Journal of Comparative International Management

Competition and Market Contestability in Ghanaian banking industry: A Panzar-Rosse Approach

Isaac Boadi, John Kwaku Mensah Mawutor, Modupeola Adefunso Dzorka and Vivian Aku Gbade

Volume 24, Number 2, 2021

URI: https://id.erudit.org/iderudit/1085566ar
DOI: https://doi.org/10.7202/1085566ar

See table of contents

Publisher(s)

Management Futures

ISSN

1481-0468 (print)
1718-0864 (digital)

Explore this journal

Cite this article

Boadi, I., Mawutor, J., Dzorka, M. & Gbade, V. (2021). Competition and Market Contestability in Ghanaian banking industry: A Panzar-Rosse Approach. *Journal of Comparative International Management*, *24*(2), 28–58. https://doi.org/10.7202/1085566ar

Article abstract

The present study evaluates the market structure of Ghana's banking industry and estimates the nature and degree of competition. This study uses non-structural methodology proposed by Panzar-Rosse Model known as "H-statistic" to empirically assess competitiveness in the Ghanaian banking market. The study uses 23 banks in Ghana from 2000 to 2019, compiled and reported by Ghana Association of Bankers (GAB). The study results show that banks in Ghana derive their revenue in conditions of monopolistic competition. Thus, Contestable markets theory and Chamberlainian competition theory are validated by the study results. Furthermore, the study results revealed that from 2000 to 2019, after various structural reforms including the implementation of the FINSAP, competition in the Ghanaian banking sector increased. Finally, when the dataset was decomposed into local and foreign banks, the results indicate that monopolistic competition market conditions are found for both local and foreign banks. Managerially, the presence of a monopolistic market condition adds to the call for managers of the banks to consider factor input prices in an attempt to generate more revenues. Second, to avoid negative consequences of competition, managers of these banks should not rely on a single income source but also indulge in non-intermediation activities. In terms of policy, pro-structural shift policies that have helped with the transition from a monopoly structure to a monopolistic competition free entry or contestable market structure should be rigorously pursued by the policymakers. Besides, policy directives that enhance greater consolidation in the banking sector shouldbe pursued rigorously. Finally, the results from this study could help policy-makers to fashion an appropriate optimal intervention and stability policies geared towards enhancing banking stability at different levels of bank competition.

Competition and Market Contestability in Ghanaian banking industry: A Panzar-Rosse Approach

Isaac Boadi
University of Professional Studies, Accra, Ghana

John Kwaku Mensah Mawutor
University of Professional Studies, Accra, Ghana

Modupeola Adefunso Dzorka
University of Professional Studies, Accra, Ghana

Vivian Aku Gbade
University of Professional Studies, Accra, Ghana

The present study evaluates the market structure of Ghana's banking industry and estimates the nature and degree of competition. This study uses non-structural methodology proposed by Panzar-Rosse Model known as "H-statistic" to empirically assess competitiveness in the Ghanaian banking market. The study uses 23 banks in Ghana from 2000 to 2019, compiled and reported by Ghana Association of Bankers (GAB). The study results revealed that from 2000 to 2019, after various structural reforms including the implementation of the FINSAP, competition in the Ghanaian banking sector increased. In general, the study results show that banks in Ghana derive their revenue in the monopoly market conditions. Specifically, the finding further suggests that whereas monopolistic competition is found for the listed banks, monopoly conditions are found in non-listed banks. Managerially, the presence of a monopoly adds to the call for managers of the banks to consider factor input prices in an attempt to generate more revenues. In terms of policy, pro-structural shift policies that will help with the transition from a monopoly structure to a perfect competition or contestable market structure should be rigorously pursued by the policy-makers. This study, therefore, adds to the existing literature on investment management research, notably banking, in a developing country, i.e. Ghana. The results have implications for the management of banks, governments and regulators. This shows the need for pro-structural shift policies that improve competition.

Keywords Banking competition, Panzar-Rosse method, Ghana

1. Introduction

There is a growing body of banking literature that recognizes the importance of competition and its estimation techniques. The banking sector's fast deregulation, privatization and liberalization across developing and emerging economies have fueled more research attention and policy on competition and market structure (Rakshit and Bardhan, 2020). In many countries, liberalization and privatization policies have generated a huge debate in the banking literature with respect to the relevance of competition in the banking industry. Khattak and Ali (2021) conclusively showed that limited competition results in secured investment decisions and banking stability. Guzman (2000), argues that according to traditional theory, competition improves economic welfare. In the US where bank competition is high in local markets, newly established firms receive more credits Petersen and Rajan (1995). Berger et al. (2004), report that competitive banking systems enhance allocation of capital. The supply of credits to households and firms are influenced by bank competition (Leon, 2015). Contrary to previously published studies, Khattak and Ali (2021) suggest that sustained competition impedes traditional relationships. Using cross-country data, banking markets that are characterized by less competition potentially reduces small firms' financial obstacles Beck et al. (2004). Bonaccorsi di Patti and Dell'Ariccia (2004) maintain that in a market situation where informational asymmetries is pronounced, bank competition does not promote new firms' creations in Italy. The inconclusive findings revealed, sums up the arguments in threefold namely the "competition-fragility view" (Repullo, 2004); "competition-stability view" (Schaeck and Cihak, 2014) and the "non-linear relationship view" (Jiménez et al., 2013). Although these arguments are supported by diverse related studies, the discussion still lacks conclusive arguments.

The banking sector in Ghana has undergone major reforms and changes. These changes were designed to make banks reinforce their financial base and enhance their levels of efficiency in the sector. Although competition scales down market influence and income of banks, and affect their capability to handle opposite developments, competition on the contrary could drop financial intermediation costs and help improve economic efficiency. Examining the extensive financial sector structural reforms and the degree of competition in the banking space underscores the importance and originality of this study. Specifically, three main research questions are posed in the study: (1) Do bank's reforms affect competition? (2) Do market conditions affect revenue generation? (3) Does the ownership status of banks affect the nature, extent and nature of competition in Ghana's banking sector?

The relevance of this study to literature are as follows: First, degree of competitions have been estimated in banking literature using various methods. Notable among these methodologies include: structural approach and non-structural approach. While the structural approach has been widely discussed in previous empirical studies, support for the non-structural approach promoted by Panzar and Rosse (1987) is limited and inadequate. The non-structural approach i.e. "*H-statistic"* explains the conventional market equilibrium model. In other words the association between the revenue of a specific bank and price variations of a specific bank. The *"H-statistic"*

is employed in this study to assess the nature and extent of competition in Ghana's banking sector. Second, although the *"H-statistic"* model has been applied largely to banking institutions, studies that have estimated competition after the country's comprehensive financial sector reforms such as the introduction of Financial Sector Strategic Plan (FINSSIP) and Financial Sector Adjustment Program (FINSAP) are scanty. Third, the paper sheds light on the richness of the dataset. The current dataset allows the authors to examine other relevant issues largely ignored. The variations in accounting and auditing practices, financial ratios and periods of reporting frequently applied by these banks compelled the authors to decompose the dataset into listed and non-listed. The unique skills and orientations between the listed and non-listed equally indicate that these banks differ in terms of competitions. Hence, the addition to a large and growing body of literature by yielding a related example. Furthermore, an appreciation of competitive conditions of banking business in Ghana would help banks to reinforce their positions and largely stimulate the stabilization of the Ghanaian economy. Besides, across the world, the financial system landscape has revolved following the global financial meltdown between 2007-2009. Financial analysts continue to proffer that the upsurge of bank credit in 2008 cast doubts whether continued banking sector competition was somewhat responsible for the credit crunch. Again, this study discusses the issues of whether the banking license status affected the competitive conduct of Ghanaian banking. Finally, this study adds to the existing knowledge of regulators or policy-makers on the categories of regulatory frameworks and other policy indicators needed to boost competition in the country.

The study results revealed that from 2000 to 2019, after various structural reforms including the implementation of the FINSAP, competition in the Ghanaian banking sector increased. Furthermore, the study results show that banks in Ghana derive their revenue in the monopoly market conditions. Finally, the finding further suggests that whereas monopolistic competition is found for the listed banks, monopoly is found in non-listed banks.

These results contribute to literature in a number of ways: Managerially, the presence of a monopoly adds to the call for managers of the banks to consider factor input prices in an attempt to generate more revenues. In terms of policy, pro-structural shift policies that will help with the transition from a monopoly structure to a perfect competition or contestable market structure should be rigorously pursued by the policy-makers. This study, therefore, adds to the existing literature on investment management research, notably banking, in a developing country, i.e. Ghana. The results have implications for the management of banks, governments and regulators. It shows the need for pro-structural shift policies that improve competition.

The overall structure of the study takes the form of seven sections. The information about Ghana's financial sector reforms is provided in section 2. Section 3 focuses on theoretical framework. Section 4 is concerned with the related studies and hypothesis development. Section 5 is concerned with the methodology employed for this study. Section 6 provides the findings of the study. The final section discusses and provides the conclusion of the study.

2. Ghana's financial Sector Reforms

The health and efficiency of the financial sector are crucial to economic growth (Levine, 1997; Rajan & Zingales, 1998). Researchers have argued that economic growth can never be achieved without the development of the financial sector (Lin & Nugent, 1995). Ghana's financial sector transformations and structural changes began in 1987. Prior to these reforms, state-owned banks dominated and monopolized the entire financial sector. In respect of expansion and activities, state-owned banks benefited from monopoly. The period was marked with a lot of restrictions which destroyed private sector confidence. According to a report published by the World Bank, only two banks namely Barclays Bank and Standard Chartered Bank existed (World Bank, 1995). Besides the huge portfolio of default loans faced by the banking sector, political manipulations, infirm and inexperienced management, inadequate capital, out-of-date information and accounting systems affected the activities of the sector. The sector failed to diversify their portfolios adequately. In an attempt to introduce discipline and correct these setbacks, several Structural Adjustment Programmes were introduced by governments to strengthen fiscal and monetary policies. This subsequently led to the introduction of the FINSAP. FINSAP which focused on competition and efficiency revolved around three distinct phases. The first phase which started from 1987 to 1991, provided a blueprint for legal and regulatory conditions and adjustments of the existing banking acts. Between 1992 to 1995 the second phase began. This phase outlined managerial oversight to the central banks. The last phase characterized by restructuring and merger started from 1995 to 2003. Besides these reforms, FINSSIP was further promoted and popularized in 2003 to address the medium-term supervision of financial sector transformation particularly regulatory and institutional capacity overhaul and commencement of Universal Banking License. The overall effects of these reforms led to the increased presence of foreign-owned banks in the banking space. If these financial sector reforms were to enhance competitiveness within the Ghanaian banking sector, then any study that estimates the degree and nature of competition would not be out of place.

