The impact of Mobile Money innovation in Ghana on bank profitability

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Article Information

Abstract

The study investigated the bank specific, industry and macroeconomic factors that impact the profitability of banks from a developing country perspective. The differentiator for this paper is the inclusion of mobile money floats as a factor that influence bank profitability in a mobile money driven financial system. Using panel data techniques, the study found that bank-related factors that drive bank profitability are operating expense ratio, capitalisation, and bank size. All macroeconomic variables included in the study are also important in explaining bank profitability and so is market concentration and regulation. The study however, revealed that mobile money floats does not influence bank profitability significantly, however, bank size complements and moderates the relationship between mobile money and bank profitability positively. The study recommend that smaller banks should invest more in information technology to attract more mobile money floats to improve upon profitability and consequently financial inclusion and economic development.

Introduction

The role of the financial system in economic growth and development cannot be over emphasized. An efficient financial system facilitates the smooth flow of funds amongst economic agents, thus ensuring that the needed credit flows to the private sector for productive activities. In the developed world, the banking sector work together with financial markets to ensure the flow of private capital for economic activities (Fadzlan Sufian, Muzafar Shah Habibullah 2009). However, in developing countries where financial markets are underdeveloped, banks play a critical role in the financial system and hence economic growth and development. The banking sector dominate the financial system of developing countries, therefore the performance of banks in developing countries should be of interest to industry players, governments ,international development partners etc.

The banking sector in developing countries have undergone significant reforms, especially in Africa, with the gradual adoption of Basel II & III accords. Banking consolidations and stricter regulations of banks have become a common place across Africa. The banking landscape in African countries has changed and one contributory factor to this change, aside regulation is introduction of mobile money (MM) by telecommunication

companies in developing countries. The mobile money model initially thought of as a way of increasing financial inclusion, has taken developing countries by storm. According to the Bank of Ghana (BOG), between 2012 and 2016, mobile money transactions in Ghana grew by 737.4 percent (BOG, 2017). To this end, an understanding of the contribution of mobile money in developing countries to profitability of financial institutions is long overdue.

Previous studies on bank profitability have often focused on only the traditional determinants of bank profitability; liquidity, asset quality, operational efficiency, capital adequacy, expense management and bank size, being the internal factors, and economic growth, inflation, market capitalization, market concentration, interest rates, and regulation, being the external factors (Bourke, 1989, Fadzlan Sufian, Muzafar Shah Habibullah 2009; Elisa Menicucci and Guido Paolucci 2015; Fadzlan Sufian and Royfaizal Razali Chong 2008). (Khurshid Djalilov and Jenifer Piesse 2016; Twila-Mae Logan 2016; Panayiotis P. Athanasoglou et al 2008). A few studies have also considered the influence of information technology on bank profitability (Wilson U Ani, Cosmas O Odo & Ezeudu Ikenna, 2014, Holden & El-Bannany ,2004).

This study however, seeks to examine the profitability performance of banks in a developing country's perspective, but with specific emphasis on understanding the influence of mobile money floats held by banks on bank profitability in Ghana. The mobile money business model in developing countries though an initiative of telecommunication companies, banks are major players in the mobile money ecosystem.

Mobile Money innovation in Ghana

Mobile money was launched in Ghana in 2009, after initial struggles, Ghana by 2017 became the fastest growing mobile money market in Africa with about 11 million active mobile money accounts (Mattern, 2017). MM is a financial innovative ICT driven service that uses non-bank retail channels to deliver financial services to clients who otherwise could not be reached profitably with traditional bank branch-based services. It is an electronic money fully backed by the central bank's (Bank of Ghana) notes and coins, that is, it has an equivalent value of notes and coins issued by the Bank of Ghana and stored in the Subscriber Identification Module (SIM) in a mobile phone as an identifier (GSMA,2013, (Pelletier, Khavu, & Estrin, 2020). Mobile money operators (usually Telecoms) issue the e-value or e-money which is stored in the subscriber's identification module in a phone. Apart from transfer of value from one person to another person (P2P), mobile money wallets are used for a variety of transactions; for payment of goods and services, paying for utility bills, TV and internet subscription fees, salaries of some workers, taxi fares, micro-credit, savings and micro-insurance(BOG,2017).

The e-value held with mobile money account holders, earn interest on quarterly basis. The mobile money balances with customers are called mobile money floats and these floats sit with banks. Total float balance was GH¢1.25740 billion as of December, 2016 as against float balance of GH¢547.96 million as of December, 2015, indicating a growth of 129.5 per cent (BOG 2017). Total mobile money floats for December 2019 stood at a colossal sum of GH¢3 billion.

