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Market Power and Cost Efficiency in the African Banking Industry

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Abstract

In this study, we test the so-called 'Quiet Life Hypothesis' (QLH) which postulates that banks with market power are less efficient. We employ instrumental variable Ordinary Least Squares, Fixed Effects, Tobit and Logistic regressions. The empirical evidence is based on a panel of 162 banks consisting of 42 African countries for the period 2001-2011. There is a two-step analytical procedure. First, we estimate Lerner indices and cost efficiency scores. Then, we regress cost efficiency scores on Lerner indices contingent on bank characteristics, market features and the unobserved heterogeneity. The empirical evidence does not support the QLH because market power is positively associated with cost efficiency. Owing to data availability constraints, this is one of the few studies to test the QLH in African banking.

***Keywords*:** Finance; Savings banks; Competition; Efficiency; Quiet life hypothesis

***JEL Classification*:** E42, E52, E58, G21, G28

1. Introduction

In a scenario where market participants possess substantial market power in the setting of market prices, neoclassical theory predicts that such participants (e.g. financial institutions) can set prices above corresponding marginal costs so as to increase profits as much as possible (Koetter & Vins, 2008). Such a phenomenon of maximizing idiosyncratic profits instead of increasing market access to specific commodities is known as 'quiet life' and investigated within the framework of a 'Quiet Life Hypothesis' (QLH)[1]. From the perspective of the banking sector, the QLH is likely when competition is low as large banks are not incentivized to be cost efficient and widen financial access. Such a hypothesis is of scholarly and policy relevance in Africa for three main reasons. They are: (i) the substantially documented surplus liquidity concerns in African financial institutions (Saxegaard, 2006; Fouda, 2009; Asongu, 2014, p.70); (ii) a recent stream of literature proposing that some financial institutions in Africa may be enjoying a 'quiet life' and abusing their market privileges (Boateng et al., 2018; Asongu et al., 2016a) and (iii) shortcomings in the existing literature. In principle, the literature is consistent with the view that small sized institutions have lower interest margins compared to their larger counterparts (Beck & Hesse, 2006; Ahokpossi, 2013). For example, it has been established that: (i) large banks influence interest rate charges within the financial sector; (ii) big financial institutions are connected with more expensive loans (Ngigi, 2013a, 2013b) and

[1] The Quiet Life Hypothesis (QLH) is an assumption that financial institutions with substantial market power may allocate less investment to enhance financial access by means of intermediation efficiency. According to the hypothesis, instead of using their favourable market position to boost loan quantity and/or reduce the price of loans, these financial institutions tend to exploit such 'market power' to improve their gains or enjoy a 'quiet life' (Coccorese & Pellecchia, 2010).

(iii) policies that favour competition in Sub-Saharan Africa (SSA) enhance financial access by decreasing loan price (Ahokpossi, 2013).

From a theoretical viewpoint (Asongu et al., 2018, 2019a), large financial institutions which are endowed with high market power should reflect lower margins in interest rates because they are associated with positive externalities like internal and external economies of scale. However, for the past decades, big banks have been documented to be associated with less financial allocation efficiency (Mitchell & Onvural, 1996; Boateng et al., 2018). There are three main perspectives in the literature that elucidate this paradox between big banks and financial efficiency. *Firstly,* big financial institutions may use information sharing offices (like public credit registries and private credit bureaus) to reduce transaction costs with associated increase in their profit margins (Brown & Zehnder, 2010; Asongu et al., 2016b). *Secondly*, large banks can also be linked with diseconomies of scale: a phenomenon that can be allied with inefficiencies in terms of management, organisation and coordination (Karray & Chichti, 2013; Clark, 1996; Mester, 1992). *Thirdly*, large financial institutions could be managed with the objective of achieving advantages of 'quiet life' instead of leveraging on their privileged positions to increase financial efficiency (Mitchell & Onvural, 1996; Boateng et al., 2018). This study is closest to the third perspective. Therefore, by assessing the QLH in terms of cost efficiency, we contribute to the literature by clarifying if big banks in Africa are cost efficient.

In the light of the above, this study complements a recent stream of the African financial literature that is grounded on assumptions that large financial institutions could be abusing their market powers (Barth et al., 2009; Triki & Gajigo, 2014; Tchamyou & Asongu, 2017). It is important to note that claims in these previous studies have primarily been based on inferences from anecdotal evidence rather than from direct empirical assessments. Our study directly deals with this concern from a cost efficiency perspective. It departs from Ariss (2010) (a study in Table 1 closest to this inquiry) by: (i) exclusively focusing on a continent where the worry of restricted financial access is most severe (Tchamyou, 2019a, 2019b; Tchamyou et al., 2019) and (ii) using a slightly more updated dataset. The latter point also enables the study to extend a recent stream of economic development literature that has used the same dataset (Asongu, 2017; Asongu & Biekpe, 2017). While Asongu (2017) examined the effect of lowering information costs on loan price and quantity in the African banking industry, Asongu and Biekpe (2017) investigated linkages between information asymmetry, information technology and market power in the African banking industry. Hence, the positioning of this study on market power and cost efficiency in the African banking industry, extends the argument in this recent stream of literature particularly with respect to the debate on market power as summarised in the Table 1[2].

[2] Moreover, a recent bulk of African financial development literature has failed to engage the dimension of market power (Fowowe, 2014; Chikalipah, 2017; Daniel, 2017; Wale & Makina, 2017; Iyke & Odhiambo, 2017; Bocher et al., 2017; Chapoto & Aboagye, 2017; Osah & Kyobe, 2017; Oben & Sakyi, 2017).

The rest of the study is organised as follows. Section 2 provides conceptual clarifications and the related literature while Section 3 discusses the data and methodology. The empirical results and corresponding discussion are covered in Section 4 whereas Section 5 outlines concluding remarks and future research directions.

2. Conceptual clarifications and related literature

2.1 Conceptual clarifications

2.1.1 Bank size, market power and efficiency

The literature on linkages between market power, bank size and efficiency is still open to much debate. Results from empirical studies, while subtle, are for the most part ambiguous on the underlying relationships among these three elements. This section is organised into two strands: (i) the linkage between bank size and efficiency and (ii) the relationship between efficiency and market power.

Firstly, from intuition, a positive nexus may be expected between bank size and cost efficiency because big banks are more likely to develop material, technical, human and financial resources that improve their use of inputs to generate outputs such as loans and other income generating assets. Along the same line of thinking, given that costs associated with intermediation and agency activities are more linked with larger firms, it can be expected that small banks are connected with considerably lower inefficiency scores. According to Berger and Mester (1997), as the size of a bank grows, it becomes more able to

control costs, create higher income with related profits. This stance was shared by Srivastava (1999) who established evidence of higher average efficiencies for medium-sized banks, followed by large banks. The result that small financial institutions are the least efficient consolidates the perspective that the relationship is positively monotonic. Whereas to the best of our knowledge, there is no clear link between bank size and estimated efficiencies that have been documented (Fukuyama, 1993; Lang & Welzel, 1996; Altunbas et al., 2000; Karray & Chichti, 2013), the hypothesis that big banks have higher levels of inefficiency has been respectively supported and rejected by Allen and Rai (1996) and Goldberg and Rai (1996).

2.1.2 Economies of banking and efficiency

There are eight main banking economies, which are regularly identified in the literature. They comprise (i) cost efficiency, (ii) revenue efficiency, (iii) captivity efficiency, (iv) concentration efficiency, (v) 'X'-efficiency, (vi) scale efficiency and (vii) scope efficiency. For ease of exposition, these efficiency measurements are discussed under four main strands.

