Market Structure and Competition in the Ethiopia Banking Industry: Empirical Analysis Using

Panzar-Rosse Model

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Abstract

The banking sector competition considered in the scientific community as important research areas and many of them related it to performance to explain market competitiveness. This paper has made attempt to assess the degree of competition and the long term equilibrium in Ethiopian commercial banking sector. The study use a mixed structural and not structural market approach to measure the degree of competitiveness based on quantitative studies is adopted to form a causal link among different extraneous and firm specific factors variables with bank performance. The paper employed a secondary data from audited financial account of 16 out of 18 commercial banks collected from each respective banks and the NBE from the period 2010 to 2016. The paper is examining the market using the most frequently applied measures of concentration k-bank concentration ratio (CRk) and Herfindahl-Hirschman Index (HHI). The widely accepted Panzar and Rosse (1987) model and its H-statistic are also used as a non-structural method to assess the degree of competition where a panel data regression model was employed to investigate the relationship between Market share, bank size and other factors on profit and price performances analyzed using generalized least square (GLS) method on R Software. The empirical results using CRk and HHI show that Ethiopian banking is a highly concentrated market and show stagnated trends during the study period. The Panzar-Rosse "H-statistic" suggests that banks in Ethiopian operate under monopoly or monopolistic competition depending on the market segment.

Keywords: Herfindahl-Hirschman Index; Panzar-Rossel; H-statiistic; Banking; Market segment; monopolistic competition

1. Introduction

The banking industry sector is the ultimate engine for achieving economic prosperity of a country and it is involved in the mobilization of financial resources from the surplus units to the deficit units (Uddin and Gupta, 2012). The health of the financial services industry affects the economy at many levels including individuals, firms, and overall national development (Mercan, 2012). In a financial system, banks play a significant role in different sectors like financing, payment system, transmission of monetary policy and the provision of credit (Kashi and Beynabadi, 2013). Thus, banking sector is widely regarded as a vital cog in investment and savings cycle in the economy of a particular country (Arrawatia and Misra, 2014).

As in other industries, the degree of competition in the financial sector can matter for a number of reasons, such as the efficiency and profitability of the production of financial services, the quality of financial products, and the degree of innovation in the sector. In particular, due to the special role played by banks, the competition in banking markets closely relates to the economic stability and growth (Claessens and Laeven 2004). Thus, market competition in the banking industry has been and will always be one of the most discussed topics in any economy for researchers, investors and regulators. Especially, as incomplete development of capital market in developing countries, banks play an even more crucial role in their economies, such as Ethiopia.

Banking competition is an extremely important issue as banks play a vital role in the economy (Bikker et al., 2009a). Competition influences the performance of banks in terms of profitability and efficiency (Uddin and Suzuki, 2014). As in any other industry, competition can affect the efficiency and the degree of innovation in the banking sector (Arrawatia and Misra, 2014). It is recognized in many studies that there is link between competition and stability. This link has also helped to formulate many prudential policies towards banks (Vives, 2001). Obviously, competition in the banking sector has a major impact on the wealth of consumers and companies and it affects the performance and financial health of banks. The drivers for assessing the level of competition are banking sector liberalization, financial markets deregulation, financial innovations, merger and consolidation etc. (Arrawatia and Misra, 2014).

There is also active debate on the impact of competition on financial stability and fragility, as economic theory provides conflicting predictions about the relationship between the competition and banking system stability and fragility (Berger et al2009a). The competition-stability view suggests that a more competitive banking sector is more prone to financial crises than a less competitive banking sector. Because the less competitive banking systems have market power to generate high profits which can provide a "buffer" against adverse shocks and thus reducing the probability of systemic banking crisis. Moreover, the supervision of a few banks is more effective than many banks. However, the opposing view competition-fragility argues that a less competitive banking structure enhances bank fragility. The market power in less competitive banking market could induce banks to engage in risky activities, which increase the system fragility and thus enhance the probability of financial crisis. Therefore, the competition in banking market has very important policy implications. The Ethiopian banking industry has gone through a series of significant changes after the first introduction of economic reform in 1994. Perhaps, the banking reform is one of the last but most fundamental aspects in Ethiopia's economic reform.