Table 1: Overview of mobile money transactions and value in Ghana between 2012 and 2019

Year	2012	2013	2014	2015	2016	2017	2018	2019
Total volume of transactions(mil)	18.04	40.85	113.18	266.25	550.22	981.56	1,454.47	N/A
Total value of transactions (GH¢'mil)	594.12	2,652.47	12,123.89	35,444.38	78,508.9	155,844.84	223,207.23	781,345.67
Balance on Float (GH¢'mil)	19.59	62.82	223.33	547.96	1,257.4	2,321.07	2,633.93	3,000

Mobile money transactions, both in value and in volume has seen a phenomenal increase over the study period. Transactions value of mobile money in Ghana has recorded an annual average growth of about 200 percent, about the top mobile money markets in Africa. A huge chunk of these monies remain in the banking system daily. Mobile money floats held with banks have also grown averagely by about 123 percent over the same period. Given the significant growth in mobile money floats held with banks in Ghana, to what extent does

the increased liquidity of mobile money floats contribute to the profitability performance of banks in developing countries and Ghana for that matter. How are banks in Ghana able to generate income from mobile money floats and hence better improve shareholder's wealth these are important questions that need investigating.

Studies on banking profitability performance abounds for the developed countries, but the same cannot be said of developing countries. Empirical evidence of drivers of bank performance in developing economies are limited (Fadzlan Sufian, Muzafar Shah Habibullah 2009), especially for African countries. This study therefore contributes to the empirical literature on the factors that drive the profitability of banks in developing economies. The paper, may be the first to specifically investigate the influence of mobile money floats on banking performance in Africa. The findings of the study will inform regulators on the role of mobile money in the financial services sector and consequently how to regulate all players in the mobile money eco-system. Telecommunication companies and financial technology firms have become major players in the financial system and by this study it is evidently clear that these companies should not be left out of the regulatory framework of the central bank or any other regulatory agency.

The rest of the paper is organized as follows. The next section deals with empirical evidence from prior studies on factors that influence bank profitability. Section three provides detailed information on sources of data, the econometric model and the techniques of econometric estimations. Empirical results, discussions, and conclusions are contained in sections four and five respectively.

Literature Review

Studies on bank performance, have established three main constructs that determine bank profitability, which include bank factors, industry-related factors and macroeconomic indicators (Athanasoglou, Brissimis, & Delis, 2005; Athanasoglou, Delis, & Staikouras, 2008; Sufian & Habibullah, 2009; Ally, 2014). This study follows the same approach by incorporating banking, industry and macroeconomic variables to explore the determinants of bank profitability in the Ghanaian banking industry.

The general model as espoused by several authors on the determinants of bank profitability is expressed

here below:

$$\pi_{it} = \alpha + \sum_{f=1}^{f} \beta_f X_{it}^f + \sum_{g=1}^{g} \beta_g X_{it}^g + \sum_{h=1}^{h} \beta_h X_{it}^h + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 1$$

The first part $(\sum_{f=1}^{f} \beta_f X_{it}^f)$ represents the bank-related factors, the second part $(\sum_{g=1}^{g} \beta_g X_{it}^g)$ denotes the industry-related factors. The third part represents $(\sum_{h=1}^{h} \beta_h X_{it}^h)$ signifies the macroeconomic factors. Bank profitability is represented by π_{it}, while $i,$ and t represent individual banks and time period respectively. The variables, α and ε_{it} also represent the constant term and error term respectively.

Internal and external determinants of bank profitability

Prior studies on banking sector profitability, generally consider banks profitability to be driven by internal factors and external factors. Internal determinants of bank profitability are micro bank- specific factors that differentiate banks by sources and usage of funds, capital, liquidity and expenses management. Internal determinants of bank profitability may include; level of liquidity, provisioning policy, operational efficiency, capital adequacy, expenses management and bank size (Elisa Menicucci and Guido Paolucci 2015). Management's strategic decisions determines which internal factors affect bank profitability. External determinants of bank profitability are not bank-specific, but rather could be industry related and or macroeconomic variables which influence bank profitability. They include; economic growth, inflation, market capitalization, market concentration, interest rates, and regulation, etc.

Evidence from prior studies reveal that, the influence of bank-specific factors on bank profitability vary from one study area to another. A few studies have, reported that all bank related variables used for their studies have all shown significant relationship with bank profitability measures(Fadzlan Sufi an, Muzafar Shah

Habibullah 2009; Elisa Menicucci and Guido Paolucci 2015; Fadzlan Sufian and Royfaizal Razali Chong 2008). While other studies including cross- country studies reviewed for this study reveal that bank-specific determinants of bank profitability vary significantly between countries(Khurshid Djalilov and Jenifer Piesse 2016; Twila-Mae Logan 2016; Panayiotis P. Athanasoglou et al 2008).

Sufian and Habibullah (2009) study employed panel regression model examined the determinants of bank profitability among 37 Bangladeshi commercial banks from 1998 to 2004. They found that size had strong positive relationship with return on assets and net interest margin but had significant negative nexus with return equity. The study further revealed that inflation has strong negative influence on net interest margin but insignificantly related with two profitability measures (return on assets and return on equity). Ally (2014) study explored the bank and macroeconomic factors predicting the profitability of 23 banks in Tanzania from 2009 to 2013. The study results showed that bank size, capital adequacy non-performing loans ratio and liquidity had strong positive impact on return on assets whereas management expense ratio showed strong adverse influence on return on assets.