Firstly, with regard to *cost efficiency*, increasing bank size has been acknowledged by many authors to bring cost reductions and economies of scale (Mitchell & Onvural, 1996; Karray & Chichti, 2013). This is principally because of the apparent absorption of fixed costs via large volumes, notably: information and communication technology, network, branding and regulatory costs. It is also important to balance this narrative with the position in the

previous section maintaining that the relationship between bank size and unit costs is also U-shaped. Furthermore, because large financial institutions operate with more complex and heavy technology, there may be limited avenues for economies of scale.

Secondly, according to De Keuleneer and Leszczynska (2012), the discussion on *revenue efficiency* is based on the assumption that efficiency is contingent on bank-specific features that are particularly related to the size of the bank. There are three main narratives motivating this strand. (i) Many enterprises employ financial institutions, irrespective of size if good services are offered by such firms. Therefore, the idea that big enterprises request substantial credit in order to deal with a financial institution is not always true. Moreover, the impression that such big corporations tend to deal for the most part with banks that are always loyal and profitable is also not always true. (ii) Whereas it might be posited that big international networks enable superior services, an appealing network of correspondence could offer services that are superior or even equivalent to the network of a proprietor with international branches. (iii) While better risk diversification is also articulated by advocates of big banks, diversification of risk can be obtained in a plethora of ways, notably, via various credit insurance channels and credit syndications.

Thirdly, consistent with De Keuleneer and Leszczynska (2012), *captivity efficiency* articulates the prospect of big continental financial institutions which focus on boosting their control over the distribution of financial commodities.

Accordingly, while controlling their Undertakings for Collective Investment in Transferable Securities Directives (UCITS), they also underwrite a plethora of structured commodities which they distribute leaving little choice to the clients they claim to advise. In the process, little information is allowed for transparent competition. In essence, bank size is associated with an advantage in this kind of abuse.

Fourthly, the notion of *concentration efficiency* in the last strand is founded on the evidence that despite the absence of a relationship between bank size and efficiency or between profitability and bank size, many bankers still pursue size as an objective (De Keuleneer & Leszczynska, 2012). Therefore, it is proposed that relative size within a market is essential because increased profitability is highly correlated with market concentration. It follows that a higher degree of concentration enables financial institutions to charge higher margins that justify greater rewards for managers.

In the light of the above, there is a multitude of conceptions and definitions of efficiency. For instance, consistent with Wagenvoort and Schure (1999), when investigating efficiency, a researcher could be interested in one of the following three forms of efficiency: (i) *X-efficiency* (whether banks use their available inputs efficiency), (ii) *scale efficiency* (if banks produce the right amount of outputs) and (iii) *scope efficiency* (whether banks choose an efficient combination of outputs). The discussion in this section is to articulate that while

there are various measures of efficiency, the positioning of this study is on cost efficiency.

2.1.3 Summary of empirical literature on the Quiet Life Hypothesis (QLH)

As apparent in Table 1 below, the QLH has not been given the scholarly attention it deserves in the African continent, in spite of the region experiencing comparatively more severe problems in financial access (Triki & Gajigo, 2014). From the table, with the exception of Ariss (2010) who has included a few African countries, the bulk of the literature has not done so.

Table 1: Summary of empirical literature

Author(s)	Regions (Period)	Quiet Life Hypothesis(QLH)
Tu & Chen (2000)	Taiwan (1986-1999)	Yes
Weill (2004)	Europe (1994-1999)	No
Maudos & de Guevara (2007)	Europe (1993-2002)	No
Koetter & Vins (2008)	Germany (1996-2006)	Yes
Koetter et al. (2012)	USA (1986-2006)	Yes
Pruteanu-Podpiera et al. (2008)	Czech Republic (1994-2005)	No
Schaeck & Cihak (2008)	Europe & USA (1995-2005)	Yes
Al-Jarrah & Gharaibeh (2009)	Jordan (2001-2005)	No
Solis & Maudos (2008)	Mexico (1993-2005)	No (for deposit market) Yes (for loans market)
Al-Muharrami & Matthews (2009)	Arab Gulf (1993-2002)	No
Fan & Marton (2011)	SEE (1998-2008)	No
Fu & Heffernan (2009)	China (1985-2002)	No
Delis & Tsionas (2009)	Europe (1996-2006)	Yes
Fu & Heffernan (2009)	China (1985-2002)	No
Punt &van Rooij(2009)	EU (1992-1997)	No
Ariss (2010)	A sample of developing countries (1999-2005)	Yes (cost efficiency) No (profit efficiency)
Coccorese & Pellecchia (2010)	Italy (1992-2007)	Yes
Tetsushi et al. (2012)	Japan (1974-2005)	Yes
Titko & Dauylbaev (2015)	Baltic countries (2007-2013)	No

Sources: Coccorese and Pellecchia (2010); Titko and Dauylbaev (2015) and Author. SEE: South East European countries. EU: Europe Union. QLH: Quiet Life Hypothesis.

3. Methodology and Data

3.1 Methodology

3.1.1 Empirical estimation of cost efficiency and the Lerner index

In order to estimate time varying cost efficiency scores, the stochastic frontier model of Aigner-Lovell-Schmidt (1977) is employed in accordance with Coccorese and Pellecchia (2010).

Let us consider that for firm i at time t, production costs are a function of output (Q), input prices (W), inefficiency (u) and random error (v). With the last two terms independently and identically distributed (iid), the logarithmic specification of the cost function can be written as follows:

$$\ln C_{it} = f(Q_{it}, W_{it}) + v_{it} + u_{it} \quad (1)$$

where the error term and non-negative inefficiency terms follow a normal distribution and a truncated normal distribution respectively. Hence, while v_{it} is $N(0, \sigma_v{}^2)$, u_{it} is $N(\mu, \sigma_u{}^2)$. Moreover u_{it} is modeled as a function of time as follows:

$$u_{it} = u_i \{\exp[-\gamma(t - T_i]\} \quad (2)$$

Hence, for firm i, the last period T_i contains the base level of its own inefficiency which is time-dynamic. In other words: if $\gamma > 0$, the level of inefficiency decays toward the base level (i.e. firm i would have the tendency of improving its cost efficiency over time); if $\gamma < 0$, the firm's inefficiency increases to the base level; while $\gamma = 0$ means that inefficiency is constant with

time. Since, $t = T_i$, the last period for firm i contains the base level of inefficiency.

In order to model the cost, we employ a translog function with three inputs and one output. The function first proposed by Christensen et al. (1971) and then extended to a multiproduct framework (Brown et al., 1979) has been substantially employed for the assessment of the QLH in the banking literature (Koetter & Vins, 2008; Coccorese & Pellecchia, 2010; Ariss, 2010). The cost function is as follows:

$$\ln C_{it} = \alpha_0 + \alpha_1 \ln Q_{it} + \sum_{h=1}^{3} \alpha_h \ln W_{hit} + \frac{1}{2}\left\{ \alpha_{QQ} (\ln Q_{it})^2 + \sum_{h=1}^{3} \sum_{k=1}^{3} \alpha_{hk} \ln W_{hit} \ln W_{kit} \right\}$$

$$+ \sum_{h=1}^{3} \alpha_{Qh} \ln Q_{it} \ln W_{hit} + v_{it} + u_{it} \qquad (3)$$

where $i = 1,.....N$ and $t = 1.....T$, are subscripts for banks and time respectively. C is the total cost, Q, is the output, W_h are factor prices, while v_{it} and u_{it} are respectively the inefficiency and error terms. It is important to note that $\varepsilon_{it} = v_{it} + u_{it}$.

$$MC_{it} = \frac{\partial C_{it}}{\partial Q_{it}} = \frac{\partial \ln C_{it} C_{it}}{\partial \ln Q_{it} Q_{it}} = \left(\alpha_Q + \alpha_{QQ} \ln Q_{it} + \sum_{h=1}^{3} \alpha_{Qh} \ln W_{hit} \right) \frac{C_{it}}{Q_{it}} \qquad (4)$$

$$LERNER_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \qquad (5)$$

where P_{it} is the price charged by banks on their output. Accordingly, in theory the Lerner index can vary between 0 (in case of perfect competition) and 1. It important to note that efficiency scores are obtained by estimating the Aigner-Lovell-Schmidt cost function and then generating cost efficiency scores (CES).