2.1. The justification for using Ghana as unit of analysis

Over the years the Ghanaian banking sector has been battered by poor and inefficient management, political influences and a huge portfolio of non-performing loans (NPL). During the global financial meltdown, the banking industry globally suffered significant losses. The banking industry in Ghana was not an exception. Table I displays non-performing loans of banks in Ghana between 2000-2019. The non-performing nature of the banks as shown in Table I, banks' non-performing loans got worse from 2012 providing justification for broad-based reform and cleaning exercise in the banking space in Ghana.

Table I: Non-performing loans of Banks between 2000-2019

Years	Non-performing loans
2019	-90,380,978.00
2018	-222,048,998.00
2017	-92,914,066.00
2016	-188,396,830.00
2015	-203,526,353.00
2014	-82,685,288.00
2013	-51,961,781.00
2012	-226,715,388.00
2011	-41,930,717.00
2010	-49,403,572.00
2009	-74,945,292.00
2008	-27,336,095.00
2007	-9,941,088.00
2006	1,682,137.00
2005	-18,388,000.00
2004	-575,800.00
2003	-438,700.00
2002	-844,091.00
2001	-264,531.00
2000	-112,000.00

Source: Author's computation (2021)

In recent years, there has been a dramatic increase in research studies conducted using Ghana as a unique laboratory. First, Acheampong and Dana (2015) established that Ghana represents a fast-expanding market (FEMs). The financial history of Ghana was enriched in the later part of 2017 when the central bank finally cracked the whip on non-performing banks resulting in the collapse of banks which later led to further mergers and acquisition. The year 2018 was characterized as a remarkable year for Ghana's banking industry. Several reforms such as new capital requirement directives, mergers and acquisitions, licenses revocations have been carried out. Despite the impact of all these reforms and several other reforms yet to be introduced, the Ghanaian banking sector has become buoyant and colorful to the admiration of many. These developments in the banking space provide a base for further investigations to be conducted. Second, Ghana's financial sector is regarded as relatively well developed. The current economic crisis has highlighted that a well-functioning financial system is significantly important for economic growth. Bawumia et al., (2008) indicate that the banking sector accounts for 70% of the financial sector banking. This implies that the sector plays an important role since a failure of this sector could have adverse effects on the entire economy. The industry's profit before tax margin consistently improved over the last four years (2009 to 2013) from 17% to 45.3% respectively. In the period under study, the return on assets (ROA) improved significantly from 1.4% to 4.1% with total assets growth by 33%

from GHS27,100m in 2012 to GHS36,100m in 2013. Third, the banking industry continues to make significant returns on equity mirroring the average returns on the money markets in the past two years. Industry average return on equity was 27.5% compared to 23.8 % in 2012.[1].During the global financial crisis between 2008 and 2011, the banking industry in Ghana did not suffer significant losses but it appears that the industry's profitability was impeded because of the slowdown in the global economy. Finally, within Sub-Saharan Africa banks appear to be very profitable. Flaminiet, et al, (2009), found that for the past 10 years the average returns on assets stood at 2 percent significantly higher than in other parts of the world.

3. Theoretical framework

3.1.Theoretical underpinnings

The present study is situated in four idiosyncratic theories. These theories are the Contestable markets theory, Industrial Organization competition theory, Chamberlainian competition theory and Schumpeterian competition theory.

Contestable markets theory

Contestable market is a market where companies can enter and leave freely with low sunk costs. In the late 1970s and early 1980s, contestable markets theory became popular (Panzar and Willig, 1971; Baumol, Panzar and Willig 1982). This theory asserts that weakened entry barriers, namely high costs of entry and regulation policies, often allow firms with few competitors to operate in a competitive style. Thus, existing firms tend to focus more on maximizing sales rather than profits. This is as a result of the fear that entrants could effortlessly come and reduce their market share. In a contestable market, incumbent firms and new entrants have equal access to the same technology. The utilization of contestable markets theory to banking firms are scanty and mixed. While a study by Davies and Davies (1984) in the context of the United Kingdom yielded no empirical affirmation, North American banking markets show characteristics of contestability (Shaffer, 1982).

Industrial organization competition theory

Industrial organization competition popularized by Mason (1939) suggests a direct association between the framework and designs of the industry and returns. Such industry idiosyncrasy assumed to have influence on firm returns consist of barriers to entry (Bain, 1956), product differentiation, the number, size of firms and elasticity of demand (Porter, 1980). The association between the framework and designs of the industry and returns is now accepted as structure, conduct, and performance (SCP) paradigm (Porter, 1981). The SCP hypothesis states that changes in the framework and designs of the industry affects the way the banks perform. The effects of market characteristics on the performances of firms have been analyzed by using models to test the SCP hypothesis (Smirlock 1985; Lee and Hsieh 2013).

[1] [1] http://www.bog.gov.gh

Chamberlainian competition theory

Chamberlainian monopolistic competition credited to Chamberlaain (1993) and his compatriot Robinson (1933) states that every firm has some monopoly power, but entry drives monopoly profits to zero. This theory focuses on the peculiar idiosyncratic organizational traits. The rationale of Chamberlainian competition theory is that skills and dexterity of firms account for variations in returns from executing strategies. This suggests that firms earn more returns if firms are to choose strategies that totally utilizes their distinctiveness. Chamberlainian monopolistic competition is fundamentally premised on the following assumptions: there are more firms in the market, market entry and exit are free and commodities have close substitutes. Chamberlainian monopolistic competition has been cited by numerous authors, namely Kotler (1976), Stevenson (1976) and Thompson and Strickland (1980).

Schumpeterian competition theory

Schumpeterian competition theory, developed and popularized by Schumpeter (1950), is not so permanent and surely less certain. Schumpeterian competition appears to be one of the most widely accepted economic theories to competition in recent times. This theory states that competition is a changing process wherein firms endeavor to remain under different structures and schemes that frequently yield results. Thus, informational asymmetries are relevant if firms are to be ahead of their competitors. Throughout the annals of economics and professional life of Schumpeter, this theory has been revised several times (1912, 1928, 1939 and 1942). In several strategic management research studies, Schumpeter's provides a lot of insights into revolutionary competition (Nelson and Winter, 1974, 1982). According to McKelvey (1982), numerous and major developments in organizational theory are traced to Schumpeterian roots.

3.2. A Review of the Models

The industrial organization (IO) approach forms the basis of the bank competition theories. The industrial organization (IO) approach which indicates how banks react excellently to the settings that they operate is classified into two, namely structural and nonstructural approaches.

Several related studies in banking literature have attempted to estimate the nature and extent of competition. Notable among these Competitiveness measurements include: structural approach and non-structural approach. Structural approach which is focused on SCP examines market structure and prices fixing behavior. Two hypotheses explain the SCP hypothesis: Market structure influences, and conduct influences performance. The overall effect of these two hypotheses is that market power which allows to produce monopolistic profits is a function of banking industry concentration. The non-structural approach is based on two approaches namely traditional market equilibrium (Bresnahan, 1982; Lau, 1982) and the *"H-statistic"* (Panzar and Rosse, 1987). The *"H-statistic"* calculated from a shortened form of revenue equations that considers the elasticity of total revenues to factor input prices refers to the link between price differences and the revenue of a specific bank (Gutiérrez de, 2007). Relevant empirical studies that have used the *"H-statistic"* model are shown in Table II. According to Panzar-Rosse this statistic is able to mirror the framework and designs of the market in which the firm resides. Table III and Figure I show the

Panzar-Rosse *"H-statistic"* model and is interpreted as follows: $H \leq 0$ (Monopoly competition), $H = 1$ (perfect competition), and $0 < H < 1$ (Monopolistic competition). This interpretation is relevant only when the firm is in a long-run equilibrium (Nathan and Neave, 1989). Two issues are relevant in equilibrium: (i) risk-adjusted rates of returns are the same across banks, (ii) returns represented by ROA and ROE are unrelated with inputs prices. In this regard, long-run equilibrium observations are tested in this study. This involves estimating a parameter E, where EQ=0 indicates equilibrium and EQ<0 indicates disequilibrium. Early applications of Panzar-Rosse models that have provided evidence about presence of monopolistic competition include countries such as US, India, Italy; Mexico and Uganda (Shaffer, 1982; Prasad and Ghosh, 2007; Drummond et al., 2007; Majid et al., 2007; Maudos and Solis, 2007).

The relevance of nonstructural approach over a structural approach stems from the following: First, nonstructural approach relates bank revenue behavior with different market structures. Second, nonstructural methods estimate the bank's competitive conduct ignoring clear information with respect to market structure (Panzar and Rosse, 1987). Again, the nonstructural approach estimates bank competition by considering deviation from competitive pricing. Also, the nonstructural approach renders a quantitative assessment of competitive conduct of banks. The *"H-statistic"* is the reduced form revenue equation in a general market model after profit maximization, i.e., after equating marginal revenue with marginal cost. Finally, the nonstructural approach considers firm-specific data. Thus, this approach accounts for exclusive features of distinct banks. The *"H-statistic"* is employed in this study to assess the nature and extent of competition in Ghana's banking sector.

From the related studies shown in Table II, developed markets like the US highlight the importance of competitions in the banking sector. Notwithstanding, it remains a portion of the literature. The literature on the Sub-Saharan countries remained scanty. To the best of the author's knowledge, the only study which comes close to the Sub-Saharan context and by extension Ghana is Biekpe (2011). Although Biekpe (2011) applied the Panzar-Rosse *"H-statistic"* model using a data span from 2000 to 2007, the present study extends the discussions further, employs a recent dataset, examines competition periods before and after the introduction of FINSSIP and along market conditions for listed and non-listed banks.