Herdhayinta and Supriyono (2019) studied the case of Regional Development Bank in relation to the determinants of bank profitability in Indonesia with data from 2011 to 2015, employing the pooled ordinary least squares method. The findings showed that bank size, liquidity risk and interest rate had positive influence on profitability (return on assets and return on equity). Operating expense ratio and net interest margin was significant with profitability (return on assets and return on equity). However, capital adequacy ratio, total core capital ratio had significant negative nexus with return on equity whiles money supply had significant positive effect on return on assets.

With regards to external factors, prior studies reveal that; inflation, economic growth, regulation, interest rates, and market concentration significantly influence bank profitability at various points in time. Athanasoglou et al. (2008) study evaluated the profitability behavior of bank, industry and macroeconomic determinants among South Easter European credit institutions from 1998 to 2002. Using a panel data regression and the random-effects model, their findings indicate that credit risk, banking sector regulation and operating expense had negative and significant association with return on assets and return on equity. Also, foreign ownership and inflation had positive and significant relationship with return on assets whereas capitalization, bank size and concentration had significant nexus with only return on assets. Duraj and Moci (2015) study adopted the pooled ordinary least squares method to examine the factors affecting the profitability of 16 banks in Albania from 1999 to 2014. The results of the multiple regression revealed that deposit to loan ratio and GDP had significant positive impact on return on equity whiles inflation had strong negative relationship with return on equity.

Again, Petria et al. (2015) investigated the main factors determining the profitability of 27 members states belonging to the European Union using pooled ordinary least squares method from 2004 to 2011. The results demonstrates that, economic growth and business mix indictor had positive and significant influence on return on assets and return on equity while management efficiency, market concentration (HHI) and liquidity risk had significant adverse impact on return on assets and return on equity.

Staikouras and Wood (2011) study examined the internal and external factors that contribute towards the performance of 685 European banks using panel regression model from 1994 to 1998. The authors found that aside the internal factor(bank size, gap to total assets ratio, equity to total assets ratio, loans loss provision to total loans ratio), interest rate, gross domestic product had significant positive impact on return on assets whereas overhead to total assets and loans to total assets had negative influence on return on assets. Obamuyi (2013) study examined the determinants of Nigerian banks profitability using panel regression model with data obtained from 20 banks from 2006 to 2012. The findings revealed that, interest rate, gross domestic product had positive impact on the return on assets.

Zhang (2011) study utilized the pooled ordinary least squares method to examine the determinants of profitability in the U.S banking industry from 2000 to 2008. The author found that gross domestic product growth exerted positive impact on profitability (represented by return on assets and return on equity). Short-term interest rate and long-term interest had negative influence on the two profitability proxies

Empirical studies in Ghana indicate that internal factors such as; non-interest income to total assets, capital adequacy, bank size, operating expenses show a strong relationship with bank profitability. Same studies reveal the following as the external factors; inflation, economic growth, money supply, market concentration

that influence bank profitability in Ghana. For example, Krakah, Ameyaw and Sällberg (2010) studied the factors that predict the profitability of Ghana Commercial Bank Ltd and Merchant Bank Ltd using pooled ordinary least squares method. The study results indicate that noninterest income to total assets, bank size and money supply had positive and significant influence on return on assets.

Kutsienyo (2011) conducted an empirical study on determinants of 26 commercial banks profitability in Ghana panel regression and generalized least square regression model with data from 2000 to 2009. The study results established that bank size, liquidity, capital adequate have strong positive impact on return on assets whereas operating expense and asset quality had negative influence on return on assets. It was also identified that gross domestic product and inflation had positive impact on return on assets whiles money supply and concentration had negative effect on return on assets. Anarfi, Abakah and Boateng (2016) study explored the determinants of profitability of 21 Ghanaian banks using panel regression with data from 2007 to 2014. They found that loans to total assets ratio and capital to total assets ratio exerts significant positive influence on return on assets while overheads to total assets ratio had adverse impact on return on assets for the period. Though a couple of studies have been conducted on determinants of bank profitability in Ghana, none of these studies have specifically considered mobile money as a force in the Ghanaian banking landscape. It is this fresh perspective that this study is contributing to the literature on banking performance in Africa.

Methods

The data on consumer price index was retrieved from World Bank development indicators website and real gross domestic product and interest rate from Bank of Ghana annual reports. The data on market concentration, noninterest income, operating expense to total assets ratio, total loans to total assets, bank size, equity to total assets ratio computed from the financial reports of the banks. The data on balance on float of mobile money was accessed from National Communication Authority website. The study sample included 17 commercial banks. To be included for the study, a bank had to have full data for the study period, therefore 17 banks were covered in the sample. The remainder of banks had missing data or were part of the recent merged banks in Ghana following the consolidation of banks in the Ghanaian banking sector between 2017 and 2019. The study employed panel regression model to examine the influence of mobile money floats on bank profitability among Ghanaian banks from 2013 to 2019. The adoption of the panel regression model is consistent with related studies (Staikouras & Wood, 2011; Ally, 2014) that looks at the superiority of the model over pooled ordinary least squares approach. According to Baltagi (2015; 2008) panel data techniques provide more robust and conclusive results compared to the traditional cross-sectional and time series techniques because panel data techniques benefit from the advantages of both time series and cross sectional techniques while correcting for their weaknesses.