Despite a great number of investigations devoted to market competition in banking sector, the developing countries still are largely ignored. Thus another purpose of this study is to contribute to the existing literatures concerning this issue and to cast some light on Ethiopia, as a developing economy. The major empirical method applied for assessing the competition in banking markets in this paper is based on the Structure Conduct Performance and non-structural models that were developed in the context of the New Empirical Industrial Organization (NEIO) approach. Two tests are widely used; one is mark-up test by Bresnahan (1982), and another is H statistic by Panzar-Rosse (1987). Market concentration indicators such as the N-firms concentration ratio and the Herfindhal Hirschman index (HHI) are commonly employed in the traditional structural approach SCP studies. Although the market concentration indicators offer some insight into competitive conditions in market, they say little about the underlying behavior of market participants.

Therefore, a relatively new methodology (non-structural approach) is employed to systematically examine the nature of competition due to both theoretical and empirical drawbacks of the traditional methods. Bresnahan (1989) gives a comprehensive survey of econometric methodologies for measuring the degree of competition. Shaffer (1994) and (2002) provided a detailed analysis of comparison between structural and non-structural models. In particular, the Panzar-Rosse methodology is preferred for our study, to the best of our knowledge; there is no previous study that adopted the Panzar-Rosse approach to assess the competitive conditions in the Ethiopian banking system.

The present paper contributes to the burgeoning literature on banking competition in two ways. Firstly, it addresses to analyze the factors related to competition, and by doing this it shows the factors related to competition and how it affects banking industry of Ethiopia. Secondly, the findings of this study may generate some guidelines for the policymakers to formulate policies and strategies with regard to the structure of the banking sector of Ethiopia.

The rest of the paper is structured as follows: Section 2 describes the available literature concerning concentration and competition. Section 3 introduces the data and methodology adopted for the study. Section 4 presents the empirical results of the study and the last section conclude the paper.

2. Literature review

The Panzar-Rosse approach is an econometric methodology to quantitatively assess the competitive conditions of the market. The empirical test was developed by Panzar and Rosse (1987) to distinguish between monopoly, monopolistic competition and perfect competition. The idea behind the Panzar-Rosse test is that banks will price differently in response to changes in input prices or any other exogenous economic shock. The ability of pricing depends on the degree of market power it can control and the market structure it operates within. In turn, changes in pricing strategy will finally lead to changes in revenue. Therefore, variation in revenues can reflect the market structure in which they operate. In other words, whether banks exercise market power can be measured by the extent to which changes in input prices are reflected into revenues earned by bank itself. So for examining the level of market competition, we can simply analyze how bank's revenue responds to changes in input prices.

The Panzar-Rosse competition test is derived from a reduced form revenue equation at firm level under certain assumptions, like long run equilibrium condition, profit maximization, banks face homogeneous production function, banks are treated as single product firms (De Bandt and Davis, 2000), and higher input prices are not associated with higher quality services that generate higher revenues (Molyneux et al., 1996).

The Panzar-Rosse H statistic represents the percentage variation of the revenues resulting from one percent aggregate change in the price of input factors used by the bank. The economic interpretation of the H statistic is as follows. If banks operate as a monopoly in the market, then the H statistic is non-positive (less than or equal to zero). This is because monopolist's revenue will respond in the opposite direction to the change in input prices, as an increase in input prices leads to increase in marginal costs, thus reducing equilibrium output and revenue. Panzar and Rosse (1987) further showed that the H statistic is also negative when the structure is a perfectly collusive oligopoly or a conjectural variations short run oligopoly.