Table II: Summary of principal studies adopting the Panzar-Rosse Model

S/N	Authors	Main research question	Countries	Findings
1	Shaffer (1982)	Is profits, often measured as return on assets, not correlated with the prices of inputs?	USA	North American banking markets show characteristics of Perfect Competition and Monopolistic Competition.
2	Nathan and Neave (1991)	What is the state of competition in different sectors of the Canadian financial services industry?	Canada	Banking revenues behave as if earned under monopolistic competition.
3	Liyod-williams et al. (1991)	n.a	Japan	The results suggest that banks in Germany, the United Kingdom, France and Spain earned revenues as if under conditions of monopolistic competition in the period.
4	Molyneux et al. (1994)	n.a	Germany, UK, France, Italy and Spain	Banking markets in Germany, France, the United Kingdom, and Spain belonged to monopolistic competition, whereas Italian banking was dominated by monopolistic market power, which remained in disequilibrium.
5	Rime (1999)	Does monopolistic competition exist in Switzerland?	Switzerland	Monopolistic competition exists in Switzerland.

Source: Author's compilation (2021)

Table II: Summary of principal studies adopting the Panzar-Rosse Model (Con't)

6	Hondroyiannis et al. (1999)	n.a	Greece	Greek bank revenues were earned as if under conditions of monopolistic competition.
7	Bikker and Groenveld (2000)	n.a	15 European countries	Monopolistic competition is found for 15 European countries except Belgium and Greece.
8	De Bandt and Davis (2000)	What are the competition conditions of the banking industries in the US and three European countries, i.e., France, Germany, and Italy, right before the adoption of the Single Currency by the European Monetary Union (EMU)?	France, Germany and Italy	Evidence showed that banks in the sample countries were operating under imperfect competition.
9	Smith and Tripe (2001)	n.a	New Zealand	Firms in New Zealand earned their revenue under monopolistic competition.
10	Haffani (2002)	What is the structure of the Tunisian banking sector?	Tunisia	Results showed that the Tunisian banking sector operated under monopolistic conditions with increasing competition.
11	Belaisch (2003)	Do Brazilian banks compete?	Brazil	The study finds positive evidence of the presence of a noncompetitive market structure in the Brazilian banking system, a factor that could explain why intermediation may be relatively low and costly.
12	Jiang et al. (2004)	n.a	Hong Kong	Competition could lower financial intermediation costs and contribute to improvements in economic efficiency.

Source: Author's compilation (2021)

Table II: Summary of principal studies adopting the Panzar-Rosse Model (Con't)

13	Lee and Lee (2005)	n.a	Korea	Banks in Korea earned their revenue under monopolistic conditions.
14	Yildirim and Philippatos (2007)	n.a	15 countries of Latin America	Firms in 15 countries earned their revenue under monopolistic competition.
15	Hauner and Peiris (2005)	n.a	Uganda	In the case of Uganda, Hauner and Peiris (2005) found that the increased level of competition as a result of economic and financial sector reforms was associated with a rise in efficiency.
16	Bikker et al. (2006)	n.a	101 countries	Nearly all banking markets in the industrialized world are relatively competitive.
17	Al-Mouharrami et al. (2006)	n.a	Arab countries GCC	Arab countries GCC show perfect competition: Kuwait, Saudi Arabia and the union of the emirates' monopolistic condition: Bahrain and Qatar. M: Oman

Source: Author's compilation (2021)

Table II: Summary of principal studies adopting the Panzar-Rosse Model (Con't)

18	Prasad and Ghosh (2007)	n.a	India	The empirical evidence reveals that Indian banks earn revenues as if under monopolistic competition.
19	Drummond et al. (2007)	n.a	France, Germany, Spain, the United Kingdom, and the United States	This study has assumed that the banking industry in India operates under the assumption of long-run market equilibrium.
20	Abdul Majid, M. and Sufian, F. (2007)	n.a.	Malaysia	The Islamic banks in Malaysia earned their revenue in the condition of monopolistic competition.
21	Maudos and Solis (2007)	n.a.	Mexico	The Lerner index shows a decrease in competitive rivalry in the deposit market and an increase in the loan market, a cross subsidization strategy being observed.
22	Turk-Ariss (2008)	n.a.	12 countries of MENA	Firms earned their revenue from monopoly.
23	Biekpe (2011)	n.a.	Ghana	The study also finds that Ghanaian banks are monopolistically competitive.

Source: Author's compilation (2021)

Table III. Interpreting the Panzar-Rosse H Statistic Competitive

	Competitive Environment Test
$H \leq 0$	Monopoly or conjectural variation short-run monopoly.
$0 < H < 1$	Monopolistic competition.
$H = 1$	Perfect competition, or natural monopoly in a perfectly contestable market, or sales maximizing firm subject to a breakeven constraint.
	Equilibrium Test
$E < 0$	Disequilibrium
$E = 0$	Equilibrium.

Sources: Rosse and Panzar 1977; Panzar and Rosse 1982, 1987; Shaffer 1982, 1983; Nathan and Neave 1989, 1991

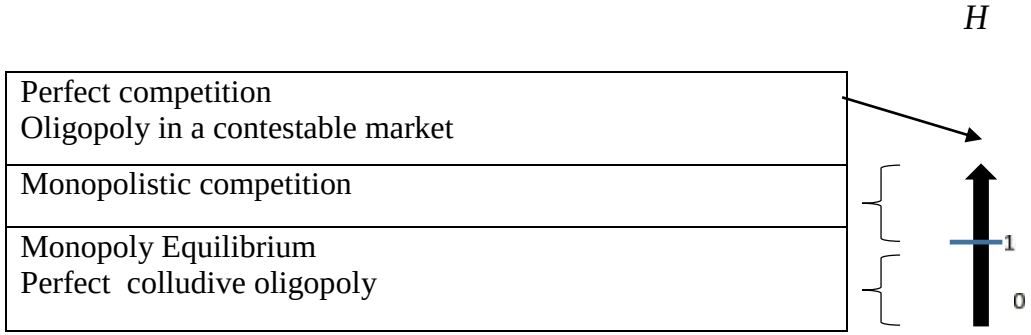

Figure 1: Panzar-Rosse *H* statistic is interpretations
Source: Gutiérrez de Rozas (2007, p. 15)

4. Related studies and hypothesis development

Several empirical studies have been conducted on the relationship between financial sector reforms programmes and market competition. While these studies remain substantial in literature, findings remain mixed and limited. In Africa, the application of the Panzar and Rosse approach has yielded interesting results. After the implementation of various structural reforms in Ghana, Korsah, Nyarko and Tagoe (2001) confirmed an increase in competition in Ghana's banking system. The study further concluded that profitability of the sector was a function of the oligopolistic nature found in the sector. A study by Biekpe (2011) grouped several financial sector reforms programmes in Ghana conveniently into three stages. The first phase of reforms was from 1987 to 1991; the second from 1992 to 1995; and the third phase of reforms was from 1995 to 2003. Biekpe (2011) argued that policies that encourage and stimulate greater consolidation in the financial sector would go a long way to enhance competition among banks and improve efficiency and profitability. In the case of Uganda, Hauner and Peiris (2005) found that the increased level of competition as a result of economic and financial sector reforms was associated with a rise in competition and efficiency. In Zambia, a study that aims to evaluate the degree of competition in the Zambian banking sector in the wake of dynamic market shifts induced by entry of new foreign banks and privatization of the state-owned bank, concluded that reforms that allow foreign bank penetration and privatization can heighten competitive pressures in the banking sector Simpasa (2013) . In testing for the quiet-life hypothesis (.i.e. Quiet life hypothesis (QLH) which states that banks with a higher market power will generate high profitability quietly), Williams (2012) and Koetter et al. (2012) extend the literature on the adjusted Lerner index for the banking sector in Latin America and the USA, respectively. While Latin America study invalidated this hypothesis, further analysis by Koetter et al. (2012) on USA suggests that privatization of public sector banks and restructuring fostered competition in the banking industry after reforms. The South Asian economies have experienced significant structural transformation from a highly regulated banking system to a competitive one. These structural transformations and reforms in South Asian economies have potentially led to the liberalization in the banking sector and made the entry norms of foreign banks easy with the help of the South Asian Association for Regional Cooperation and the World Trade Organization. According to Perera et al. (2006) the combined effects of these reforms have made the financial sector in the region more competitive and efficient (Perera et al., 2006). Two decades after the financial sector reforms, there is a consensus that even after two decades of financial sector reforms, the implementation of financial sector policies have witnessed a gradual increase in banking competitiveness. This study, therefore, would hypothesize the following relationship:

H_1 *: Banking sector reforms affect competition*

Globally there is a growing body of literature that recognizes the importance of P-R methodology in assessing the nature of banking competition. Maudos and Pérez (2003), used a sample of commercial and savings banks from 1992 to 1999 and concluded that competition decreases during the period under consideration (the full-sample estimation of the H-statistic is 0.71). Bikker and Haaf (2002) whose studies analyzed the relationship between competition and market structure, focused on the validity of the SCP paradigm and concluded on the conventional view that concentration impairs competition. Using annual Tobit-based estimates of the *"H-statistic"* to estimate twelve EU countries from 1994 to 1999, Weill (2004) reported a decreasing pattern of monopolistic competition in Spain. Thus, the results show a negative relationship between competition and efficiency. Molyneux, Lloyd-Williams and Thornton (1994), employed P-R methodology on a number of European countries from 1986 to 1989 and advocated for an intermediate level of monopolistic competition in the Spanish case. Claessens and Laeven (2004) uses a multi-country analysis of banking competition and estimated the *"H-statistic"*for fifty developed and developing countries for the period 1994-2001. Claessens and Laeven (2004) found that monopolistic competition is the best description of the markets under consideration. Casu and Girardone (2006) employ a sample containing the former EU-15 member countries and conclude that degree of concentration is not related to the level of competition. Garrido (2004) employs various econometric techniques to assess the extent of competition among Spanish banks from 1994 to 2000 and concludes that Spanish banks during the period of study show monopolistic competition. Using data from 1989 to 1996, Bikker and Groeneveld (2000) document that the banking sector in European countries is not competitive during the study period. Applying the Panzar-Rosse method to Tunisia's banking sector between 1980 and 1999, Haffani (2002) confirms that Tunisian banking sector operated under monopolistic conditions with increasing competition. A study using pooled and the fixed effect method focusing on the Arab Gulf