The following general model is specified for the study:

$$Y_{it} = \alpha + \sum_{x=1}^{x} \beta X_{it} + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where, Y_{it} = dependent variable, that is, profitability measures, α = constant term, X_{it} = independent variables (banking, industry and macroeconomic factors), ε_{it} = error term, β = parameters to be estimated.

The study considered the random-effects and fixed-effects panel regression models. The Breusch and Pagan Lagrangian multiplier test for random effects as well as the Hausman test were computed to decide the more appropriate model to be used. Both the Breusch and Pagan Lagrangian multiplier test for random effects and the Hausman test favoured the random effect model. The random-effects model considers the individual differences that exist between each firm whiles the fixed-effects models treats all the firms as the same. The null hypothesis of the Hausman test state that the random-effects is the preferred model and the alternative hypothesis suggest that the fixed-effects model is more preferred. The F-statistics of the all the models are highly significant and shows that all the independent variables used jointly explained significant variation in the dependent variables.

The variables used to proxy profitability are net interest margin (NIM), return on assets (ROA) and return on equity (ROE). The independent variables include: total loans to total asset ratio (TLTA), bank size (BS), noninterest income to total assets (NIITA), operating expense to total assets ratio (OC), equity to total assets ratio (EQASS), economic growth (RGDP), inflation (CPI), market concentration (CON), regulation (REG), interest rate (INT), mobile money balance on float (MOMO), interacting between balance on float of mobile money and bank size (MOMOSIZE). The empirical models for the study are presented below:

$$NIM_{it} = \alpha_0 + \beta_1 TLTA_{it} + \beta_2 OC_{it} + \beta_3 EQASS_{it} + \beta_4 CO_{it} + \beta_5 NIITA_{it} + \beta_6 REG_t + \beta_7 MOMO_t + \beta_8 BS_{it} + \beta_9 MOMOBS_t + \beta_{10} RGDP_t + \beta_{11} CPI_t + \beta_{12} INT_{it} + \sigma_{it} + \mu_{it} \ \dots\dots \ (3)$$

$$ROA_{it} = \alpha_0 + \beta_1 TLTA_{it} + \beta_2 OC_{it} + \beta_3 EQASS_{it} + \beta_4 CO_{it} + \beta_5 NIITA_{it} + \beta_6 REG_t + \beta_7 MOMO_t + \beta_8 BS_{it} + \beta_9 MOMOBS_t + \beta_{10} RGDP_t + \beta_{11} CPI_t + \beta_{12} INT_{it} + \sigma_{it} + \mu_{it} \ \dots\dots \ (4)$$

$$ROE_{it} = \alpha_0 + \beta_1 TLTA_{it} + \beta_2 OC_{it} + \beta_3 EQASS_{it} + \beta_4 CO_{it} + \beta_5 NIITA_{it} + \beta_6 REG_t + \beta_7 MOMO_t + \beta_8 BS_{it} + \beta_9 MOMOBS_t + \beta_{10} RGDP_t + \beta_{11} CPI_t + \beta_{12} INT_{it} + \sigma_{it} + \mu_{it} \ \dots\dots \ (5)$$

That is to say that, bank profitability(NIM,ROA, and ROE) is influenced by total loans to total assets ratio(TLTA), operating cost expense to total assets ratio(OC), equity to total assets(EQASS), market concentration(CON), regulation(REG), mobile money balance on float(MOMO), bank size(BS), interaction between mobile money balance on float and bank size(MOMOBS), real gross domestic product(RGDP), consumer price index(CPI), and T-bill 91-day rate(INT).

The two error terms become one in the fixed-effects model because there is no individual differences between the firms. Thus, $\sigma_{it} + \mu_{it} = \varepsilon_{it}$, which is the composite error term for the fixed-effects model is the p-value of the Hausman test is less than 0.05. Alternatively, if the p-value is greater than 0.05, the random-effects models is computed.

Variables and definitions

The dependent variables; (NIM, ROA, and ROE) are commonly used in banking profitability studies globally (Sufian & Habibullah, 2009; Herdhayinta & Supriyono, 2019) for the NIM and (Staikouras & Wood, 2011; Zhang, 2011; Ally, 2014) for ROA and in the case of ROE, the following studies in Africa apply (Boadi, 2015; Anarfi, Abakah & Boateng, 2016).

The bank specific independent variables are the traditional determinants of bank profitability in the banking literature. Total loans to total asset ratio (TLTA) (Athanasoglou et al., 2008), Rahman, Hamid, Khan (2015) ,Operating expense to total assets (OC) (Athanasoglou et al., 2008; Kutsienyo, 2011; Herdhayinta and Supriyono, 2019). Noninterest income to total assets (NIITA); (Boadi, 2015; Krakah, Ameyaw & Sällberg, 2010), Equity to total assets (EQASS); Rahman, Hamid and Khan (2015). (Duraj & Moci, 2015; Alshatti, 2016), (Herdhayinta & Supriyono, 2019), Bank size (BS); (Athanasoglou, Delis, & Staikouras, 2006; Staikouras & Wood, 2011; Ally, 2014).