The H statistic is equal to one when the market structure is characterized as perfectly competitive. Under this condition, a proportional shift in all input prices will increase marginal and average costs by the same proportion, without changing the equilibrium output produced by banks. In order to survive the competition, banks will be forced to increase prices until they cover the increased costs. During this adjustment process, the inefficient banks might be acquired by efficient ones or be eventually driven out of the market by competition; the reduction in the number of banks in the industry will reduce the supply of the industry, thereby leading to a rise in output price and revenue by the same amount as costs. H statistic is also unity for a sales-maximizing firm that is subject to breakeven constraint as well as a natural monopoly operating in a perfectly contestable market. For the situation of monopolistic competition, the H statistic lies between zero and unity. In this case, banks behave like monopolists, but the market entry or exit of other banks with imperfect rival products make them cannot generate abnormal profits as monopoly. Hence, revenue will increase less than proportionally to changes in input prices from one percent aggregate change in the price of input factors used by the bank.

In conclusion, both the magnitude and sign of the H statistic can be informative. Vesala (1995) proved that when H statistic is non-positive, it is a decreasing function of the demand elasticity, that is, a smaller absolute value of H statistic is associated with less monopoly power. However, when H statistic is positive, it is an increasing function of the demand elasticity, that is, the higher H statistic, the less is the market power. Bikker and Haaf (2002) also state that when the value of H statistic is between 0

and 1, it generally increases with the competitiveness of the market. In other words, higher value of H statistic indicates stronger competition than lower values. In empirical application, the rejection of H≤0 excludes the monopoly model, if we also reject the hypothesis of H=1, which rules out the perfect competition model, that means we are in favour of the only model left, which could be consistent with monopolistic competition.

There are various assumptions needed to be satisfied when we apply the Panzar-Rosse methodology. One of the critical conditions is that the H statistic is only viable when the market is in the long run equilibrium. This condition can be tested by the assumption that if market is in equilibrium, the rate of return (profit) should not be significantly correlated with input prices. This is because in long run equilibrium profit is given by the structure of the market and is independent of short run random shocks. As a result, the equilibrium test can be performed by estimating the same model used in competition test but use bank rate of return rather than revenue for dependent variable. Then we calculate the sum of the elasticity of the bank return with respect to the bank's input factors, which denoted by E statistic. A finding of E=0 would confirm the equilibrium condition, otherwise indicate disequilibrium. One thing should be noticed here, the equilibrium does not mean that competitive conditions are not allowed to change, but take a gradual approach as argued by De Bandt and Davis (2002).

The empirical studies are different in many aspects, such as country sample, time period, regression variables and estimation methods, so theoretically speaking, it is impossible to compare the results from different papers. The choice of the dependent variable in estimating the Panzar-Rosse H-statistic has varied between un-scaled and scaled revenue in empirical studies. Previous studies have used a scaled dependent variable i.e. bank revenue divided by total assets (Molyneux et al, 1994; Hondroyiannis et al, 1999; Bikker and Haaf, 2000; Hempell, 2002) with the reason that scaling helps to remove firm level differences as well as provides for a better approximation. Other papers argued that the use of a scaled dependent variable could be interpreted as a lending rate or "price" and therefore can change the nature of the Panzar-Rosse model from being a revenue equation to being a price equation (Vesala, 1995; De Bandt and Davis, 2000; Bikker et al, 2016).

Bikker et al (2016) further theoretically and empirically proved that misspecification of using scaled variable and scaling factor would bias the H statistic towards one. Besides the controversy about the use of scaled and un-scaled revenue, the choice between interest revenue and total revenue also varies in the literature. Traditional approaches in this literature have used interest income alone as dependent variable, which is consistent with the intermediation approach, as financial intermediation is the core business in banking revenue. In the current study, total income is considered instead. As banks operate in a more competitive environment for survival, the distinction between interest and non-interest income becomes less relevant, competition being equally vigorous for both. Cross subsidization and accounting differences across countries are additional arguments suggesting it is better to have a comprehensive view of bank revenues.