Cooperation Council's banking sector, found the *"H-statistic"* was 0.24 and 0.47 respectively and concluded that the banking sector was operating in a monopolistic competition environment (Al-Muharrami et al., 2006).. In South Africa, Mlambo and Ncube (2011) noted that the South African banking sector operated under monopolistic competition. In Zambia, Simpasa (2013) reported that banks earned their revenue under conditions of monopolistic competition. Although the compilation of articles produces varying degrees of banks' behavior, it supports the relevance of the application of the Panzar and Rosse approach. This study tests the following hypotheses:

H_2 *: Banks in Ghana derive their revenue in the monopoly market conditions.*

Studies have shown that distinct characteristics of the banking sector influence market competition. Wong et al. (2006) employed the Panzar-Rosse method during the period 1991 to 2005 and assessed the competition in the banking sector of Hong Kong. Wong et al. (2006) identified a higher competition pressure among larger banks and lower among smaller banks. Fu and Heffernan (2009) reported that the majority of banks in the Chinese banking system operated below the levels of efficiencies of effective scale after the financial sector reforms. Staikouras et al. (2006) employed 25 Member States of the EU to carry out a multi-country study. Staikouras et al. (2006) found larger banks exhibit monopolistic competition characteristics than smaller banks. A study which examines 23 OECD countries from 1988 to 1998 reports that competition appears to be stronger for large banks and weaker for small banks (Bikker and Haaf, 2002). This result is supported and consistent with the work by De Bandt and Davis (2000). A study by Wahid (2017) sought to analyze the following three main questions within the Malaysian banking system: Are Islamic banks more competitive than conventional banks? What are the levels of competition for Islamic and conventional banking sectors pre, during and post the 2007-2009 global financial crisis? Does penetration of Islamic banks affect the competitive structure of conventional banks? Wahid (2017) suggested that Malaysian Islamic banks are relatively more competitive than their conventional counterparts. Furthermore, the author observes that the level of competition for both Malaysian Islamic and conventional banks increased tremendously during the 2007-2009 global financial crisis. Jin, Liu, Liu and Yin (2014) results suggest competition increases, regardless of the ownership structure of individual banks (i.e. state holding banks or joint-stock banks). We test the hypothesis as:

H_3 *: Banks' ownership status affects nature and extent of competition in Ghana's banking sector.*

5. Methodology

5.1.Sample, data sources and justification

The present study uses a data of 23 banks in Ghana from 2000 to 2019 sourced from Ghana Association of Bankers (GAB). Table IV presents a list of banks used in the study. It captures the entire industry concentration levels from 2000 to 2019. Using Herfindahl-Hirschman Index (HHI), banks in Ghana concentration among market participants are considered moderate.

5.2.Empirical models

This study replicates the models employed by earlier study (Bikker et al., 2006) to estimate how risk profile and actions affect banks' revenues. The "*H-statistic"* is estimated as:

$$H = \sum_{k=1}^{K} \beta_k \tag{1}$$

The *"H-statistic"* is the reduced form revenue equation in a general market model after profit maximization, i.e., after equating marginal revenue with marginal cost. Panzar-Rosse further stipulates that total revenue, R* (z,w,t) depends on some factors namely external variables shifting the firm's revenue function (z), factor prices that are external to the firm (w), and external variables shifting the firm's cost function (t). According to Todorov (2016), this function provides a basis for the elasticities of the firm's total revenue with respect to its factor prices (wk). The "H-statistic" is estimated as:

$$H = \sum_{k=1}^{K} \left[\frac{\partial R w_k^*}{\partial w_k R^*} \right] = \sum_{K=1}^{K} \frac{\partial \ln R^*}{\partial \ln w_k} \tag{2}$$

Table IV: Concentration measures of banks in Ghana, 2000-2019

Bank classifications	Ownership status	% Total assets	% Total deposits	% Total Loans	HHI_Total assets	HHIi_Total deposits	HHI_Total loans
Listed banks							
Access bank	Foreign	0.01%	0.01%	0.01%	0.00	0.00	0.00
Agriculture Development bank	Local	4.81%	3.59%	7.06%	23.15	12.90	49.83
Cal bank	Local	0.03%	0.02%	0.03%	0.00	0.00	0.00
Ecobank	Foreign	0.06%	0.06%	0.06%	0.00	0.00	0.00
Ghana Commercial bank	Local	3.48%	3.32%	5.95%	12.10	11.05	35.44
Republic bank	Foreign	5.92%	4.20%	8.02%	35.02	17.64	64.26
Societe General	Foreign	17.81%	17.74%	25.14%	317.02	314.66	632.26
Standard Chartered bank	Foreign	0.05%	0.05%	0.05%	0.00	0.00	0.00
Non-listed banks							
Consolidated bank of Ghana	Local	0.01%	0.01%	0.00%	0.00	0.00	0.00
Fidelity bank	Local	1.89%	2.30%	1.88%	3.58	5.31	3.52
National Investment bank	Local	1.27%	1.42%	1.74%	1.61	2.02	3.02
Prudential bank	Local	1.37%	1.34%	1.76%	1.88	1.80	3.11
Absa	Foreign	0.04%	0.04%	0.05%	0.00	0.00	0.00
Bank of Africa	Foreign	7.10%	6.24%	7.55%	50.45	38.95	56.98
FBN	Foreign	1.17%	0.21%	0.71%	1.37	0.04	0.51
First Atlantic bank	Foreign	6.33%	7.03%	3.59%	40.09	49.40	12.92
First National bank	Foreign	0.00%	0.00%	0.00%	0.00	0.00	0.00
Guramtee Trust bank	Foreign	6.82%	6.99%	3.89%	46.58	48.83	15.12
Stanbic bank	Foreign	2.76%	3.13%	2.56%	7.63	9.79	6.56
United bank of Africa	Foreign	21.29%	23.46%	17.58%	453.43	550.19	309.08
Universal Merchant bank	Foreign	0.01%	0.01%	0.01%	0.00	0.00	0.00
Zenith bank	Foreign	17.76%	18.82%	12.35%	315.27	354.24	152.54
		100.00%	100.00%	100.00%	1,273.94	1,392.87	1,259.88
HHI					0.13	0.14	0.13

Source: Author's computation (2021)

The *"H-statistic"* interpretation is meaningful if the following assumptions and conditions are met: (i) cost behavior are considered to be uniformed, (ii) the model is suitable to homogeneous markets. Thus, the banking institutions are considered as individual products and that higher quality products are as a result of higher input prices, (iii) firms under examinations should be in long-run equilibrium. Shaffer (1982) developed an equilibrium test that justifies the hypothesis of market equilibrium. The equilibrium test confirms that profits represented by ROA and ROE are unrelated to prices of inputs. The equilibrium test is as follows:

$$\ln(1-ROA_{it}) = \alpha_0 + \alpha_1 \ln(PAFR_{it}) + \alpha_2 \ln(PPE_{it}) + \alpha_3 \ln(PPCE_{it}) + \alpha_4 \ln(RCLTA_{it}) + \alpha_5 \ln(RTATAB_{it}) + \alpha_6 \ln(RCTA_{it}) + \alpha_7 \ln(UBL_{it}) + \alpha_8 \ln(LISSTU_{it}) + \varepsilon_{it} \quad (3)$$

$$\ln(1-ROE_{it}) = \alpha_0 + \alpha_1 \ln(PAFR_{it}) + \alpha_2 \ln(PPE_{it}) + \alpha_3 \ln(PPCE_{it}) + \alpha_4 \ln(RCLTA_{it}) + \alpha_5 \ln(RTATAB_{it}) + \alpha_6 \ln(RCTA_{it}) + \alpha_7 \ln(UBL_{it}) + \alpha_8 \ln(LISSTU_{it}) + \varepsilon_{it} \quad (4)$$

To account for negative values of ROA and ROE, these returns proxies are measured as ln (1-ROA) and ln (ROE) (Claessans and Laeven, 2004; Casu and Giradone, 2006). The equilibrium E-statistic in the study is defined as $\alpha_1+\alpha_2+\alpha_3$. Using the F-test, the study tests whether EQ = 0. The market is considered to be in symmetry if EQ = 0 is dismissed. The study refers to EQ1 as the E-statistic situated on model (3) and to EQ2 as the E- statistic based on model (4). The reduced form revenue equation employ in the study is:

$$\ln(RII_{it}) = \alpha_0 + \alpha_1 \ln(PAFR_{it}) + \alpha_2 \ln(PPE_{it}) + \alpha_3 \ln(PPCE_{it}) + \alpha_4 \ln(RCLTA_{it}) + \alpha_5 \ln(RTATAB_{it}) + \alpha_6 \ln(RCTA_{it}) + \alpha_7 \ln(UBL_{it}) + \alpha_8 \ln(LISSTU_{it}) + \varepsilon_{it} \quad (5)$$

In equation 5, the dependent variable RII is expressed as ratio of Interest Income to Total Assets. Numerous surrogates are used to account for the factor input prices. Difficulties in measuring the three inputs prices directly accounted for the usage of these proxies. Table V displays and discusses the proxies used in the studies such as Annual funding rate (PAFR), Annual personnel expenses to total assets (PPE) and Price of capital expenditure (PPCE). Bank-specific variables employed as control variables include Credit risk (RCLTA), Banks surveyed (RTATAB), Leverage (RCTA), Universal banking license (UBL) and Ownership status (OWNSP). UBL and OWNSP represent before and after the introduction of FINSSIP and listing status are introduced in the study as dummies. Lastly, ε is an error term. Natural logarithms of all variables are considered. Equation 1 is calculated by employing OLS with time dummies and GLS with fixed bank-specific effects. The *"H-statistic"* is equivalent to $\alpha_1+\alpha_2+\alpha_3$. Both H = 1 and H = 0 are estimated using the F-test. The H1 is the *"H-statistics"* as shown in equation 5. The alternative reduced revenue equation as presented in equation 6 is suggested to account for robustness check is stated as:

$$\ln(RTR_{it}) = \alpha_0 + \alpha_1 \ln(PAFR_{it}) + \alpha_2 \ln(PPE_{it}) + \alpha_3 \ln(PPCE_{it}) + \alpha_4 \ln(RCLTA_{it}) + \alpha_5 \ln(RTATAB_{it}) + \alpha_6 \ln(RCTA_{it}) + \alpha_7 \ln(UBL_{it}) + \alpha_8 \ln(LISSTU_{it}) + \varepsilon_{it} \quad (6)$$

The dependent variable RTR which is the ratio of total revenue to total assets now includes non-interest revenues. The *"H-statistic"* equals $\alpha_1+\alpha_2+\alpha_3$. The F-test will be used to estimate whether H = 1 and whether H = 0. Based on equation 6, H2 is referred to as the *"H-statistic"*. Similar equations are used to examine competitions along periods before and after the recent reforms, listed and non-listed banks.