Industry and macroeconomic variables

Market concentration measures the degree of market distribution of power. A higher market concentration denotes few firms are having the larger share of the market and could lead to monopolistic behavior where quantity is reduced and price is adjusted up. It is measured using the three leading banks with the largest share of total assets divided by the industry total assets for the period (Staikouras & Wood, 2011), (Athanasoglou et al., 2006), (Kutsienyo, 2011; Petria et al., 2015). A highly regulated market may reduce the number of firms entering the market, this could have the effect increasing profits for the existing firms. For this study, regulation is used to indicate the introduction of robust banking regulation which culminated in the increment of minimum capital requirement by Bank of Ghana in 2017. It is expected to have positive influence on bank profitability although empirical literature found strong negative influence on profitability and was attributed to weakening market power which will lead to a decline in economies of scale and interest rate spread (Athanasoglou et al., 2006).

The macroeconomic variables used in the study include: Real gross domestic product (RGDP), Inflation (CPI), Interest rate (INT). RGDP is used to represent the inflation-adjusted measure of real activities in the

economy. Studies have found strong positive nexus between economic growth and bank profitability (Staikouras & Wood, 2011; Zhang, 2011; Petria et al., 2015). CPI refers to the consumer price index of goods and services and is the mostly widely used surrogate for inflation (Ally, 2014). A rise in inflation is expected to hurt economic activities which will eventually affect the performance and profitability of banks in the economy. Empirical studies have produced conflicting results with some studies contending that the relationship is adversely strong (Sufian & Habibullah, 2009; Duraj & Moci, 2015) whiles other authors found strong positive nexus (Athanasoglou et al., 2006; Kutsienyo, 2011). INT is measured using interest rate on 91-Tbill as a proxy for interest rate charged by the banks. An increase in this variable is expected to have positive impact on net interest spreads, bank profit and performance (Staikouras & Wood, 2011; Obamuyi, 2013).

Balance on float of mobile money (MOMO)

MOMO measures the mobile money floats held by banks for the period. The balance on float add up to total deposits of banks, which is expected to increase the amount of funds available for borrowers or investment in short-term securities. Thus, a positive relationship is expected between this variable and bank profitability. Studies have shown a positive relationship between mobile money adoption and financial inclusion and a partnership between mobile money operators and banks (Bold et al, 2012; Ehrbeck et al, 2012; Jenkins, 2008; Porteous, 2006). MOMOBS is an interactive term between mobile money and bank size. It is expected that larger banks will hold larger share of mobile money floats and with economies of scale will be in the position to generate higher returns than smaller banks. The study therefore postulate that bank size will moderate the relationship with mobile money and bank profitability positively. Table 2: presents the variable definition or description and expected sign.

Table 2: Variable Description and Expected Sign

No	Variable Name	Variable Definition or Description	Expected Sign
1.	Net interest margin (NIM)	Net interest income/Total Assets	
2.	Return on Assets (ROA)	Net profit after tax/Total Assets	
3.	Return on Equity (ROE)	Net profit after tax/Shareholders Fund	
4.	Total loans to Total Assets (TLTA)	Total loans and advances/Total Assets	+/-
5.	Operating expense to Total Assets ratio (OC)	Operating expense/Total Assets	+/-
6.	Equity to Total Assets ratio (EQASS)	Shareholders Fund/Total Assets	+/-
7.	Noninterest income to Total Assets (NIITA)	Noninterest income/Total Assets	+
8.	Bank size (BS)	Bank size is represented by log of Total Assets	+
9.	Market concentration (CON)	3 banks with largest Total Assets/Industry Total Assets	+
10.	Regulation of banking industry (REG)	Dummy variable, with 1 representing the period after 2017 and 0 denoting otherwise	+
11.	Interest rate (INT)	Represented by risk free rate on 91-Tbill	+

12.	Inflation (CPI)	Proxy by consumer price index	-
13.	Real gross domestic product growth (RGDP)	Inflation-adjusted real gross domestic product	+
14.	Mobile money balance on float (MOMO)	The balance of float of all mobile money transactions occurring in a year and held by banks.	+
15.	Interaction between balance on mobile money floats and bank size (MOMOSIZE)	It is the interaction variable between balance on float of mobile money transactions and log of total assets	+

Results and Discussions

Descriptive statistics, unit root test and the main regression results are discussed in this section. Table 3 present descriptive statistics, which help to identify outliers and the distribution of the data. From the descriptive statistics, no outliers were found in the data as revealed by the maximum, minimum and standard deviation of the variables in the descriptive statistics. Pairwise correlation results showed no strong relationship among the independent variables suggesting there is no problem of multicollinearity. However, panel regression models correct violation of multicollinearity, heteroscedasticity and normal distribution of residuals (Wooldridge, 2013). The results of the unit root test in Table 4 shows that all the variables are stationary at level using the constant option. The introduction of trend option of the unit root test suggest that the variables are stationary at trend with exception of MOMO. However, a graphical check of variable revealed a constant trend and as such all the variables are stationary. The variable REG was a dummy variables and as such unit root testing was not possible.