The regression output pertaining to the cost function from which the CES are generated is provided in Appendix 4.

3.1.2 Testing the 'Quiet Life' Hypothesis (QLH)

The QLH test is implemented for African financial institutions by regressing the CES on the estimated Lerner index (LERNER) contingent on a conditioning information set, consisting of: market-level, bank-level and fixed effects for the unobserved heterogeneity. Thus, a negative and statistically significant estimate of the variable corresponding to LERNER can be interpreted as evidence for the validity of the QLH. Given that CES are theoretically within the interval of 0 and 1, estimation by Ordinary Least Squares (OLS) is not appropriate. This shortcoming has motivated many authors to employ double-censored Tobit specifications (Kumbhakar & Lovell, 2000; Koetter et al., 2012; Ariss, 2010; Coccorese & Pellecchia, 2010).

In the light of the above, as recently argued by Asongu and Nwachukwu (2016), the Tobit model is appropriate when bounds on the outcome indicator originate from non-observability. Moreover, as shown in recent literature (McDonald, 2009; Coccorese & Pellecchia, 2010), if no observations for the CES are either 0 or 1 (which is the case for the most part), estimating by double-censored Tobit model is the same as analysing a linear regression model given that the two likelihood functions converge. Therefore, on the one hand, we use a Logistic regression (as an alternative to the non-linear approach), and on the other, we employ OLS and Fixed Effects (FE) regressions under the linear hypothesis. Thus, the alternative nonlinear (logistic) specification in Eq. (6) is the following:

$$CE_{it} = \frac{\exp\left(x_{it}^{'}\beta\right)}{1+\exp\left(x_{it}^{'}\beta\right)} + \phi_{it} \qquad (6)$$

where x_{it} is the same vector of regressors used in the Tobit model, β is the vector of parameters and ϕ_{it} is an iid with mean zero and variance σ_{ϕ}^{2} variance.

Given a linear hypothesis, the corresponding FE regression is as follows:

$$CE_{it} = x_{it}\beta + \alpha_i + n_{it} \qquad (7)$$

where α_i and n_{it} are the unobserved time-invariant individual effects and error term respectively. In the absence of individual effects in the former, it becomes a constant and Eq. (7) can be estimated by OLS.

In order to address the potential issue of endogeneity that may arise, the Lerner index is instrumented with internal instruments or its first lags. This is essentially because the Lerner variable could be endogenous given that the efficiency structure (ES) hypothesis postulates a causal relation from efficiency to the market. The study employs an instrumental variable approach to control for the simultaneity dimension of endogeneity. Moreover, the unobserved heterogeneity dimension is controlled by accounting for dummy independent variables such as legal origins and income levels. The instrumental variable approach consists of regressing the independent variable of interest (i.e. the Lerner index) on its first and second lags while controlling for fixed effects and then saving the corresponding fitted values that are subsequently used as the

independent variables of interest. Such an approach has been used in recent literature (Efobi et al., 2016; Asongu & Nwachukwu, 2017).

3.1.3 Robustness checks and sensitivity analysis

The following checks are performed to ensure consistency in the results. (i) Two hypotheses (linear and nonlinear) underline the adopted estimation technique. (ii) Under each hypothesis, two estimation techniques are adopted (OLS and Fixed Effects for the linear hypothesis or Tobit and Logistic regressions for the nonlinear hypothesis). (iii) For each estimation technique, three specifications are considered. (iv) We control for both the unobserved heterogeneity and simultaneity bias. (v) Modeling is based on Heteroscedasticity and Autocorrelation Consistent (HAC) standard errors.

It is important to note that as like in Coccorese and Pellecchia (2010), in the robustness exercise, we also estimated a stochastic frontier model as suggested independently by Meeusen and van den Broeck (1977) and Aigner et al. (1977). Accordingly, they were the first to have suggested a 'composed error model' for the estimation of cost and production functions, such that the specification of the error term consists of the two components: (i) inefficiency and (ii) random noise. Hence, in our estimations, the cost inefficiency component u_{it} represents an asymmetric term that satisfies $u_{it} \geq 0$ but is free without any *a priori* hypothesis to vary over time. Here, consistent with Aigner et al. (1977) and Coccorese and Pellecchia (2010), it is assumed that the impacts u_{it} are distributed as a positive half-normal random variable $N^0(0,\sigma_U{}^2)$.

3.2 Data

The cost function is estimated with three inputs and one output. Total operating cost is measured by the following: overheads, output (i.e. loans plus other earning assets) and inputs by the price of deposits, price of labor and price of capital[3]. The Lerner index is then computed from the price and marginal cost (see Eq. 5). Whereas the latter is calculated from the Translog cost function output (see Eq. (4) and Appendix 5), the former is the price charged by financial institutions on their output, computed as the ratio between total revenues (interest income plus net noninterest income) and total assets.

Consistent with recent finance literature (Kusi et al., 2017; Asongu & Odhiambo, 2018; Kusi & Opoku- Mensah, 2018; Asongu et al., 2019b), we control for bank-level, market oriented and fixed effects.

Firstly, the bank-level variables include the following. (i) The ratio of loans to total assets: contrary to other bank assets (e.g. securities), lending requires more effort and organizational capabilities by the staff. Hence, if not properly performed, it could generate inefficiencies. (ii) Deposit to assets ratio: while deposits are the main source of financing for banks, they also require good organization to be mobilized and well managed. Therefore, a higher fraction of deposits among liabilities could lead to cost inefficiencies. (iii) The number of bank branches is also used since widespread branch network entails the

[3] The price of deposits is computed by dividing interest expenses by the sum of deposits, money market plus short term funding. The price of labor is defined as the ratio of personnel expenses to total assets. The price of capital is equal to the ratio of 'other operating costs' to the value of fixed assets.

creation and management of a retail organization, which could have a negative (or positive) effect on cost efficiency. Whereas we expect negative coefficients for the first-two variables for reasons discussed above, the third could have a negative (or positive) effect on CES depending on co-ordination and organizational problems (or opportunities) linked to a bigger dimension. Accordingly, bank branches could also be assimilated to bank size.

Secondly, the study also controls for three main market variables, namely: GDP growth, population density and inflation. (i) The GDP growth rate is included to take account of the influence of business cycle fluctuations on efficiency. For instance, in dynamic and expanding markets, banks can benefit from a soaring demand that if exploited, could improve efficiency as a result of growing activities in branches and increased networking. In the same vein, while exploiting the opportunities for short-run profitability, banks could forgo efficiency. Hence, the expected sign cannot be anticipated with certainty. (ii) The sign of population density is also ambiguous because, while in markets of high population density it should be less costly to offer banking services, dealing with more customers could generate inefficiencies because of issues associated with meeting all customers' requirements. (iii) Theoretically, inflation should increase inefficiencies because of risks associated with uncertainties.