The Panzar-Rosse methodology has been widely applied by a large number of works to empirically analyze the degree of competition and market structure in banking sectors for both single country and cross country studies. Several studies have measured the degree of competition and tested the market for equilibrium using structural and non-structural methods. One study used a panel data set covering the period from 1986 – 2004 using data from 67 different countries (Bikker, Shaffer, & Spierdijk, 2006). The study has shown that Panzar-Rose price or revenue functions cannot be used to measure the degree of banking competition, as the authors concluded that the Panzar-Rosse H-statistic needs requires more information costs, market equilibrium and market demand elasticity.

Bikker (2006) used data reported by Spanish depositary institutions covering the period from 1986 – 2005. The study uses 92% of aggregate assets of credit institutions sector, which is fairly representative and comprehensive. Author used the Panzar-Rosse methodology and has shown that the level of competition is higher than reported in the previous literature. Author has also reported that on the Spanish sample in case of large banks the market gets close to perfect competition, and no apparent relationship between competition and market is found.

Italian banking system has also been analysed using data from the period 1988- 2000 with the final data set including 104 observations (Coccorese, 2004). The study uses non-linear simultaneous-equation model with an ultimate goal to identify the degree of competitiveness characterizing eight Italian largest banks. The study shows that the degree of competition on the Italian market is considerable and that there is no conflict between competition and concentration.

One paper evaluated the degree of competition among Italian banks for the period 1986-1996 by employing the Panzar-Rosse H-statistic (Coccorese, 2004). All of the used banks were classified into of the three groups on the basis of their respective size. The study uses total revenues as the dependent variable, as the models were created for each of the observed years. The results have shown that the model coefficients for the factor prices always positive and statistically significant. The main conclusion of the study is that the Italian banks have operated under the monopolistic competition in the period 1988-1996, and that the banks have been in the long-run equilibrium in only four of the observed years.

Molyneux (1995) used banking market data from 14 European countries over the period 1995-2001, to assess the competition and pricing power in European banking. Among other indicators four indicators they used net interest margin, Lerner index, returns on assets, Panzar-Rosse H-statistic, and HHI market concentration, and have shown that competition often gives conflicting predictions of competitive behavior across and within countries.

Another study assessed the degree of competitiveness in the banking industry of the EU in total as well as the degree of competitiveness in individual countries (Bikker & Groeneveld, 1998). The data panel used in this study covers the period 1989-1996 and have shown that mainly large banks play a greater role in the financial intermediation process. Their results suggest that national banking sectors in the EU are not identical.

Bikker & Haaf (2000) applied the Panzar-Rosse model to banks from 23 European and non-European countries for the years 1988-1998. They have reported that banking markets in the industrial world are mainly operating under monopolistic competition. They also find that competition and bank size are proportional and that in some countries the competition has increased significantly over time.

Maudos & Guevara, (2009) have analyzed the 43 commercial banks operating in Mexico over the period 1993-2005. The study uses net interest margin as the dependent variable and shows that it can be explained by average operating costs and by market power. The results show that net interest margin is mainly determined by average operating costs and the Lerner index (Maudos & Guevara, 2009).

Al-Muharrami (2009) analysed the market structure of the banking market of Saudi Arabia using data during the period 1993-2006. The Panzar-Rosse methodology results show that Saudi Arabia banking industry has a status of a monopolistic competition, and that the market is not highly concentrated as well as that it shows signs of concentration decline.

Greece banking market competition and concentration has also been assessed is several studies. Staikouras(2006), & Vesala (1995) analyzed panel data of Greek banks over the period 1993-2004 and found that the static models used tend to underestimate the level of market power.

Number of other studies has used the Panzar-Rosse method to measure the degree of competition in the banking sector. Papadopoulos(2004), Weill(2004) analyzed the Czech Banking Industry, Nathan & Neave (1989) banks in Canada, Mamatzakis, Staikouras, & Koutsomanoli-Fillipaki (2005) analyzed the degree of concentration and competition in the enlarged European Union banking environment over the period 1998–2002, Liu, Molyneux P., Altunbas, Y. and Gardener (2013) measured competition and stability in 11 European countries over the period 2000-2008, Matthews, Murinde, & Zhao (2007) reported an empirical assessment of competitive conditions among the major British banks, during a period of major structural change and found a monopolistic competition, Yildirim & Philippatos (2007) used the data from eleven Latin American countries for the period 1993 to 2000 to find that banks appear to be earning their revenues under monopolistic competition, which was proven in many other developed and emerging financial systems.