Table 3: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
ROA	3.422742	3.32264	-3.700542	32.298
ROE	22.91138	25.253	-23.72384	257.083
NIM	0.0809409	0.0203	0.0387633	0.15799
NIITA	0.0184916	0.01028	5.06E-06	0.07917
OC	0.0951768	0.13873	0.0106359	1.38069
TLTA	0.4000209	0.17364	0.0445976	0.99475
EQASS	0.1620827	0.09608	0.0837036	0.8711
INT	18.15714	4.38222	13.3	25.8
RGDP	5.4	2.04823	2.2	8.1
BS	7.281009	1.27633	5.635218	9.74605
REG	0.2857143	0.45366	0	1
CPI	12.73114	3.9042	7.176	17.455
MOMO	2.892669	0.58853	1.798098	3.47712
MKCON	0.3254727	0.02392	0.286823	0.37007
MOMOBS	21.28247	6.42168	10.13267	33.5646

Source: Computed by author based on data from banks financial reports, world bank database and national communication authority: NIM-net interest margin, ROA- returns on assets, ROE- returns on equity, TLTA-total loans to total assets ratio, OC- operating cost expense to total assets , EQASS- equity to total assets, CON-

market concentration, REG- regulation, MOMO-mobile money balance on float, BS- bank size, MOMOBS-interaction between mobile money balance on float and bank size, RGDP- real gross domestic product, CPI-consumer price index, INT- and T-bill 91-day rate

Table 4: Unit Root Testing of Study Variables

	Levin-Lin-Chu unit-root test (constant)		Levin-Lin-Chu unit-root test (trend)	
	Statistic	P-value	Statistic	P-value
NIM	-1.81	0.0351	-38.6204	0.000
OC	-30.989	0.000	-37.6829	0.000
TLTA	-13.929	0.000	-44.5117	0.000
EQASS	-21.099	0.000	-12.1332	0.000
MKCON	-43.085	0.000	-46.6087	0.000
INT	-26.83	0.000	-34.6165	0.000
RGDP	-5.2573	0.000	-16.7542	0.000
NIITA	-3.2007	0.001	-91.5852	0.000
CPI	-9.9246	0.000	-13.9387	0.000
ROA	-11.4203	0.000	-13.4552	0.000
ROE	-17.1062	0.0000	3.0294	0.000
MOMO	-3.8172	0.0001	6.7798	1.000
MOMOBS	-39.8227	0.0000	-11.1526	0.000
BS	-16.1923	0.0000	-1.10E+03	0.000

***Source:** Computed by author based on data from banks financial reports, world bank database and national communication authority: NIM-net interest margin, ROA- returns on assets, ROE- returns on equity, TLTA-total loans to total assets ratio, OC- operating cost expense to total assets , EQASS- equity to total assets, CON-market concentration, REG- regulation, MOMO-mobile money balance on float, BS- bank size, MOMOBS-interaction between mobile money balance on float and bank size, RGDP- real gross domestic product, CPI-consumer price index, INT- and T-bill 91-day rate*

The study results in Table 5, were estimated using panel regression random effect model. The results were presented using two models for each dependent variable and the first model is without the balance of mobile money floats and bank size interaction (MOMOBS) and the second model of the same dependent variables with the MOMOBS. Thus, Models 2, 4 and 6 have the MOMOBS variable whereas models 1, 3 and 5 do not have MOMOBS. The reason for the exclusion was to determine the factors that drive bank profitability without the moderating effect of bank size on bank profitability. The study sought to examine if bank size plays a moderating role in influencing the relationship between mobile money floats and bank profitability in Ghanaian banks, hence the inclusion of the moderating term.

The study results indicate that TLTA exerts positive influence on bank profitability in all the models. However, the strength of the relationship is not significant. This result partly confirms Rahman, Hamid, Khan (2015) study that found insignificant positive relationship with ROE but had rather strong positive relationship with NIM and strong negative nexus with ROA. This result demonstrates that credit risk is not a strong predictor of bank profitability in Ghana. Operating expense ratio had significant and negative relationship with ROE (Models 5&6). This results concurs with theoretical expectation and several empirical studies that found evidence of strong negative relationship between operating costs and bank performance (Kutsienyo, 2011; Herdhayinta & Supriyono, 2019). Regarding, NIM and ROA, the results partly confirm the expense preference behavior hypothesis postulated by Edwards in 1977 and confirmed by Hannan two years later(Hannan , Timothy H , 1979a). However, the results are not strong enough to suggest that expense –preference behavior exist in the Ghanaian banking industry.

The EQASS had mixed relationship with bank profitability. There was strong positive association between EQASS and ROA (Model 3&4) whiles a significant negative relationship was established between EQASS and ROE (Model 5&6). The lack of consensus on the relationship between EQASS and bank profitability has been reported by other authors (Duraj & Moci, 2015; Alshatti, 2016; Herdhayinta & Supriyono, 2019). The relationship between bank profitability and capitalization is not straightforward. While some authors argue that a higher capital ratio reduces the cost of capital and a positive relationship with profitability is postulated, others also argue that, a lower capital ratio make a bank more risky and thus capitalization should have a negative influence on profitability (Fadzlan Sufian, Muzafar Shah Habibullah 2009) .