6. Findings

6.1. Descriptive statistics

Table V shows structure of the dataset used in equation 3, 4, 5 and 6. From Table V, the average variables within the banking industry from 2000 to 2019 did not show a vast difference across the sample. This suggests that variables have their observations found around the means.

Table V: Description Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Ratio of Interest Income to Total Assets	306	-0.9552	0.1678	-3.0337	-0.6041
Ratio of total revenue to total assets	306	-0.9227	0.1889	-3.0283	-0.4669
Return on assets	306	0.0126	0.0069	0.0001	0.0311
Return on equity	305	0.0840	0.0465	0.0001	0.2059
Annual funding rate	304	-0.0291	0.0186	-0.1327	-0.0006
Annual personnel expenses to total assets	305	-0.0296	0.0786	-1.2375	-0.0004
Ratio of general operating expenses to total assets	306	-0.3654	0.0567	-1.1597	-0.2632
Credit risk	306	-1.7165	0.9599	-4.0372	-0.2849
Ratio of total assets of bank to total assets of banks surveyed	306	-1.2950	0.4838	-4.0995	1.7766
Ratio of capital to total assets	306	-0.4375	0.3637	-3.3247	1.9838
Universal banking license	306	0.2451	0.4308	0.0000	1.0000
Ownership status	306	0.6569	0.4755	0.0000	1.0000

Source: Author's computation (2021)

As displayed in Table VI, none of the coefficients exceeded 0.7, indicating that the correlation between the independent variables is not too high (±0.90 and above). Thus, all the predictive variables are suitable for estimations.

Table VI: Pearson Correlation Matrix

Potential correlates of competition	PAFR	PPE	PPCE	RCLTA	RTATAB	RCTA	UBL	LISSTU
Annual funding rate	1.0000							
Price of personnel expenses	-0.1766*	1.0000						
Price of capital expenditure	0.0276	0.4097*	1.0000					
Credit risk	0.0695	-0.2194*	-0.0318	1.0000				
Banks surveyed	-0.1982*	0.3982*	0.1750*	-0.1836*	1.0000			
Leverage	-0.3204*	0.2557*	-0.0125	-0.2933*	0.1271*	1.0000		
Universal banking license	-0.0438	0.2299*	0.0089	-0.4460*	0.1271*	0.2890*	1.0000	
Listing status	0.3829*	0.2602*	0.1693*	-0.1331*	0.1344*	0.1281*	0.1569*	1.0000

Notes: *RII*, ratio of Interest Income to Total Assets, *RTR*, ratio of total revenue to total assets now includes non-interest revenues, *PAFR* annual funding rate is estimated as Interest expenses to total funds, *PPE*, annual personnel expenses to total assets, *PPCE*, ratio of general operating expenses to total assets, *RCLTA*, credit risk is the ratio of customer loans to total assets, *RTATAB*, ratio of total assets of bank to total assets of banks surveyed, *RCTA* ratio of capital to total assets, *UBL* and *OWNSP* representing universal banking license and ownership status are introduced in the study as dummies.

Source: Author's computation (2021)

6.2. Estimation results

6.2.1. Equilibrium environment tests with dummies

According to Nathan and Neave (1989) for the test results to be accurate, two conditions should be satisfied in measuring the-Panzar Rosse model: (i) risk-adjusted rates of returns are the same across banks, (ii) returns represented by ROA and ROE are unrelated with inputs prices. The long-run equilibrium test is conducted by estimating a parameter EQ, where EQ=0 indicates equilibrium and E<0 indicates disequilibrium. This hypothesis is summarized in Table VII.
The banking industry equilibrium is estimated by examining equations 3 and 4 with ROA and ROE as dependent variables. Table VII displays the results for the full sample with dummies. Specifically, long-run equilibrium is found in model 1, 2, 3 and 4 as shown in Table VII

Table VII: Equilibrium environment tests with dummies

Variables	OLS Estimation ROA Model 1	GLS Estimation ROA Model 2	OLS Estimation ROE Model 3	GLS Estimation ROE Model 4
Annual funding rate	0.0851***	0.0851***	-0.0051	-0.0051
	(0.0224)	(0.0273)	(0.1559)	(0.1174)
Price of personnel expenses	-0.0025	-0.0025	-0.0020	-0.0020
	(0.0051)	(0.0036)	(0.0344)	(0.0170)
Price of capital expenditure	0.0074	0.0074	0.0472	0.0472*
	(0.0070)	(0.0091)	(0.0479)	(0.0286)
Credit risk	0.0021*	0.0021***	0.0065	0.0065
	(0.0011)	(0.0007)	(0.0077)	(0.0043)
Banks surveyed	-0.0000	-0.0000	-0.0042	-0.0042*
	(0.0004)	(0.0004)	(0.0029)	(0.0022)
Leverage	-0.0013	-0.0013	-0.0316***	-0.0316***
	(0.0009)	(0.0012)	(0.0062)	(0.0098)
Universal banking license	0.0025**	0.0025***	0.0135**	0.0135***
	(0.0010)	(0.0005)	(0.0065)	(0.0033)
Listing status	0.0029***	0.0029***	0.0202***	0.0202***
	(0.0009)	(0.0005)	(0.0060)	(0.0038)
Constant	0.0144***	0.0144***	0.0393	0.0393
	(0.0035)	(0.0041)	(0.0239)	(0.0244)
Observations	303	303	303	303
R-squared	0.1676	0.1751	0.1379	0.1221
Adj R-squared	0.145	-	0.1144	-
Time effects	Yes	Yes	Yes	Yes
Number of Banks	20	20	20	20
Number of Year	20	20	20	20
H=0 (P.value)	0.0000	0.0000	0.0000	0.0000
F.statistic		97.25		113.88
Equilibrium test I (ROA)	0.09	0.09	-	-
Equilibrium test 2 (ROE)	-	-	0.0401	0.0401

Note: E1 = 0.0851 -0.0025 + 0.0074 = 0.09 = 0
E2 = -0.0051- 0.0020 + 0.0472 = 0.0401 = 0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation (2021)

6.2.2. Equilibrium environment tests without dummies
Table VIII displays the results for the full sample without dummies. Specifically, long-run equilibrium is found in all the model as shown in Table VIII

Table VIII: Equilibrium environment tests without dummies

Variables	OLS Estimation ROA Model 5	GLS Estimation ROA Model 6	OLS Estimation ROE Model 7	GLS Estimation ROE Model 8
Annual funding rate	0.0207***	0.0207***	0.2433*	0.2433**
	(0.0211)	(0.0312)	(0.1457)	(0.1224)
Price of personnel expenses	-0.0002	-0.0002	0.0121	0.0121
	(0.0052)	(0.0030)	(0.0351)	(0.0154)
Price of capital expenditure	0.0060	0.006	0.0414	0.0414
	(0.0072)	(0.0091)	(0.0486)	(0.0313)
Credit risk	0.0017	0.0017**	0.0046	0.0046
	(0.0011)	(0.0007)	(0.0077)	(0.0049)
Banks surveyed	0.0004	0.0004	-0.0011	-0.0011
	(0.0004)	(0.0004)	(0.0028)	(0.0021)
Leverage	-0.0000	-0.0000	-0.0232***	-0.0232**
	(0.0009)	(0.0011)	(0.0059)	(0.0093)
Universal banking license	-	-	-	-
	-	-	-	-
Listing status	-	-	-	-
	-	-	-	-
Constant	0.0197***	0.0197***	0.0769***	0.0769***
	(0.0033)	(0.0041)	(0.0222)	(0.0233)
Observations	303	303	303	303
R-squared	0.1153	-	0.0898	-
Time effects	Yes	Yes	Yes	Yes
Number of Banks	20	20	20	20
Number of Year	20	20	20	20
H=0 (P.value)	0.0000	0.0000	0.0000	0.0000
F.statistic		36.8500		47.04
Equilibrium test I (ROA)	0.0265	0.0265	-	-
Equilibrium test 2 (ROE)	-	-	0.2968	0.2968

Note: E3 = 0.0207-0.0002 + 0.0060 = 0.0265= 0
E4 =0.2433 + 0.0121 + 0.0414 = 0.2968 = 0

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation (2021)

Overall, the estimation results for equilibrium in all the models as shown in Table VII and VIII indicate that Wald test failed to reject the null hypothesis H=0. Thus, during the period of study, the banking sector in Ghana operated under long-run equilibrium. Hence, the justifications to estimate and discuss the *"H-statistics"*.

6.2.3. *Full sample results for "H-statistic" with dummies*

Under the full sample, using either interest income or total income, results from the competitive environment test as displayed in Table IX models 9, 10, 11, and 12 confirmed negative and significant effects in all cases. Results from the study which showed H values of -3.3802 and -3.1295 are significantly distinct from zero and unity. Thus, monopoly conditions are prevalent in the Ghanaian banks sector. This condition suggests that input prices will increase marginal costs, changes equilibrium output and reduces total firm revenue. In terms of explanatory variables, annual funding rate (PAFR) is negative and significant at 1 per cent in relation to interest income and total revenue. The remaining variables are negatively and statistically significant at 1 and 5 per cent levels: PPE, PPCE, RTATAB and LISSTU. The negative sign between these variables suggests that an increased factor costs lower revenue.

6.2.4. *Full sample results for "H-statistic" without dummies*

Similar results are produced when a competitive environment test is estimated under the full sample without dummies. As displayed in Table X, models 13, 14, 15, and 16 confirm a negative and significant in all cases. For both interest income and total revenue, the study reveals H values of -3.7736 and -3.4422 respectively. This is significantly distinct from zero and unity. Thus, monopoly conditions exist in the Ghanaian banks sector. In terms of the explanatory variables, negative and significant results are found for PAFR, PPE, PPCE, RTATAB and RCTA suggesting that an increased factor costs lower revenue.