Thirdly, we further account for fixed effects by controlling for the unobserved heterogeneity, namely: 'legal-origin' and wealth-effects. (i) The premise for legal origin effects builds on the law-finance theory which articulates the relevance of

legal origins in financial development (La Porta et al., 1998; Beck et al., 2003). Accordingly, English common law is more adapted to openness (and competition) and hence should be associated with better efficiency scores compared to French civil law. (ii) Intuitively, it is normal to expect higher income countries to exhibit higher levels of financial development because a large percentage of the monetary base transits through the formal banking sector (Asongu, 2012). Moreover, developed financial systems should naturally be associated with a higher degree of competition and consequently high cost efficiency.

The sample consists of a panel of 162 banks consisting of 42 African countries for the period 2001-2011. The data is from Bankscope and World Bank Development Indicators databases. The summary statistics, correlation matrix (showing the nexuses among key variables used in the paper), variables definitions (and corresponding sources), components of competition (and efficiency) and estimates of the cost function are presented in Appendix. From the summary statistics (Appendix 1) it could be inferred that there is substantial variation in the data utilized so that one should be confident that reasonable estimated nexuses would emerge. The purpose of the correlation matrix (Appendix 2) is to mitigate issues of multicollinearity. From an initial assessment, there are no concerns in terms of the relationships to be modeled. Results of the cost efficiency function are disclosed in Appendix 4.

4. Empirical results

The findings of the QLH are presented in Table 2. The table consists of two panels. While the first (i.e. Panel A) exclusively controls for the unobserved heterogeneity, the second (i.e. Panel B) controls for both the unobserved heterogeneity and simultaneity in order to better account for endogeneity. Hence, in Panel B the Lerner index is instrumented as discussed in Section 3.1.2 Each panel consists of four main models that are each divided into three specifications. The models include: OLS, Fixed Effects, Tobit and Logistic regressions.

It is apparent from the findings that market power for the most part is positively associated with cost efficiency scores. Hence, based on this positive association, the QLH is rejected. Most of the significant control variables display the expected signs. This established finding is not consistent with Asongu and Odhiambo (2019) who have used the same dataset to assess whether market power increases the quantity of loans and reduces loan price. They have confirmed evidence of the QLH and further asserted that such "quiet life" is driven by the below-median Lerner index sub-sample. An insight resulting from this comparative analysis is that, while market power is associated cost efficiency as established in this research, such cost efficiency may not be translated into an increase in the quantity of loans and a reduction in loan price in the African banking industry. This comparative explanation is sound in the light of the substantially documented concerns of surplus liquidity prevailing in the African banking industry (Saxegaard, 2006; Fouda, 2009; Tchamyou, 2017).

Table 2: Testing the QLH with the ALS Model (Dependent variable: Cost Efficiency Scores)

Panel A: Initial regressions with HAC SE (controlling for unobserved heterogeneity)

	Linear Hypothesis						Nonlinear Hypothesis					
	OLS (Baseline modelling)			Fixed Effects			Tobit			Logistic		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	**0.839*** **	**0.704*** **	**0.707*** **	**0.840*** **	**0.701*** **	**0.686*** **	**0.839*** **	**0.704*** **	**0.707*** **	**1.760*** **	**0.959*** **	**1.001*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
LERNER	**0.016***	**0.018***	0.017	**0.017****	**0.018***	**0.019***	**0.016*** **	**0.018*** **	**0.017****	**0.108*** **	**0.122*** **	**0.104*** **
	(0.055)	**(0.078)**	(0.101)	**(0.042)**	**(0.063)**	**(0.074)**	**(0.000)**	**(0.009)**	**(0.021)**	**(0.005)**	**(0.000)**	**(0.000)**
GDPpcg	**0.00002 ****	9.98e-06	−3.2e-05	1.60e-05	2.06e-05	−6.04e-05	**2.28e-05 *** **	**9.9e-06***	−3.2e-05	9.51e-05	2.74e-05	−0.0004
	(0.036)	(0.526)	(0.973)	(0.319)	(0.345)	(0.949)	**(0.006)**	**(0.095)**	(0.954)	(0.544)	(0.807)	(0.922)
Inflation	**−0.0004 *** **	**−0.0002 *** **	**−0.0002 *** **	**−0.0004 *** **	**−0.0002** **	**−0.0002** * **	**−0.0004 *** **	**−0.0002 *** **	**−0.0002 *** **	**−0.003** **	**−0.001** **	**−0.001** **
	(0.000)	**(0.003)**	**(0.003)**	**(0.007)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.004)**	**(0.000)**
Pop.density	---	−3.6e-05	−2.7e-05	---	**−3.5e-05**	**−6.5e-05**	---	**−3.6e-05****	**−2.7e-05**	---	**−0.0002** **	**−0.0001** **
		(0.292)	(0.505)		**(0.202)**	**(0.101)**		**(0.041)**	**(0.214)**		**(0.047)**	**(0.128)**
Loan/A	---	**0.286*** **	**0.300*** **	---	**0.301*** **	**0.312*** **	---	**0.286*** **	**0.300*** **	---	**2.029*** **	**2.115*** **
		(0.000)	**(0.000)**		**(0.000)**	**(0.000)**		**(0.000)**	**(0.000)**		**(0.000)**	**(0.000)**
Deposits/A	---	0.004	0.012	---	7.72e-06	0.011	---	0.004	0.012	---	**−0.204*** **	−0.141
		(0.856)	(0.670)		(0.999)	(0.680)		(0.702)	(0.412)		**(0.000)**	(0.073)
Bank Brchs	---	---	0.0001	---	---	0.001	---	---	0.0001	---	---	**0.005***
			(0.907)			(0.255)			(0.761)			**(0.071)**
English	---	---	−0.020	na	na	na	---	---	**−0.020*** **	---	---	**−0.194*** **
			(0.161)						**(0.000)**			**(0.000)**
Middle I.	---	---	0.0002	na	na	na	---	---	0.0002	---	---	0.002
			(0.984)						(0.963)			(0.952)
Chi-Square	---	---	---	---	---	---	**50.008*** **	**461.366*** **	**470.890*** **	---	---	---
L.likelihood	---	---	---	---	---	---	**1034.573**	**1309.260**	**1080.081**	---	---	---
Adj/Within. R^2	0.030	0.488	0.494	0.035	0.527	0.538	---	---	---	0.028	0.516	0.548
Fisher	**9.487*****	**22.246*** **	**42.221*** **	**9.377*****	**26.437*** **	**61.578*****	---	---	---	**9.798*****	**157.358*** **	**99.772*** **
Obs	886	880	748	886	880	748	886	880	748	886	880	748

Panel B: Robustness checks with HAC SE (controlling for endogeneity)

	Linear Hypothesis						Nonlinear Hypothesis					
	IV OLS (Baseline modelling)			IV Fixed Effects			IV Tobit			IV Logistic		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	**0.845*** **	**0.663*** **	**0.671*** **	**0.849*** **	**0.659*** **	**0.649*** **	**0.845*** **	**0.663*** **	**0.671*** **	**1.767*** **	**0.597*** **	**0.705*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
IVLERNER	0.004	**0.091*** **	**0.083*** **	−0.008	**0.082*** **	**0.072*** **	0.004	**0.091*** **	**0.083*** **	0.082	**0.708*** **	**0.590*** **
	(0.921)	**(0.001)**	**(0.005)**	(0.875)	**(0.004)**	**(0.008)**	(0.849)	**(0.000)**	**(0.000)**	(0.572)	**(0.000)**	**(0.000)**
GDPpcg	**2.2e-05*** **	1.46e-05	5.05e-05	**2.6e-05****	**2.9e-05****	−9.4e-05	**2.2e-05*** **	**1.46e-05 *** **	5.05e-05	0.0001	6.2e-05	−0.0001
	(0.000)	(0.151)	(0954)	**(0.044)**	**(0.047)**	(0.909)	**(0.000)**	**(0.004)**	(0.942)	(0.583)	(0.627)	(0.969)
Inflation	**−0.0003**	**−0.0002**	**−0.0002**	**−0.0003**	**−0.0002****	**−0.0002***	**−0.0003**	**−0.0002**	**−0.0002**	**−0.002***	**−0.001***	**−0.001***