To our knowledge, this is the first research conducted with the aim of measuring competition and efficiency of banks in Bosnia and Herzegovina using the Panzar Rosse and HHI methodology. The significance of the research is that it offers an insight into the Bosnian banking market from the competition and efficiency perspective, which can be usefully in the desired country's economic integration into the European Union and its developed financial markets.

3. Methodology

3.1. Empirical model specification: Panzar-Rosse model

The primary goal is to analyze the nature of competition in the Ethiopian commercial banking sectors from the perspectives of microeconomic settings. This paper adopts panzar-Rosse (1987) model formulated for banking market structure which has theoretical foundation and empirical appeal from the research community. The PR method allows for bank specific differences in the reduced form revenue function at the firm or bank level and uses a test statistics, H, which under certain assumptions can serve as a measures of the competitive behavior of banks and acknowledge of bank output and prices is not required. The model assumes the potential competitors have the same cost function as firms that already serve in the market. Both can easily enter or leave the market without losing their capital. Active banks in business work with marginal cost with competitive profit to protect their market share from new entrants. So potential competitor have no room to cut price and become a new incumbents. The test is derived from a general banking market model which is based on the work of Claessen and Laeven (2004). It determines equilibrium output and equilibrium number of banks.

3.1.1. Competition test

The underlying assumptions of the P-R approach are that it should be used where the observations are in long-run equilibrium. The long-run equilibrium can be tested by using the H-statistic in a reduced form equation of profitability. Two measures that can be used for profitability are the return on assets or return on equity in place of the revenue as the dependent variable. The resultant H is supposed to be significantly equal to zero in equilibrium and significantly negative in the case of disequilibrium. The risk adjusted rates of return in a competitive market will equalize across firms such that rates of return should not be correlated statistically with factor input prices. To verify the condition of long-run equilibrium, the following regression is estimated

$$\ln R_{it} = \alpha + \beta_1 \ln(PF_{it}) + \beta_2 \ln(PL_{it}) + \beta_3 \ln(PK_{it}) + \Upsilon_1 \ln(TL_{it}/TA_{it}) + \Upsilon_2 \ln(E_{it}/TA_{it}) + \Upsilon_3 \ln(LLP_{it}/TL_{it}) + \sigma T + \varepsilon_{it}$$

Where the subscript i denotes bank i, the subscript t denotes year t.

R =Bank Revenue, ($Rit = IR_{it}$, TR_{it}, IR_{it}/TA_{it}, TR_{it}/TA_{it})

Where subscripts *i* and *t* denote bank *i* at time *t and* the specification for dependent variable differs in the choice between un-scaled revenue (the absolute level of revenue) and scaled revenue (the ratio of revenue to total asset), as well as varies in using total revenue or interest revenue. As the four alternatives are commonly used in empirical models, and there is no consensus on the single best proxy for bank revenue, we employ all four different specifications (Rit = IR_{it}, TR_{it}, $IRit/TA_{it}$, TR_{it}/TA_{it}) for endogenous variable in our empirical competition test model to see whether these four specifications give different results for our sample. The four dependent variables are computed as follows: IR_{it}=interest revenue interest income from making loans; TR_{it} = total revenue, calculated as interest income plus other operating income, such as fee income, commission income and other non-interest income; IR/TA= Ratio of interest income to total asset; TR/TA= Ratio of total revenue to total assets;

The following are the three input factors use as explanatory variables: the ratio of interest expense to total deposits as proxy for price of funds (PF); the proxy for price of labor (PL) is the ratio of personnel expense to total number of employees; and the ratio of other operating expense to fixed assets is used as proxy for capital price (PK).