Table IX: Competitive environment tests with dummies

Variables	OLS Estimation	GLS Estimation	OLS Estimation	GLS Estimation
	Interest Income		Total Revenue	
	Model 9	Model 10	Model 11	Model 12
Annual funding rate	-3.0828***	-3.0828***	-2.6727***	-2.6727***
	(0.5432)	(0.6130)	(0.6286)	(0.6167)
Price of personnel expenses	-0.1057	-0.1057***	0.0162	0.0162
	(0.1227)	(0.0377)	(0.1420)	(0.1342)
Price of capital expenditure	-0.1917	-0.1917	-0.4730**	-0.4730
	(0.1702)	(0.2025)	(0.1970)	(0.3683)
Credit risk	0.0051	0.0051	0.0281	0.0281
	(0.0276)	(0.0282)	(0.0319)	(0.0437)
Banks surveyed	-0.0055	-0.0055	-0.0123	-0.0123**
	(0.0103)	(0.0043)	(0.0119)	(0.0049)
Leverage	-0.0132	-0.0132	-0.0407	-0.0407
	(0.0219)	(0.0160)	(0.0253)	(0.0329)
Universal banking license	0.0248	0.0248	-0.0095	-0.0095
	(0.0232)	(0.0156)	(0.0268)	(0.0155)
Listing status	-0.0442**	-0.0442***	-0.0278	-0.0278**
	(0.0213)	(0.0113)	(0.0247)	(0.0126)
Constant	-1.1210***	-1.1210***	-1.2152***	-1.2152***
	(0.0843)	(0.0924)	(0.0976)	(0.1584)
Observations	303	199	303	303
R-squared	0.1592	0.1524	0.1132	0.1135
Adj R-squared	0.1363	-	0.0891	-
Time effects	Yes	Yes	Yes	Yes
Number of Banks	20	20	20	20
Number of Year	20	20	20	20
H=0 (P.value)	0.0000	0.0000	0.0000	0.0000
F.statistic		66.28		33.90
H1: Competitive environment test (Interest Income)	-3.3802	-3.3802	-	-
H2: Competitive environment test (total Revenue)	-	-	-3.1295	-3.1295

Note: H1 = -3.0828 - 0.1057 - 0.1917 = -3.3802
H2 = -2.6727 + 0.0162 - 0.4730 = -3.1295

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation (2021)

Table X: Competitive environment tests with dummies

Variables	OLS Estimation	GLS Estimation	OLS Estimation	GLS Estimation
	Interest Income		Total Revenue	
	Model 13	Model 14	Model 15	Model 16
Annual funding rate	-3.4312***	-3.4312***	-2.9706***	-2.9706***
	(0.5018)	(0.6507)	(0.5771)	(0.6450)
Price of personnel expenses	-0.1188	-0.1188***	-0.0004	-0.0004
	(0.1227)	(0.0396)	(0.1411)	(0.1315)
Price of capital expenditure	-0.2236	-0.2236	-0.4712**	-0.4712
	(0.1698)	(0.2184)	(0.1953)	(0.3736)
Credit risk	-0.0046	-0.0046	0.0284	0.0284
	(0.0270)	(0.0289)	(0.0310)	(0.0453)
Banks surveyed	-0.0100	-0.0100**	-0.0162	-0.0162***
	(0.0099)	(0.0049)	(0.0114)	(0.0056)
Leverage	-0.0188	-0.0188	-0.0499**	-0.0499
	(0.0207)	(0.0140)	(0.0238)	(0.0327)
Universal banking license	-	-	-	-
	-	-	-	-
Listing status	-	-	-	-
	-	-	-	-
Constant	-1.1853***	-1.1853***	-1.2629***	-1.2629***
	(0.0773)	(0.0983)	(0.0888)	(0.1609)
Observations	303	303	303	303
R-squared	0.1443	-	0.1089	-
Time effects	Yes	Yes	Yes	Yes
Number of Banks	20	20	20	20
Number of Year	20	20	20	20
H=0 (P.value)	0.0000	0.0000	0.0000	0.0000
F.statistic		50.37		30.55
H3: Competitive environment test (Interest Income)	-3.7736	-3.7736	-	-
H4: Competitive environment test (total Revenue)	-	-	-3.4422	-3.4422

Note: H3 = -3.4312 - 0.1188 - 0.2236 = -3.7736
H4 = -2.9706 -0.0004 - 0.4712 = -3.4422

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation (2021)

6.2.5. *"H-statistic" results for periods before and after* FINSSIP

As displayed in Table XI, mixed results are generated when the dataset is decomposed into two periods namely period before and after FINSSIP. The overall results for Panzar-Rosse *"H-statistic"* are estimated in Models 17 to 24. H values of -0.0126 and -1.8614 are interest income before and after the introduction of universal banking license are produced by the study results. For total revenue, H values stand at -0.0323 and -1.9655 for the same periods. The competitive environment test results displayed in Table XI, indicate that the market competitions for periods before and after FINSSIP are characterized as monopoly.

Table XI: Competitive environment tests before and after the introduction of universal banking license

Variables	Competitive environment test							
	OLS Estimation	OLS Estimation	GLS Estimation	GLS Estimation	OLS Estimation	OLS Estimation	GLS Estimation	GLS Estimation
	Interest Income		Interest Income		Total Revenue		Total Revenue	
	Before	After	Before	After	Before	After	Before	After
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Annual funding rate	-2.5185***	-6.7234***	-2.5185***	-6.7234***	-1.7825**	-1.9655	-1.7825***	-1.9655
	0.5753	1.6379	0.4617	1.5698	0.5944	1.9262	0.4611	1.2976
Price of personnel expenses	-0.0126	-2.7549	-0.0126	-2.7549	-0.0323	14.1138***	-0.0323	14.1138
	0.1251	1.3587	0.0312	2.156	0.1292	1.5978	0.0320	3.0528
Price of capital expenditure	-2.0739***	0.8935	-2.0739*	0.8935	-1.9889***	-4.5390***	-1.9889**	-4.5391
	0.3929	0.4288	0.7815	0.6713	0.406	0.5042	0.7999	0.9772
Credit risk	-0.0315	0.0215	-0.0315	0.0215*	-0.0777**	0.1091**	-0.0777	0.1091
	0.0358	0.0366	0.0278	0.0416	0.037	0.0431	0.0520	0.0419
Banks surveyed	0.0035	-0.0021	0.0035	-0.0021	-0.0051	0.0088	-0.0051	0.0088
	0.0118	0.0169	0.0058	0.0136	0.0122	0.0199	0.0068	0.0111
Leverage	0.0126	-0.0439	0.0126	-0.0439*	0.0212	-0.0594	0.0212	-0.0594
	0.0264	0.0331	0.0154	0.0239	0.0273	0.0389	0.0227	0.0629
Universal banking license	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
Listing status	-0.0774**	0.0360	-0.0774***	0.0360	-0.0536**	0.1433**	-0.0536**	0.1434
	0.0234	0.0452	0.0190	0.0208	0.0242	0.0531	0.0186	0.0438
Constant	1.7217***	-0.9102***	-1.7244***	-0.9102***	-1.6608***	-2.5620***	-1.6608***	-2.5620
	0.1465	0.1840	0.2716	0.2337	0.1514	0.2164	0.2821	0.3237
Observations	228	75	228	75	228	75	228	75
R-squared	0.2656	0.2765	0.2744	0.1985	0.205	0.6531	0.2012	0.624
Adj R-squared	0.2423	0.2009	-	-	0.1797	0.6169	-	-
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Banks	20	20	20	20	20	20	20	20
Number of Year	15	15	15	15	15	15	15	15
H=0 (P.value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F.statistic			149.96	57.87			70.24	69.34
Competitive environment test (Interest Income								
H17: Periods before universal banking license	-0.0126	-	-0.0126	-	-	-	-	-
H18: Periods after universal banking license	-	-1.8614	-	-1.8614	-	-	-	-
Competitive environment test (total Revenue)								
H21: Periods before universal banking license	-	-	-	-	-0.0323	-	-0.0323	-
H22: Periods after universal banking license	-	-	-	-	-	-1.9655	-	-1.9655

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: Author's computation (2021)

6.2.6. *"H-statistic" results for listed and non-listed banks*

The study dataset is further segregated into listed and non-listed banks. This decomposition is shown in Models 25 to 32. In a competitive environment when interest income is considered, whereas listed banks show H values of 0.0163, H values of -0.3233 is found for non-listed banks. The results indicate that whereas monopolistic competition market conditions are found in the listed banks, monopoly is found in non-listed banks

Table XII: Competitive environment tests for listed and non-listed banks

Variables	OLS Estimation	OLS Estimation	GLS Estimation	GLS Estimation	OLS Estimation	OLS Estimation	GLS Estimation	GLS Estimation
	Interest Income		Interest Income		Total Revenue		Total Revenue	
	Listed	Non-listed	Listed	Non-listed	Listed	Non-listed	Listed	Non-listed
	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
Annual funding rate	-2.3138***	-3.5831***	-2.3138***	-3.5831***	-1.5233**	-2.8731**	-1.5233**	-2.8731**
	0.4983	0.7431	0.4429	0.8989	0.5272	0.8758	0.5389	0.8892
Price of personnel expenses	0.0163	-0.2689	0.0163	-0.3000	-0.0030	1.168513*	-0.0030	1.1685
	0.0557	0.5396	0.0307	0.2359	0.0590	0.6359	0.0323	1.1166
Price of capital expenditure	-1.6666***	-0.0544	-1.6666***	-0.0544	-1.4187***	-0.7809**	-1.4187***	-0.7809
	0.2723	0.2674	0.2205	0.2146	0.2881	0.3152	0.2799	0.6492
Credit risk	-0.0014	-0.0602	-0.0014	-0.0570	0.0069	0.0314	0.0069	0.0314
	0.0138	0.0666	0.0123	0.0629	0.0146	0.0785	0.0171	0.1688
Banks surveyed	-0.0085	0.0114	-0.0085	0.0125	-0.0099	-0.0045	-0.0099	-0.0045
	0.0077	0.0161	0.0081	0.0085	0.0081	0.0189	0.0100	0.0136
Leverage	0.0153	-0.0427	0.0153	-0.0411	-0.0045	-0.0713	-0.0045	-0.0713
	0.0147	0.0398	0.0117	0.0299	0.0155	0.0469	0.0147	0.0428
Universal banking license	-0.1404***	0.0438	-0.1404***	0.0438**	-0.1016***	-0.0002	-0.1016***	-0.0002
	0.0260	0.0321	0.0185	0.0169	0.0275	0.0379	0.0268	0.0219
Listing status	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-
Constant	-1.5744***	-1.1762***	-1.5744	-1.1662***	-1.4614***	-1.3607***	-1.4614***	-1.3607***
	0.0914	0.1350	0.0591	0.1341	0.0967	0.1591	0.0684	0.2253
Observations	104	199	104	199	104	199	104	199
R-squared	0.4485	0.1318	0.4167	0.1202	0.3434	0.0961	0.3056	0.0961
Adj R-squared	0.4083	0.1	-	-	0.2955	0.0629	-	-
Time effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Banks	20	20	20	20	20	20	20	20
Number of Year	15	15	15	15	15	15	15	15
H=0 (P.value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F.statistic	-	-	313.47	44.1100	-	-	226.75	24.51
Competitive environment test (Interest Income)								
H25: Local banks	0.0163	-	0.0163	-	-	-	-	-
H28: Foreign banks	-	-0.3233	-	-0.3233	-	-	-	-
Competitive environment test (total Revenue)								
H29: Local banks	-	-	-	-	-0.0030	-	-0.0030	-
H32: Foreign banks	-	-	-	-	-	0.0000	-	0.0000