	***	***	***	***	*	**	***	***	***	**	**	**
	(0.000)	**(0.001)**	**(0.002)**	**(0.000)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.001)**	**(0.000)**
Popden	---	−1.9e-05	−2.6e-05	---	−2.8e-05	−5.9e-05	---	−1.9e-05	−2.6e-05	---	−8.6e-05	−0.0001
		(0.560)	(0.531)		(0.318)	(0.123)		(0.316)	(0.259)		(0.460)	(0.223)
Loan/A	---	**0.285*** **	**0.293*** **	---	**0.301*** **	**0.312*** **	---	**0.285*** **	**0.293*** **	---	**2.073*** **	**2.122*** **
		(0.000)	**(0.000)**		**(0.000)**	**(0.000)**		**(0.000)**	**(0.000)**		**(0.000)**	**(0.000)**
Deposit/A	---	0.026	0.027	---	0.027	0.037	---	0.026*	**0.027***	---	−0.030	−0.022
		(0.370)	(0.334)		(0.377)	(0.195)		(0.059)	**(0.069)**		(0.728)	(0.818)
Bank Brchs	---	---	0.0005	---	---	0.0009	---	---	0.0005	---	---	**0.007****
			(0.671)			(0.246)			(0.313)			**(0.028)**
English	---	---	−0.009	na	na	na	---	---	−0.009*	---	---	**−0.131*** **
			(0.508)						(0.083)			**(0.001)**
Middle I.	---	---	−0.007	na	na	na	---	---	−0.007	---	---	−0.045
			(0.593)						(0.182)			(0.264)
Chi-Square	---	---	---	---	---	---	**31.411*** **	**419.888*** **	**449.831*** **	---	---	---
L.likelihood	---	---	---	---	---	---	705.401	897.256	743.820	---	---	---
Adj/Within. R^2	0.017	0.505	0.496	0.022	0.555	0.565	---	---	---	0.017	0.528	0.533
Fisher	**14.933*** **	**36.632*** **	**52.702*** **	**13.012*** **	**33.480*****	**52.792*** **	---	---	---	**4.290*****	**105.458*** **	**62.280*** **
Obs	563	561	483	563	561	483	563	561	483	563	561	483

LERNER: Lerner Index. GDPpcg: GDP per capita growth. Pop.dent: Population density. Loan/A: Loan on Total Assets. Deposit/A: Deposits on Total Assets. Bank Brchs: Bank Branches. English: English Common law. Middle I: Middle Income. Adj. R^2: Adjusted coefficient of determination. Obs: Observations. ***, **, *: significance levels of 1%, 5% and 10% respectively. OLS: Ordinary Least Squares. IV: Instrumental Variable. QLH: Quality of Life of Hypothesis. na: not applicable because the dummy variables cannot be employed in fixed effects regressions.

5. Concluding implications, caveats and future research directions

In this study, we have tested the so-called 'Quiet Life Hypothesis' (QLH), which postulates that banks with market power are less efficient. We have employed instrumental variable Ordinary Least Squares, Fixed Effects, Tobit and Logistic regressions. The empirical evidence is based on a panel of 162 banks consisting of 42 African countries for the period 2001-2011. There is a two-step analytical procedure. First, we have estimated Lerner indices and cost efficiency scores. Then, we have regressed cost efficiency scores on Lerner indices contingent on bank characteristics, market features and the unobserved heterogeneity. The empirical evidence does not support the QLH because market power is positively associated with cost efficiency. In the light of the above, firms with higher market power can be putting efforts in pursuing cost efficiency. Hence,

they may be taking advantage of their position to cut costs. Therefore, bank size could contribute to variations in bank margins and spreads (Beck & Hesse, 2006, p. 1) and the high cost of loans may not necessarily be associated with big banks as suggested by Ngigi (2013ab). Moreover, these findings are contrary to the literature that has confirmed evidence of the QLH, namely: Casu and Girardone (2007) with Granger causality test in Europe (2000-2005); Tu and Chen (2000) in Taiwan (1986-1999) in which results are valid only before 1991; Koetter and Vins (2008) for Germany (1996-2006) though the magnitude of the estimated effects of the QLH is small; Solis and Maudos (2008) in Mexico (1993-2005) for loans market; Delis and Tsionas (2009) for Europe (1996-2006) with the usage of a local maximum likelihood technique; Ariss (2010) in a sample of developing countries for cost efficiency; Schaeck and Cihak (2008) for Europe and USA (1995-2005) and Coccorese and Pellecchia (2010) in Italy (1992-2007) though the impact of market power on efficiency is not of a particularly remarkable magnitude.

While our findings cannot be directly compared with specific African finance literature because scholarship in the area is sparse, they nonetheless run counter to indirect claims established in recent literature, notably: Boateng et al. (2018) and Asongu et al. (2016a). Hence, because of the positive association between market power and cost efficiency, consolidation of banks in the African banking industry may not necessarily reflect negative financial access externalities. This is essentially because increasing market power will not necessarily be associated with low levels of cost efficiency.

An indirect inference worth articulating is the fact that low levels of financial access may be the results of other factors, which are independent of market power in the African banking industry. Accordingly, given that big banks with substantial market power are linked to cost efficiency, the surplus liquidity issues and low financial access may be traceable to more fundamental factors like information asymmetry between lenders and borrowers. These comprise (i) adverse selection from banks ex-ante of lending and (ii) moral hazard on the part of borrowers, ex-post of lending. Hence it would be worthwhile to investigate how information-sharing offices (such as public credit registries and private credit bureaus) that are designed to reduce such information asymmetry affect the established linkages.

In the light of the above, implications of these findings cannot be directly linked to financial access because the efficiency found in this study needs to be translated into more tangible measures of financial access such as increased loan quantity and reduced loan price. Unfortunately, given that Asongu and Odhiambo (2019) have confirmed evidence of the QLH in terms of reduced loan quantity and increased loan price, it further implies that banks need to develop other strategies through which cost reduction can be translated into higher quantity of loans and reduced loan price. This policy implication builds on the fact that the comparative study has used the same dataset as in this study. In essence, this comparative emphasis only confirms previously discussed policy implications suggesting the need for bank-specific policies that enhance financial intermediation (i.e. the transformation of mobilized deposits into credit)

to be complemented with macroeconomic government-led initiatives that facilitate financial access, *inter alia*; policies designed to reduce information asymmetry and collateral (i.e. credit guarantee) constraints during in the process to granting credit to households and economic operators.

It is also worthwhile to articulate that owing to the problem of endogeneity which is partly addressed in the estimation process (i.e. by controlling for simultaneity and the unobserved heterogeneity), the relationship between market power and efficiency is not causative but associative. Moreover, high heterogeneity in the sample (especially, with respect to the few number of banks per country) also supports the cautionary conclusion that the main finding should be understood as a relationship and not causation. Future research can focus on assessing if the established interconnections could withstand empirical scrutiny within country-specific settings. Moreover, investigating if market power affects financial intermediation efficiency through 'economies of scale' is also worthwhile in order to improve the extant literature.