The other bank specific variables are intended to catch differences in risk, size and business mix. The first one is the ratio of total loans to total assets (TL/TA); this is concerned about the risk associated with loans made by banks. The expected sign of coefficient should be positive. The second bank specific variable is the ratio of equity to total assets (E/TA) which considers the leverage effect and known as solvency risk. The coefficient is expected to be negative. However, in Gunalp and Celik's (2016) paper, they pointed out that the relationship between capital adequacy ratio and the income generation ability of banks is not very straightforward and strong. The third additional variable is the ratio of loan loss provision to total loans (LLP/TL). A substantial amount of non-performing loans (NPLs) were accumulated by Ethiopian banks due to government policy directed loans. Finally, a time dummy (T) is included, which takes into account yearly macro effects and technology change. Finally, epsilon (ε_{it}) is the error term.

The Panzar-Rosse H statistic is calculated as the sum of coefficients of three input price variables:

$$H = \beta_1 + \beta_2 + \beta_3$$

The interpretation of the H-statistic is shown in Table 1

Table 1: H-Statistic Literature interpretation'

H-Value	Interpretation
-1<H<0	Monopoly Equilibrium Perfect Colluding Oligopoly Conjectural Variation short run Oligopoly
0<H<1	Monopolistic Competitions
H=1	Perfect Competition Natural monopoly in a perfect contestable market Revenue maximizing firms subject to break even constraints

Source: Rosse and Panzar(1997, 1987)

3.1.2. Equilibrium test

The basic premise on which P-R model rests is the long-run equilibrium where factor prices are not related with industry return (Panzar and Rosse, 1987). To test this proposition empirically, following empirical model is used following Casu and Girardone, (2009) ; Perera et al., (2007) that validates the PR model results if sum of elasticity's of factor costs is equals to zero. This validates the market long term equilibrium which is required to conduct the competition tests. Equation used to measure equilibrium condition written as follows:

$$\ln(ROA_{it}) = \alpha + \beta_1 \ln(PF_{it}) + \beta_2 \ln(PL_{it}) + \beta_3 \ln(PK_{it}) + \Upsilon_1 \ln(TL_{it}/TA_{it}) + \Upsilon_2 \ln(E_{it}/TA_{it}) + \Upsilon_3 \ln(LLP_{it}/TL_{it}) + \sigma T + \varepsilon_{it}$$

$$\ln(ROE_{it}) = \alpha + \beta_1 \ln(PF_{it}) + \beta_2 \ln(PL_{it}) + \beta_3 \ln(PK_{it}) + \Upsilon_1 \ln(TL_{it}/TA_{it}) + \Upsilon_2 \ln(E_{it}/TA_{it}) + \Upsilon_3 \ln(LLP_{it}/TL_{it}) + \sigma T + \varepsilon_{it}$$

$$E = \beta_1 + \beta 2 + \beta_3$$

The long-run equilibrium test is performed by re-estimating the reduced form revenue equation in the competitive test, but using bank return (i.e. ROA and ROE) as dependent variable instead of revenue measures, where ROA is the return on asset and ROE is the return on equity. The use of both ROA and ROE reflects usage common in the literature. ROA is the most commonly used measure of relative profitability in general industry studies, but ROE is also widely used in the banking sector because of the key leverage properties of equity capital.

The equilibrium test is carried out by testing whether E statistic is equal to zero or not, which is defined as the sum of coefficients on three input variables. E=0 indicates the market is in equilibrium, otherwise disequilibrium. The intuition behind this test is based on the assumption that in equilibrium, returns on assets should be significantly uncorrelated with input prices.