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation (2021)

6.2.6. Summary and interpretation of the hypotheses results

Table XIII presents the summary and interpretation of the hypotheses results developed in the study. For hypothesis *H1* (i.e. Banking sector reforms affect competition), the study results confirmed a negative and significant effects in all cases i.e. H values of -3.3802 and -3.1295 are significantly distinct from zero and unity. This suggest that under the full sample, using either interest income or total income, various structural reforms including the implementation of the FINSAP, competition in the Ghanaian banking sector increased. Hence, *H1* is supported. For hypothesis *H2* (i.e. Banks in Ghana derive their revenue in the monopoly market conditions), the study result supports and indicates that Ghanaian banking markets derive their revenues under monopoly conditions. Hence, H2 is supported. For hypothesis *H3* relating to banks' ownership status effects on the nature and extent of competition in Ghana's banking sector, the study result revealed a coefficient value of -0.3233. This suggest that firm ownerships and orientations do affect the nature and extent of competition in Ghana's banking sector. Hypothesis *H3* is therefore supported.

Table XIII: Summary and interpretation of the hypotheses results

Hypotheses	The objective of each Hypothesis	Standardized β- Coefficient	P-Value	Significant levels	Results
H1	Banking sector reforms affect competition	-3.3802	0.0000	*** p<0.01	Supported
H2	Banks in Ghana derive their revenue in the monopoly market conditions.	-0.0126	0.0000	*** p<0.01	Supported
H3	Banks' ownership status affects nature and extent of competition in Ghana's banking sector.	-0.3233	0.0000	*** p<0.01	Supported

Source: Author's computation (2021)

7. Discussion and conclusion

This study estimates the nature and extent of competition in Ghana's banking sector. The Panzar-Rosse Model is used in this study to empirically assess competitiveness in the Ghanaian banking market. The study uses 23 banks in Ghana from 2000 to 2019, compiled and reported by Ghana Association of Bankers (GAB).

Generally, the study result suggests that from 2000 to 2019, after various structural reforms including the implementation of the FINSAP, competition in the Ghanaian banking sector increased. Hence the first hypothesis is validated. This result finds support in the empirical study conducted by Korsah, Nyarko and Tagoe (2001). Korsah et al., (2001), reported an increase in competition in Ghana's banking system.

Furthermore, the study hypothesis that banks in Ghana derive their revenue in the monopoly market conditions. Results from the study indicate that Ghanaian banking markets derive their revenues under monopoly conditions. These market characteristics suggest that input prices will enhance marginal costs, decrease equilibrium output and reduce total firm revenue. Interestingly, various phases of the sector reforms introduced did not affect the Ghanaian banking market competition as characterized by monopoly. Thus, the second hypothesis is supported. This result supports and gives credence to earlier studies by Haffani (2002). Haffani (2002) applied the Panzar-Rosse method to the Tunisia's banking sector between 1980 and 1999, and confirms that Tunisian banking sector operated under monopolistic conditions with increasing competition. The result of this study further corroborates Al-Muharrami et al. (2006) study in the Arab Gulf Cooperation Council's banking sector. Al-Muharrami et al. (2006) concluded that banking sector was operating in a monopolistic competition environment. The present study results throws more light on the empirical work of Wong et al. (2006) who employed the Panzar-Rosse method during

the period 1991 to 2005 and assessed the competition in the banking sector of Hong Kong. The present study is supported by the empirical studies by De Bandt and Davis (2000) and Turk-Ariss (2008). On the contrary, the study failed to support the empirical work of Korsah et al., (2001). Korsah et al., (2001) concluded that firms derive their revenue in the oligopolistic market conditions. Studies by Maudos and Solis (2007), Majid et al. (2007), Drummond et al. (2007) and Biekpe (2011) are not supported by the results of this study.

The last hypothesis of the study states that firm ownerships and orientations do affect the nature and extent of competition in Ghana's banking sector. When separate competitive market conditions are considered, while listed banks operate under monopolistic competition, non-listed banks operations are characterized by monopoly market. This finding correlates with the empirical study by Hamza (2010) and validates Chamberlinian monopolistic competition theory.

The following managerial and policy implications are recommended by the authors:

7.1. Managerial and policy implications

First, the presence of a monopoly adds to the call for managers of the banks to consider factor input prices in an attempt to generate more revenues. Second, to avoid negative consequences of competition, managers of these banks should not rely on a single income source but also indulge in non-intermediation activities. In terms of policy, pro-structural shift policies that will help with the transition from a monopoly structure to a perfect competition or contestable market structure should be rigorously pursued by the policy-makers. Furthermore, it is relevant for policy-makers to allow tampering with market forces as this enhances competition. Again, reforms in the government borrowing requirements will help increase competition in the Ghanaian banking system. Besides, policy directives that enhance greater consolidation in the banking sector should be pursued rigorously. Finally, the results from this study could help policy-makers to fashion an appropriate optimal intervention and stability policies geared towards enhancing banking stability at different levels of bank competition.

7.2. Limitations and future research

Just like any other research study, this study is not without any limitations. First, the data points were too small to produce a robust result and estimate the impact of the reforms on competition. Finally, the data did not allow for the classifications of banks into origins i.e. local and foreign banks. Notwithstanding, the presence of these limitations do not invalidate the general outcome of the study. In other to assess an extensive competition in the Ghanaian banking sector, future research could employ other sophisticated methodologies causal association between efficiency and competition particularly in the insurance market.

References

Acheampong, G. & Dana, L.P. (2015). Liability of foreignness in fast-expanding markets: evidence from Ghana, *Thunderbird International Business Review*, 57 (5), 1–3.

Abdul Majid, M.Z. and Sufian, F. (2008). Market structure and competition in emerging market: evidence from Malaysian Islamic banking industry. Munich Personal RePEc Archive MPRA, No. 12126, 1-23.

Al-Muharrami, S., Matthews, K., Khabari, Y. (2006). Market structure and competitive conditions in the Arab GCC banking system, *Journal of Banking and Finance* 30, 3487–3501.

Bain, J. (1956). Barriers to New Competition, Harvard University Press, Cambridge, MA.

Bawumia M., Owusu-Danso T. & McIntyre A. (2008). IMF Survey Magazine: Countries & Regions, Ghana's Reforms Transform Its Financial Sector. Available at :http://www.imf.org/external/pubs/ft/survey/so/2008/car052208a.htm).

Baumol, W. J., Panzar, J. C. & Willig, R. D. (1982). Contestable Markets and the Theory of Industry. Structure, Harcourt Brace Javanovic, New York.

Beck, T., Demirguc-Kunt, A. & Maksimovic, V. (2004). Bank competition and access to finance: international evidence, *Journal of Money, Credit, and Banking*, 36 (3), 627-648.

Belaisch, A. (2003). Do Brazilian Banks Compete? IMF Working Paper 03/113 (Washington: International Monetary Fund).

Berger, A.N., Demirg€uç-Kunt, A., Levine, R. & Haubrich, J.G. (2004). Bank concentration and competition: an evolution in the making, *Journal of Money, Credit and Banking*, 36 (3), 433-451.

Biekpe, N. (2011). The competitiveness of Commercial Banks in Ghana. *African Development Review*, 23 (1), 75-87.

Bikker, J.A. & Haaf, K. (2002). Competition, concentration and their relationship: an empirical analysis of the banking industry, *Journal of Banking & Finance*, 26 (11), 2191-2214.

Bikker, J. A., Shaffer, S. & Spierdijk, L. (2009). The Panzar-Rosse Revenue Test : To Scale or Not to Scale ?. available at: http://ssrn.com/abstract=1458889.

Bikker, J.A. & Groeneveld, J.M. (2000). Competition and Concentration in the EU Banking Industry, *De Nederlandsche Bank* NV, 8.

Bonaccorsi di Patti, E. & Dell'Ariccia, G. (2004). Bank competition and firm creation, *Journal of Money, Credit, and Banking*, 36 (2), 225-251

Bikker, B., Spierdijk, L. & Finnie, P. (2006). Misspecification of the Panzar Rosse model: assessing competition in the banking industry, de Nederlansche Bank NV Working Paper No 114.

Bresnahan, T.F. (1982). The oligopoly solution concept is identified, *Economics Letters*, 10 (1-2), 87-92.

Casu, B. & Girardone, C. (2006). Bank competition, concentration and efficiency in the single European market, *The Manchester School*, 74 (4), 441-468.

Chamberlin, E. (1933). The Theory of Monopolistic Competition, Cambridge, MA, Harvard University Press.

Claessens, S., & Laevan, R. (2004). What drives bank competition? Some International Evidence. *Journal of Money, Credit and Banking*, 36(2), 563-584. http://dx.doi.org/10.1353/mcb.2004.0044.

Davies, G. & Davies, J. E. (1984). The revolution in monopoly theory. Lloyds Bank Review, 6(2), 38-52.

De Bandt, O. & Davis, E.P. (2000). Competition, contestability and market structure in European banking sectors on the eve of EMU, Journal of Banking and Finance, 24(1), 1045-1066.