The results demonstrates that NIITA is not a significant predictor of bank profitability because it is insignificantly related with NIM, ROA and ROE. This result contradict empirical studies and theoretical expectation of strong positive nexus between noninterest income and bank profitability (Boadi, 2015; Krakah, Ameyaw & Sällberg, 2010). Bank size (BS) had negative significant relationship with bank profitability in models (2,4,&6), bank size relate positively significant with NIM in model 1. The results partly confirm theoretical expectations and finding of studies that show strong positive nexus between bank size and profitability (Staikouras & Wood, 2011; Ally, 2014). However, bank size shows a negative relationship with profitability measures in models; 2,4,5&6, especially when the interactive term is included. This finding needs further investigation as it suggests the presence of diseconomies of scale, which is hard to believe in the context of the Ghanaian banking industry.

Earlier studies did not give clear guidance on the relationship between market concentration and bank profitability (Bourke, 1989), the relationship still remains inconclusive. For instance, while, some studies have found negative and significant relationship between CON and profitability (Kutsienyo, 2011; Petria et al., 2015), others have also found significant positive relationship between concentration and bank profitability (Athanasoglou et al., 2006). This study however, has found market concentration (CON) to have a strong positive effect on bank profitability (Model 2), confirming theoretical expectations and the empirical study of (Athanasoglou et al., 2006). The positive nexus is based on the notion that highly concentrated market can exhibit monopolistic tendencies by commanding higher interest rate spread to earn supernormal profits. On regulation, the results show that regulation of banking industry (REG) had a strong adverse impact on the profitability of banking industry (Model 1 and 2). This is consistent with Athanasoglou et al. (2006) that found evidence strong negative relationship banking sector regulation and bank profitability.

The study found that some macroeconomic variables had strong influence on the bank profitability. It was observed that economic growth (RGDP) had significant negative relationship with the net interest margin measure of bank profitability (Model 1 and 2). This could be the case that as the economy grows, banks become more productive and profitable especially in non-interest income and therefore can afford to reduce interest charge for borrowers and or increase interest paid to depositors of funds and hence the negative relationship. However, some studies have found strong positive nexus between economic growth and bank profitability (Staikouras & Wood, 2011; Zhang, 2011; Petria et al., 2015). Interest rate (INT) had positive and strong association with bank profitability (Model 3, 4, 5 and 6) and confirms theoretical expectation and empirical investigations (Staikouras & Wood, 2011; Obamuyi, 2013). The positive relationship could be due to the fact that banks will adjust upwards their interest rate spread to changes in prevailing interest rate in the market as interest rates reflect the cost of funds for banks. Also in Ghana, when interest rates are high, banks tend to invest heavily in risk free government securities guaranteeing a correspondingly heavy returns for banks.

Inflation (CPI) has strong adverse impact on bank profitability (Model 1 and 2). This result suggest that rising inflation has detrimental effects on profitability of Ghanaian banks and supports the findings of these studies (Sufian & Habibullah, 2009; Duraj & Moci, 2015). Some authors have however, found that inflation has positive influence on bank profitability (Athanasoglou et al., 2006; Kutsienyo, 2011).

The study found that, the balance of float on mobile money held with banks (MOMO) had positive but insignificant influence on bank profitability across all models. However, the interaction of balance of float on mobile money and bank size (MOMOBS) had strong positive impact on profitability of banking industry in Ghana. This result suggests that bank size moderates the relationship between mobile money and profitability of banks in Ghana. Mobile money floats are held by banks in Ghana in proportion to banks net worth. Therefore, bigger banks are able to hold significant amounts of mobile money floats than smaller banks and are able to do more with floats than smaller banks. Aside subscriber balances with the banks, there are also operational vaults

held with only some selected banks at the discretion of the mobile money operators. For a bank to host these mobile money operational accounts, the mobile money operators will of course elect adequately capitalised and highly sound banks and these are mostly the big banks. It is therefore not surprising that bank size moderate the influence of mobile money on bank profitability in the Ghanaian banking industry. Again, big banks have the financial resources to aggressively engage in mobile money agent onboarding and consequently hold a greater percentage of mobile money floats.

The introduction of mobile money in the Ghanaian financial services sector, came with a huge investment in banking and payment system technology. Mobile money brought in its wake financial technology companies (fintec), which partner banks to deliver superior banking and payment services to customers across the country and beyond. The big banks are able to leverage on these financial technology companies to encourage the usage of mobile money wallets among existing customers and to attract new mobile money users to themselves. One example of such innovation is the integration of customer's mobile money wallets to their bank accounts. Investment in information technology in the banking industry is critical for banks to operate efficiently and profitably (Wilson U Ani1, Cosmas O Odo and Ezeudu Ikenna,2014), and the banks which invested in IT systems benefit more in mobile money floats. Other studies, have also established a positive relationship between investment in information technology and bank profitability (Holden and El –Bannany, 2004).