References

Ahokpossi, C., (2013). "Determinants of bank interest margins in Sub-Saharan Africa", *IMF Working Paper* No. 13/34, Washington.

Aigner, D. J., Lovell, C. K. A., & Schmidt, P., (1977). "Formulation and Estimation of Stochastic Frontier Production Function Models", *Journal of Econometrics*, 6(1), pp. 21-37.

Al-Muharrami, S., & Metthews, K., (2009), "Market Power Versus Efficient-Structure in Arab GCC Banking", *Applied Financial Economics*, 19(18), pp. 1487-1496.

Allen, L., & Rai, A., (1996), "Operational efficiency in banking: An international comparison", *Journal of Banking and Finance*, 20(4), pp. 655-672.

Alunbas, Y., Liu, M. H., Molyneux, P., & Seth, R. R., (2000), "Efficiency and risk in Japanese banking", *Journal of Banking and Finance*, 24(10), pp. 1605-1628.

Ariss, R. T., (2010). "On the Implications of Market Power in Banking: Evidence from Developing Countries", *Journal of Banking and Finance*, 34(4), pp. 765-775.

Asongu, S. A., (2012). "Government Quality Determinants of Stock Market Performance in Africa", *Journal of African Business*, 13(3), pp. 183-199.

Asongu, S. A., (2014). "Correcting Inflation with Financial Dynamic Fundamentals: Which Adjustments Matter in Africa?", *Journal of African Business*, 15(1), pp. 64-73.

Asongu, S. A., (2017). "The effect of reducing information asymmetry on loan price and quantity in the African banking industry", *Research in International Business and Finance*, 41(October), pp. 185-197.

Asongu, S. A., & Anyanwu, J. C., & Tchamyou, S. V., (2016b). "Information sharing and conditional financial development in Africa", *African Governance and Development Institute Working Paper No.* 16/001, Yaoundé.

Asongu, S. A., Batuo, M. E., Nwachukwu, J. C., & Tchamyou, V. S., (2018). "Is information diffusion a threat to market power for financial access? Insights from the African banking industry", *Journal of Multinational Financial Management*, 45(June), pp. 88-104.

Asongu, S. A., & Biekpe, N., (2017). "ICT, information asymmetry and market power in African banking industry", *Research in International Business and Finance*, 44(April), pp. 518-531.

Asongu, S. A., le Roux, S., & Tchamyou, V. S., (2019a). "Essential Information Sharing Thresholds for Reducing Market Power in Financial Access: A Study of the African Banking Industry", *Journal of Banking Regulation*, 20(1), pp. 34–50.

Asongu, S. A., le Roux, S., Nwachukwu, J. C., & Pyke, C., (2019b). "Reducing information asymmetry with ICT", *International Journal of Managerial Finance*, 15(2), pp. 130-163.

Asongu, S. A., Nwachukwu, J. C., & Tchamyou, S. V., (2016a). "Information Asymmetry and Financial Development Dynamics in Africa", *Review of Development Finance,* 6(2), pp. 126–138.

Asongu, S. A., & Nwachukwu, J. C., (2016) , "The role of governance in mobile phones for inclusive human development in Sub-Saharan Africa", *Technovation*, 55-56(September-October), pp. 1-13.

Asongu, S. A., & Nwachukwu, J. C., (2017), "The Comparative Inclusive Human Development of Globalisation in Africa", *Social Indicators Research*, 134(3), pp. 1027–1050.

Asongu, S. A., & Odhiambo, M. N., (2018). "Information asymmetry, financialization, and financial access", *International Finance*, 21(3), pp. 297-315.

Asongu, S. A., & Odhiambo, M. N., (2019). "Testing the Quiet Life Hypothesis in the African Banking Industry", *Journal of Industry, Competition and Trade*, 19(1), pp. 69–82.

Battese, G. E., & Coelli, T. J., (1992), "Frontier Production Function, Technical Efficiency and Panel Data with Application to Paddy Farmers in India", *Journal of Productivity Analysis*, 3(1-2), pp. 153-169.

Barth, J., Lin, C., Lin, P., & Song, F., (2009). "Corruption in bank lending to firms: cross-country micro evidence on the beneficial role of competition and information sharing", *Journal of Financial Economics*, 99(3), pp. 361-368.

Beck, T., Demirgüç-Kunt, A., & Levine, R., (1999), "A New Database on Financial Development and Structure", *World Bank Policy Research Working Paper* No. 2146, Washington.

Beck, T., Demirgüç-Kunt, A., & Levine, R.,(2003), "Law and finance: why does legal origin matter?", *Journal of Comparative Economics*, 31(4), pp. 653-675.

Beck, T., & Hesse, H., (2006), "Bank efficiency, ownership and market structure: why are interest spreads so high in Uganda?", *Policy Research Working Paper Series* No. 4027, The World Bank.

Berger, A. N., & Mester, L. J., (1997), "Inside the black box: What explains differences in the efficiencies of financial institutions", *Journal of Banking and Finance*, 21(7), pp. 895-947.

Boateng, A., Asongu, S. A., Akamavi, R., & Tchamyou, V. S., (2018). "Information Asymmetry and Market Power in the African Banking Industry", *Journal of Multinational Financial Management,* 44(March), pp. 69-83.

Bocher, F. T., Alemu, B. A., & Kelbore, Z. G., (2017). "Does access to credit improve household welfare? Evidence from Ethiopia using endogenous regime switching regression", *African Journal of Economic and Management Studies*, 8(1), pp. 51-65.

Brown, R., & O'Connor, I., (1995, June), "Measurement of Economies of Scale in Victorian Credit Unions", *Australian Journal of Management*, 20(1), pp. 1-24.

Brown, M., & Zehnder, C., (2010). "The emergence of information sharing in credit markets". *Journal of Financial Intermediation*, *19*(2), pp. 255-278.

Casu, B., & Girardone, C., (2007), "Does Competition Lead to Efficiency? The Case of EU Commercial Banks", *Essex University Discussion Paper* No. 07-01, Colchester.

Chapoto, T., & Aboagye, A. Q. Q., (2017). "African innovations in harnessing farmer assets as collateral", *African Journal of Economic and Management Studies*, 8(1), pp. 66-75.

Chikalipah, S., (2017). "What determines financial inclusion in Sub-Saharan Africa?" *African Journal of Economic and Management Studies*, 8(1), pp. 8-18.

Chortareas, G. E., & Garza-Garcia, J. G., & Girardone, C., (2012), "Competition, efficiency and interest rate margins in Latin American banking", *International Review of Financial Analysis*, 24(2012), pp. 93-103.

Christensen, L. R., Jorgenson, D. W., & Lau, L. J., (1971), "Transcendental Logarithmic Production Frontiers", *Review of Economics and Statistics*, 55(1), pp. 28-45.

Clark, J., (1996). "Economic cost, scale efficiency and competitive viability in banking", *Journal of Money, Credit and Banking*, 28(3), pp. 342-364.

Coccorese, P., & Pellecchia, A., (2010), "Testing the 'Quiet Life' Hypothesis in the Italian Banking Industry", *Economic Notes by Banca dei Paschi di Siena SpA*, 39(3), pp. 173-202.

Dabla-Norris, E., & Floerkemeier, H., (2007), "Bank Efficiency and Market Structure: What Determines Banking Spreads in Armenia?", *IMF Working Paper* 07/134, Washington.

