186)	(0.0182)	(0.0185)
F-value	20.92***	28.07***	21.37***	5.60***	6.40***	5.69***
R-squared	0.3421	0.3658	0.3422	0.2639	0.2906	0.2668
Observations	157	157	157	157	157	157
<i>Panel B</i>						
	$\beta_1 + \beta_2$	$\beta_1 + \beta_3$	$\beta_1 + \beta_4$	$\beta_1 + \beta_2$	$\beta_1 + \beta_3$	$\beta_1 + \beta_4$
	= 0.1701	= 0.5733	= 0.1964	= 0.2407	= 0.5443	= 0.4175
F-test	(<i>p</i> =0.31)	(<i>p</i> = 0.00)	(<i>p</i> =0.26)	(<i>p</i> = 0.05)	(<i>p</i> = 0.00)	(<i>p</i> =0.13)

Robust standard errors in parentheses

*** *p*<0.01, ** *p*<0.05, * *p*<0.1