Drummond, P., Maechler, A.M. & Marcelino, S. (2007). Italy: Assessing Competition and Efficiency in the Banking in the Banking System. IMFWorking Paper WP/07/26

Dunlop, J. (1938). The movement of real and money wage rates. Economic Journal, 48(1) 413–434.

Flaminiet, V. McDonald, C. & Schumacher, L. (2009).The determinants of commercial bank profitability in sub- Saharan Africa. IMF Working Paper 09/15, *International Monetary Fund*, Washington.

Fu MX & Heffernan, S. (2009). The effects of reform on China's bank structure and performance. *Journal Bank Finance*, 33(1):39–52.

Garrido, A. (2004). El grado de competencia en el sistema bancario español, Universitat de Barcelona Working Paper.

Gutiérrez de Rozas, L. (2007). Testing for competition in the Spanish banking industry: the Panzar-Rosse approach revisited, Banco de España Research Paper No. WP-0726.

Guzman, M.G. (2000). Bank Structure, Capital Accumulation, and Growth: A Simple Macroeconomic Model, *Economic Theory* 16 (2), 421–455.

Hauner, D. & Peiris, S. (2005). Bank Efficiency and Competition in Low-Income Countries: The Case ofUganda, IMFWorking Paper No. 05/240 (December).

Hondroyiannis G, Lolos S, Papapetrou E (1999). Assessing competitive conditions in the Greek banking. *Journal International Finance Market Institution Money* 9, 377–391.

Jin, D., Liu, J., Liu, L. & Yin, D. (2014) Competition and profit hiding: evidence from banks in China. *Managerial Finance*, 40(10), 1040–1051. doi: 10.1108/MF-11-2013-0315.

Jiang, G., Wong, J., Tang, N., and Sze, A. (2004). Banking sector competition in Hong Kong – Measurement and evolution over time. Hong Kong Monetary Authority.

Jiménez, G., Lopez, J.A. & Saurina, J. (2013). How does competition affect bank risk-taking?, *Journal of Financial Stability*, 9 (2), 185-195.

Khattak, M. A. & Ali, M. (2021). 'Are competition and performance friends or foes? Evidence from the Middle East banking sector', *International Journal of Islamic and Middle Eastern Finance and Management*, 14(4), 671–691. doi: 10.1108/IMEFM-08-2019-0348.

Koetter, M., Kolari, J.W. & Spierdijk, L. (2012). Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for US banks. *Review of Economics and Statistics*, 94 (2), 462-480.

Kotler, P. (1976). Marketing management: Analysis, planning, control Englewood Cliffs, NJ,

Prentice-Hall.
Korsah, K. B., Nyarko, E. K., & Tagoe, N. A. (2001). Impact of Financial Sector Liberalization On Competition And Efficiency In The Ghanaian Banking Industry. *IFLIP Research Paper*.
Lau, L.J. (1982). On identifying the degree of competitiveness from industry price and output data, Economics Letters, 10 (1-2), 93-99.
Lee, C. & Hsieh, M. (2013). Beyond Bank Competition and Profitability : Can Moral Hazard Tell Us More?, Journal of Financial Services Research, 70(1), 87–109. doi: 10.1007/s10693-012-0151-1.
Lee, S. and Lee, J. (2005). Bank consolidation and bank competition: An empirical anal- ysis of the Korean banking industry. *Bank of Korea Economic Papers* 8, 102-144.
Leon, F. (2015). Does bank competition alleviate credit constraints in developing countries?, *Journal of Banking & Finance*, 57, 130-142.
Levine, R. (1997). Financial development and economic Growth: views and agenda. *Journal of Economic Literature*, 35, 688e726.
Lin, J. Y., & Nugent, J. (1995). Institutions and economic development. *Handbook of Development Economics*. 3, pp. 20
Lloyd-Williams, D.M., Molyneux, P. & Thornton, J. (1991). Market structure and performance in Spanish banking". *Journal of Banking & Finance*, 18, 433-43.
Majid, A., M. Zulkhibri & S. Fadzlan (2007). Market Structure and Competition in Emerging Market: Evidence from Malaysian Islamic Banking Industry. MPRA Paper No. 12126, Munich Personal RePEc Archive.
Mason, E. S. (1939). Price and production policies of large scale enterprises, American Economic Review, 29(1), 61-74.
Maudos, J. & Solis, L. (2007). Deregulation, Liberalization and Consolidation of the Mexican Banking System: Effects on Competition, Working Paper WP EC 2007–13, Department of Economics, University of Valencia.
Maudos, J. & Perez, F. (2003). Competencia vs poder de mercado en la banca española, Moneday Crédito, 217, 139-166.
McKelvey, W. (1982). Organizational systematics: Taxonomy, evolution, classification. Los Angeles, University of California Press.
Mlambo, K. & Ncube, M. (2011). Competition and Efficiency in the Banking Sector in South Africa. *African Development Review*, *23*(1), 4–15. https://doi.org/10.1111/j.1467-8268.2010.00268.x.
Molyneux, P., Lloyd-Williams, D. M. & Thornton, J. (1994). Competitive conditions in European banking. *Journal of Banking and Finance*, 18, 445-459. http://dx.doi.org/10.1016/0378-4266(94)90003-5
Nathan, A. & Neave, E.H. (1989). Competition and contestability in Canada's financial system: empirical results, *Canadian Journal of Economics*, 22 (3),576-594.
Nelson, R. R. & Winter, S. G. (1982). An evolutionary theory of economic change. Cambridge, Harvard University Press.
Nelson, R. R. & Winter, S. G. (1974). Neoclassical vs. evolutionary theories of economic growth: Critique and prospectus, Economic Journal, 84(1), 886-905.
Panzar, J. C. & Willig, R. D. (1971). Free Entry and the Sustainability of Natural Monopoly, Bell Journal of Economics, 81(1), 78-98
Panzar, J. C. & Rosse, J. N. (1982). Structure, Conduct and Comparative Statistics. Economic Discussion Paper No. 248. Bell Laboratories.
Panzar, J. C. & Rosse, J. N. (1987). Testing for monopoly equilibrium", Journal of Industrial Economics, 35(1),443-456.
Perera, S., Skully, M. & Wickramanayake, J. (2006). Competition and structure of South Asian banking: a revenue behaviour approach. *Applied Financial Economics*, 16 (11), 789-801.
Petersen, M.A. & R.G. Rajan. (1995). The Effect of Credit Market Competition on Lending Relationships. *Quarterly Journal of Economics*, 110 (2), 405–443.
Porter, M. E. (1980). Competitive strategy. New York: Free Press
Porter, M. E. (1981). The contributions of industrial organization to strategic management", Academy of Management Review, 6(1), 609-620.
Prasad, A. & Ghosh, S. (2007). Competition in Indian Banking: An Empirical Evaluation, South Asia Economic Journal, 8(1), 265.
Rajan, Raghuram G. & Luigi Zinagales, (1998). Financial Dependence and Growth. *American Economic Review* 88(3), 559-86.
Rakshit, B. & Bardhan, S. (2020). Bank competition in India: revisiting the application of Panzar–Rosse model, *Managerial Finance*, 46(11), pp. 1455–1477. doi: 10.1108/MF-09-2019-0457.

Repullo, R. (2004). Capital requirements, market power, and risk-taking in banking, *Journal of Financial Intermediation*, 13 (2), 156-182.
Rime, B. (1999). Mesure de degrede concurrence dans le syst?eme bancaire Suisse al'aide du mod?ele de Panzar et Rosse, Revue Suisse d'Economie Politique et de Statistique, 135, 21-40.
Robinson, J. (1933). The economics of imperfect competition. London, MacMillan.
Schaeck, K. & Cihak, M. (2014). Competition, efficiency, and stability, *Financial Management*, 10 (1), 215-241, available at: https://doi.org/https://doi.org/10.1111/fima.1201
Simpasa, A. M. 2013. "Competition and Market Structure in the Zambian Banking Sector." Working Paper Series 168. Tunis, Tunisia: African Development Bank.
Schumpeter, J. A. (1950). Capitalism, socialism, and democracy, (3rd ed.). New York, NY.
Shaffer, S. (1982). A non-structural test for competition in financial markets. In Bank Structure and Competition, Conference Proceedings. Chicago: Federal Reserve Bank of Chicago, 225-43.
Smith, Robert, and David Tripe. 2001. Competition and Contestability in New Zealand Banking System. Paper presented at the 14th Australian Finance and Banking Confer- ence, Sydney.
Smirlock, M. (1985). Evidence on the (Non) relationship between concentration and profitability in Banking, Journal of Money, Credit and Banking, 17 (2), 69-83.
Staikouras, C.K., Koutsomanoli and Fillipaki, A. (2006). Competition and concentration in the new European banking landscape, *European Financial Management*, 12 (3), 443-482.
Stevenson, H. (1976). Defining corporate strengths and weaknesses. Sloan Management Review, 17(3), 51-68.
Thompson, A. A. & Strickland, A. J. (1980). Strategy formulation and implementation. Dallas: Business Publications.
Todorov, A. B. (2016). Assessing Competition in the Bulgarian Insurance Industry : A Panzar-Rosse Approach. International Journal of Economics and Financial Issues, 6(3), 872–879.
Turk-Ariss R. (2008). Competitive behaviour in Middle East and North Africa banking systems, The Quarterly Review of Economics and Finance, 49(1), 693–710
Wahid, M. A. (2017). Comparing the competition of Malaysia Islamic and conventional banks: Evidence surrounding the global financial crisis. *Journal of Islamic Accounting and Business Research*, 8(1), 23–40. doi: 10.1108/JIABR-06-2015-0022.
Weill, L. (2004). Measuring cost efficiency in European banking: a comparison of frontier techniques, *Journal of Productivity Analysis*, 21 (2), 133-152.
Williams, J. (2012). Efficiency and market power in Latin American banking. *Journal of Financial Stability*, 8 (4), 263-276.
Wong. J. (2006). Competition in Hong Kong's Banking Sector: A Panzar- Rosse Assessment. HKMA Research Memorandums, Hong Kong Monetary Authority. Working Paper No. 0616.
World Bank (1995). Ghana: Growth, Private Sector, and Poverty Reduction, Report No. 14111-GH.
Yildirim, H. S. & Philippatos, G.C. (2007). Restructuring, consolidation, and competition in Latin American banking markets. *Journal of Banking and Finance* 31, 629-639.