Daniel, A., (2017). "Introduction to the financial services in Africa special issue", *African Journal of Economic and Management Studies*, 8(1), pp. 2-7.

De Keuleneer, E., & Leszczynska, N., (2012), "Size in Banking: Efficiency of Scale vs. Abuse of Power", Global Economic Intersection, http://econintersect.com/wordpress/?p=19616 (accessed: 12/09/2013).

Delis, M. D., & Tsionas, E. G., (2009), "The Joint Estimation of Bank-Level Market Power and Efficiency", *Journal of Banking and Finance*, 33(10), pp. 1842-1850.

Demirgüç-Kunt, A., & Harry, H., (2011), "Do We Need Big Banks? Evidence on Performance, Strategy and Market Discipline", *Policy Research Working Paper* No. 5576, Washington.

Efobi, U. R., Tanankem, B. V., & Atata, N. S., (2016). "Women Empowerment and Intra-household Dietary Diversity in Nigeria", *African Governance and Development Institute Working Paper* No. 16/050, Yaoundé.

Fouda, O. J. P., (2009), "The excess liquidity of banks in Franc zone: how to explain the paradox in the CEMAC", *Revue Africaine de l'Integration*, 3(2), pp. 1-56.

Fowowe, B., (2014). "Law and Finance Revisited: Evidence from African Countries", *South African Journal of Economics*, 82(2), pp. 193–208.

Fu, X., & Heffernan, S., (2009), "The Effects of Reform on China's Bank Structure and Performance", *Journal of Banking and Finance*, 33(1), 39-52.

Fukuyama, W., (1993), "Technical and scale efficiency of Japanese commercial banks: a non-parametric approach", *Applied Economics*, 25(8), pp. 1101-1112.

Goldberg, L. G., & Rai, A. A., (1996), "The structure-performance relationship for European banking", *Journal of Banking and Finance*, 20(4), pp. 745-771.

Hicks, J., (1935), "Annual Survey of Economic Theory: The Theory of Monopoly", *Econometrica*, 3(1), pp. 256–63.

Iyke, B., N., & Odiambo, N. M., (2017). "Foreign exchange markets and the purchasing power parity theory: Evidence from two Southern African countries", *African Journal of Economic and Management Studies*, 8(1), pp. 89-102.

Karray, S. C., & Chichti, J. E., (2013). "Bank size and efficiency in developing countries: intermediation approach versus value added approach and impact

of non-traditional activities", *Asian Economic and Financial Review*, 3(5), pp. 593-613.

Koetter, M., Kolari, J. W., & Spierduk, L., (2012), " Enjoying the Quiet Life under Deregulation? Evidence from Adjusted Lerner Indices for U.S. Banks", *Review of Economics and Statistics*, 94(2), pp. 462-480.

Koetter, M., & Vins, O., (2008), "The Quiet Life Hypothesis in Banking-Evidence from German Savings Banks", Department of Finance, Goethe University, *Working Paper Series: Finance and Accounting* No. 190, Frankfurt.

Kumbhakar, S. C., & Lovell, C. A. K., (2000), *Stochastic Frontier Analysis*, Cambridge MA: Cambridge University Press.

Kusi, B. A., Agbloyor, E. K., Ansah-Adu, K., & Gyeke-Dako, A. (2017). "Bank credit risk and credit information sharing in Africa: Does credit information sharing institutions and context matter?" *Research in International Business and Finance*, 42(December), pp.1123-1136.

Kusi, B. A., & Opoku- Mensah, M. (2018). "Does credit information sharing affect funding cost of banks? Evidence from African banks". *International Journal of Finance & Economics*, 23(1), pp. 19- 28.

La Porta, R., Lopez-de-Silanes, F., & Shleifer, A., (2008), "The Economic Consequences of Legal Origin," *Journal of Economic Literature*, 46(2), pp. 285-332.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W., (1998). "Law and finance", Journal of Political Economy, 106(6), pp. 1113-1155.

Lang, G., & Welzel, P., (1996), "Efficiency and technical progress in banking: Empirical results for a panel of German cooperative banks", *Journal of Banking and Finance*, 20(6), pp. 1003-1023.

Maddala, G. S., (1991), "A Perspective on the Use of Limited-Dependent and Qualitative Variables Models in Accounting Research", *Accounting Review*, 66(4), pp. 788-807

Maudos, J., & De Guevara, J. F., (2007), "The cost of market power in banking: Social welfare loss vs. cost inefficiency", *Journal of Banking & Finance*, 31(7), pp. 2103-2125.

Meeusen, W., & Van Den Broeck, J., (1977). "Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error", *International Economic Review*, 18(2), pp. 435–444.

Mester, L. J., (1992). "Traditional and nontraditional banking: An information-theoretic approach", *Journal of Banking and Finance*, 16(3), pp. 545-566.

McDonald, J., (2009), "Using Least Squares and Tobit in Second Stage DEA Efficiency Analyses", *European Journal of Operational Research*, 197(2), pp. 792-798.

Mitchell, K., & Onvural, N. M., (1996). "Economies of scale and scope at large commercial banks: Evidence from the Fourier flexible form", *Journal of Money, Credit and Banking*, 28(2), pp. 178-199.

Obeng, S. K., & Sakyi, D., (2017). "Macroeconomic determinants of interest rate spreads in Ghana", *African Journal of Economic and Management Studies*, 8(1), pp. 76-88.

Osah, O., & Kyobe, M., (2017). "Predicting user continuance intention towards M-pesa in Kenya", *African Journal of Economic and Management Studies*, 8(1), pp. 36-50.

Ngigi, G., (2013a, July). "CBK puts big banks on the spot over high interest rates", *BUSINESS DAILY*,http://www.businessdailyafrica.com/CBK-puts-big-banks-on-the-spot-over-high-interest-rates/-/539552/1908098/-/7t6949z/-/index.html (Accessed: 20/06/2016).

Ngigi, G., (2013b, April). "High cost of loans favours big banks over small lenders", *BUSINESS DAILY*,http://www.businessdailyafrica.com/High-cost-of-loans-favours-big-banks-over-small-lenders/-/539552/1744902/-/awkd24/-/index.html (Accessed: 20/06/2016).

Saxegaard, M., (2006), "Excess liquidity and effectiveness of monetary policy: evidence from sub-Saharan Africa", *IMF Working Paper* No. 06/115, Washington.

Schaeck, K., & Cihak, M., (2008), "How Does Competition Affect Efficiency and Soundness in Banking? New Empirical Evidence", ECB Working Paper Series, No. 932, European Central Bank.

Solis, L., & Maudos, J., (2008), "The Social Costs of Bank Market Power: Evidence from Mexico", *Journal of Comparative Economics*, 36(3), pp. 467-488.

Srivastava, P., (1999), "Size, efficiency and financial reforms in Indian banking", Indian Council for Research on International Economic Relations, *Working Paper* No. 49, New Delhi.

Tchamyou, V. S, (2017). "The Role of Knowledge Economy in African Business", *Journal of the Knowledge Economy*, 8(4), pp. 1189–1228.

Tchamyou, V. S., (2019a). "Education, Lifelong learning, Inequality and Financial access: Evidence from African countries". *Contemporary Social Science*. DOI: 10.1080/21582041.2018.1433314.

Tchamyou, V. S., (2019b)."The Role of Information Sharing in Modulating the Effect of Financial Access on Inequality".*Journal of African Business*, 20(3), pp. 317-338.

Tchamyou, V.S., Erreygers, G., & Cassimon, D., (2019). "Inequality, ICT and Financial Access in Africa", *Technological Forecasting and Social Change*,139(February), pp. 169- 184.