Table 5: Panel Regression Model Results on Determinants of Bank Profitability

	NIM 1	NIM 2	ROA 3	ROA 4	ROE 5	ROE 6
Constant	2.200*	3.66*	-1.630	-0.520	-1.500	-0.610
	0.028	0.000	0.103	0.604	0.133	0.545
TLTA	0.3900	0.220	1.190	1.290	1.260	1.350
	(0.700)	(0.828)	(0.235)	(0.199)	(0.208)	(0.178)
BS	2.430**	-1.840*	0.310	-2.320**	-0.48	-2.18**
	(0.015)	(0.066)	(0.754)	(0.020)	(0.629)	(0.029)
NIITA	0.670	-0.01	-0.100	-0.68	-0.87	-1.450
	(0.502)	(0.988)	(0.919)	(0.495)	(0.383)	(0.147)
OC	0.610	0.340	-1.010	-1.31	-2.11**	-2.390**
	(0.542)	(0.733)	(0.313)	(0.189)	(0.035)	(0.017)
EQASS	0.900	0.950	2.110**	2.42**	-3.56**	-3.45**
	(0.367)	(0.342)	(0.035)	(0.015)	(0.000)	(0.001)
RGDP	-2.240**	-2.500**	-0.550	-0.59	-0.59	-0.630
	(0.025)	(0.0100)	(0.585)	(0.553)	(0.556)	(0.531)
CPI	-2.080**	-2.330**	-0.56	-0.61	-0.59	-0.630
	(0.037)	(0.020)	(0.575)	(0.543)	(0.553)	(0.528)
CON	1.930**	2.110**	0.660	0.700	-0.59	0.730
	(0.054)	(0.035)	(0.510)	(0.486)	(0.553)	(0.465)
REG	-2.180**	-2.420**	-0.56	-0.610	-0.59	-0.630
	(0.029)	(0.015)	(0.577)	(0.544)	(0.554)	(0.528)
INT	-0.850	-1.040	5.440**	5.420**	4.690**	4.460**
	(0.396)	(0.297)	(0.000)	(0,000)	(0.000)	(0.000)
MOMO	1.780*	0.570	0.61	0.370	-0.63	0.450
	(0.075)	(0.569)	(0.545)	(0.715)	(0.526)	(0.656)
MOMO BS		2.160**		2.030**		1.620

	(0.031)		(0.042)		(0.106)
Wald chi = 62.85	Wald chi =104.57	Wald chi = 94.33	Wald chi =85.62	Wald chi = 157.36	Wald chi = 129.36
Prob>chi2 = 0.000	Prob>chi2 = 0.000	Prob>chi2 = 0.000	Prob>chi2 = 0.000	Prob>chi2 = 0.000	Prob>chi2 = 0.000
Hausman = 0.9900	Hausman = 0.9713	Hausman = 0.9688	Hausman = 0.9943	Hausman = 0.9806	Hausman = 0.9950
Test of random effects = 0.0001	Test of random effects = 0.000	Test of random effects = 0.0001	Test of random effects = 0.000	Test of random effects = 0.0001	Test of random effects = 0.0001

Robust standard errors in parentheses - ** $p<0.05$, * $p<0.1$ **Source:** *Computed by author based on data from banks financial reports, world bank database and national communication authority: NIM-net interest margin, ROA- returns on assets, ROE- returns on equity, TLTA-total loans to total assets ratio, OC- operating cost expense to total assets , EQASS- equity to total assets, CON- market concentration, REG- regulation, MOMO-mobile money balance on float, BS- bank size, MOMOBS- interaction between mobile money balance on float and bank size, RGDP- real gross domestic product, CPI- consumer price index, INT- and T-bill 91-day rate*

Conclusion

The study investigated the bank specific, industry and macroeconomic factors that impact the profitability of banks from a developing country perspective. The differentiator for this paper is the inclusion of mobile money floats as a factor that influence bank profitability in a mobile money driven financial system. The study found that several factors influence the profitability of the Ghanaian banking industry. The bank-related factors found to drive bank profitability are operating expense ratio, capitalisation, and bank size. Capitalisation is found to have a strong relationship with profitability in Ghanaian banking industry, though not consistent amongst profitability measures. While capitalisation showed a significant positive nexus with banks return on assets, it showed a negative relationship with returns on equity. Its relationship with net interest margin is positive but insignificant. Similarly, operating costs shows a strong negative relationship with ROA and ROE as theoretically expected. The relationship between bank size and profitability is not clear like capitalization, as the relationship with profitability measures changes from positive to negative relationship between models.

The banking industry factors that influence bank profitability are market concentration and regulation. While market concentration impact profitability positively, that of regulation impact profitability negatively. The study revealed that mobile money on its own does not affect bank profitability significantly, but the interaction of mobile money and bank size positively and significantly influence bank profitability in the Ghanaian banking industry. That implies, mobile money matters with respect to bank profitability but only for big banks. Bank size therefore moderates the influence of mobile money on bank profitability in Ghana.

All macroeconomic variables included in the study are important in predicting bank profitability in Ghana. Real gross domestic product, inflation and interest rates impact bank profitability significantly confirming theoretical expectations, however real gross domestic product showed adverse instead of positive impact. It is recommended that the regulator should ease its hold on the banking sector, encourage competition so as not to deepen market concentration. Smaller banks in Ghana are also advised to embrace information technology to attract more mobile money floats. The study recommends that other factors such as corruption, corporate governance and strength of institutions should be included in the subsequent studies on the determinants of bank profitability in Africa.

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