Tchamyou, S. V., & Asongu, S. A., (2017). "Information Sharing and Financial Sector Development in Africa", *Journal of African Business*, 18(1), pp. 24-49.

Triki, T., & Gajigo, O., (2014). "Credit Bureaus and Registries and Access to Finance: New Evidence from 42 African Countries", *Journal of African Development,* 16(2), pp. 73-101.

Tu, A. H., & Chen, S., (2000), "Bank Market Structure and Performance in Taiwan Before and After the 1991 Liberalization", *Review of Pacific Basin Financial Markets and Policies*, 3(4), pp. 475-490.

Pruteanu-Podpiera, A., & Weill, L., & Schobert, F., (2008), "Banking Competition and Efficiency: A Micro-Data Analysis on the Czech Banking Industry", *Comparative Economics Studies*, 50(2), pp. 253-273.

Wagenvoort, R., & Schure, P., (1999), "Economies of Scale and Efficiency in European Banking: New Evidence", Economic and Financial Reports 1999/1, Economic Investment, European Central Bank.

Wale, L.E., & Makina, D., (2017). "Account ownership and use of financial services among individuals: Evidence from selected Sub-Saharan African economies", *African Journal of Economic and Management Studies*, 8(1), pp. 19-35.

Weill, L., (2004), "On the Relationship Between Competition and Efficiency in the EU Banking Sectors", *Kredit und Kapital*, 37, pp. 329-352.

Appendices

Appendix 1: Summary Statistics

		Mean	S.D	Minimum	Maximum	Observations
Translog cost function variables	Ln. Cost (C)	2.982	1.292	0.155	5.749	1032
	Ln. Output (Q)	3.780	1.332	0.505	6.469	1060
	Deposit Price (W1)	0.539	8.196	0.000	176.00	1031
	Labour Price (W2)	0.022	0.016	0.000	0.201	961
	Capital Price (W3)	1.733	3.884	0.000	72.750	1043
Market variables	GDP per capita growth	13.912	96.707	-15.306	926.61	1782
	Inflation	10.239	22.695	-9.823	325.00	1749
	Population density	81.098	106.06	2.085	633.52	1782
Bank level variables	Loan/Assets	0.449	0.183	0.000	0.966	1092
	Deposits/Assets	0.664	0.198	0.000	1.154	1052
	Bank Branches	6.112	6.158	0.383	37.209	1129
	Output Price (P)	0.338	0.929	0.000	25.931	1045
Fixed effects variables	English	0.617	0.486	0.000	1.000	1782
	French	0.382	0.486	0.000	1.000	1782
	Low Income	0.462	0.498	0.000	1.000	1782
	Middle Income	0.537	0.498	0.000	1.000	1782

Ln: Logarithm. GDP: Gross Domestic Product. S.D: Standard Deviation

Appendix 2: Correlation Matrix (uniform sample size 748)

Lerner	GDPpcg	Infl.	Popden	L/A	D/A	B.Brchs	English	French	Low I	Middle I	CE	
1.000	0.022	0.008	-0.019	-0.016	0.013	0.037	-0.141	0.141	-0.105	0.105	0.136	Lerner
	1.000	-0.059	0.028	-0.193	0.008	-0.069	-0.081	0.081	-0.029	0.029	-0.120	GDPpcg
		1.000	-0.056	-0.086	0.073	-0.010	-0.097	0.097	-0.005	0.005	-0.122	Infl.
			1.000	-0.019	0.132	0.434	0.257	-0.257	-0.054	0.054	-0.075	Popden
				1.000	-0.229	0.124	0.164	-0.164	-0.010	0.010	0.676	L/A
					1.000	0.010	0.018	-0.018	0.199	-0.199	-0.143	D/A
						1.000	-0.078	0.078	-0.454	0.454	0.093	B.Brchs
							1.000	-1.000	0.230	-0.230	-0.020	English
								1.000	-0.230	0.230	0.020	French
									1.000	-1.000	-0.045	Low I
										1.000	0.045	Middle I
											1.000	CE

Lerner: Lerner index. GDPpcg: GDP per capita growth. Popden: Population density. L/A: Loan on Total Assets. D/A: Deposit on Total Assets. B. Brchs: Bank Branches. English: English Common law countries. French: French Civil law countries. Low I: Low Income. Middle I: Middle Income.

Appendix 3: Definitions of variables

Variables	Signs	Definitions of variables	Sources
Marginal Cost	MC	The change in Total cost arising from a change in Output by one unit.	Translog Cost Function
Price (charged on Output)	P	(Gross Interest and Dividend income +Total Non-Interest Operating Income)/Output	BankScope
Lerner Index	Lerner	Firm's market power ((P-MC)/P)	Authors' calculation
Cost Efficiency Scores	CE	The distance between the observed cost and minimum cost on the frontier.	Prediction from Translog Cost Function
Cost	C	Total Operating Cost (Overheads) + Total interest expenses	BankScope
Output	Q	Loans + other earning assets	BankScope
Deposit Price	W1	Total Interest Expense/Total Deposits, Money Market and Short-term Funding	BankScope
Labour Price	W2	Personnel Expenses on Total Assets	BankScope
Capital Price	W3	Other Operating Expenses on Fixed Assets	BankScope
GDP per capita	GDPpcg	GDP per capita growth (annual %)	WDI (World Bank)
Inflation	Infl.	Consumer Price Index (annual %)	WDI (World Bank)
Populaton density	Popden	People per square kilometers of land area	WDI (World Bank)
Loans/Assets	L/A	Loans on Total Assets	BankScope
Deposits/Assets	D/A	Deposits on Total Assets	BankScope
Bank Branches	B. Brchs	Number of Bank Branches (Commercial bank branches per 100 000 adults)	BankScope
English Common law	English	English Common Law Countries	La Porta et al. (2008, p.289)
French Civil law	French	French Civil law Countries	La Porta et al. (2008, p.289)
Low Income	Low I	Low Income Countries	FDSD (World Bank)
Middle Income	Middle I	Middle Income Countries	FDSD (World Bank)

WDI: World Development Indicators. FDSD: Financial Development and Structure Database. GDP: Gross Domestic Product.

Appendix 4: Estimates of the Cost Function (Aigner–Lovell–Schmidt)

Parameters	Regressors	Coefficients	Standard Errors
α_0	Constant	1.295***	0.228
α_Q	ln Q	0.712***	0.046

α_1	$\ln W_1$	-0.249**	0.125
α_2	$\ln W_2$	1.559***	0.186
α_3	$\ln W_3$	0.208*	0.116
α_{QQ}	$(\ln Q)^2/2$	0.041***	0.008
α_{11}	$(\ln W_1)^2/2$	-0.174***	0.046
α_{22}	$(\ln W_2)^2/2$	0.514***	0.090
α_{33}	$(\ln W_3)^2/2$	-0.190***	0.061
α_{Q1}	$\ln Q \times \ln W_1$	-0.015	0.015
α_{12}	$\ln W_1 \times \ln W_2$	-0.044	0.064
α_{13}	$\ln W_1 \times \ln W_3$	-0.074	0.051
α_{Q2}	$\ln Q \times \ln W_2$	-0.039**	0.018
α_{23}	$\ln W_2 \times \ln W_3$	-0.008	0.057
α_{Q3}	$\ln Q \times \ln W_3$	-0.001	0.014
Log-likelihood		189.22656	
Wald Chi-square		32941.90***	
Observations		892	
Banks		162	

***, **,*: significance levels of 1%, 5% and 10% respectively.