3.2. Data collection

The data used for this study comprise a strongly balanced panel data set collected from NBE which contains audited financial accounts from Ethiopian domestic commercial banks for seven years from 2010 to 2016. There are 16 banks that are included in the sample and yearly data is used. The banks included in the sample are those that operated throughout the whole period of the study. The banks included in our sample hold approximately 99% assets of the whole banking sector. Therefore, it is believed that our sample is a good representation of the overall Ethiopian banking industry. All the monetary variables are adjusted by using GDP deflator. The inflation adjusted monetary variables are denoted in the domestic currency which is Ethiopian Birr and quoted in millions. The test equations are specified in log-linear functional form which helps computation of elasticity and improves the regression's goodness of fit. The panel data are estimated by the fixed effect method, as Housman test suggested the fixed effect panel regression appears to be more appropriate than the random effect estimation.

4. Results and Discussion

4.1. Descriptive statistics

The following Table 2 represents the summary statistics variables of the sample frame of 112 observations used in the study period from between 2010 - 2016. To understand competitions of the Ethiopian banking industry a total of, with one dummy variable; 8 explanatory variables are included and analyses using descriptive parameters to get a deeper understanding about the current banking sector of Ethiopia. Base on table 1 below, it is evident that all variables data distribution lies within 1 standard deviations except interest and total revenue, total assets, the variation comes from the one and the only biggest bank, Ethiopian

commercial banks which holds more than 50% of the banking sector capital and generate a the lion shares of the industry interest and total revenue. Despite this the common size ratios of all banks for each variables indicates that the operations near to averages performances. The following are the summary statistics of the variables:

Table 2: Summary of descriptive statistics

	Obs.	Mean	Standard Deviation	Minimum	Maximum
ROA	98	0.03	0.01	-0.02	0.05
ROE	98	0.23	0.13	-0.06	0.70
IR	98	926.27	2237.61	5.85	11996.59
TR	98	1490.97	3290.04	8.27	17195.41
IR/TA	98	0.05	0.01	0.02	0.07
TR/TA	98	0.09	0.02	0.02	0.13
PF	98	0.03	0.01	0.01	0.04
PL	98	0.01	0.00	0.00	0.02
PK	98	11.15	57.70	0.71	504.58
TL/TA	98	0.42	0.05	0.29	0.55
E/TA	98	0.14	0.05	0.04	0.35
LLP/TL	98	0.02	0.02	0.00	0.11
T	98	4.00	2.01	1.00	7.00

Source: author's own estimation from sample data

The following table represents the correlation matrix of variables used in the study. The values have lower correlation, as shown in matrix below, hence there is little chance of multi-collinearity problem in estimating the parameters (Gajurel and Pradhan, 2012).

Table 3: Summary of Correlation of Explanatory variables

	PF	PL	PK	TL/TA	E/TA	LLP/TL	T
PF	1						
PL	0.103	1					
PK	0.037	-0.074	1				
TL/TA	0.242	0.086	0.121	1			
E/TA	-0.034	0.246	-0.076	0.242	1		
LLP/TL	0.323	-0.204	-0.055	0.013	-0.149	1	
T	0.292	0.387	0.083	0.128	-0.060	-0.283	1

Source: author's own estimation from sample data

4.2. Bank Concentration Ratio

To measure the level of concentration in the Ethiopian banking industry, we employ CR3 and CR4. In other words, we calculate the total market share for the top three and four largest banks in the market. As demonstrated in Table 4, the CR3 in terms of all aspects was always maintained above 74%; it keeps increasing from 74% in the beginning of the sample period and up closer to

78%. The marginal increase for concentration in deposit market and total assets is smaller when we compare it with total loans. The CR3 increase of deposit and total assets is closer to 4% and 3% within the study periods, respectively, but only 6% for loan market (see Table 4). This level of concentration and growth comes from the historical reason and size advantage of the government owned commercial banks of Ethiopia. The big-3 has already built up reputation and long-term business relationship with customers. Moreover, bigger banks have more branches, so it is easier for them to attract deposits than smaller banks. Government-owned bank, especially, CBE took predominant share dwarfing all other banks in the country. It faces low competition from private bank competitors. Private banks compete in their realm of niche market of their own because it seem there is an indication that the whenever new banks enter in the market there is a sign that existing private banks market share is fluctuating in the study periods while public owned banks maintained their shares and see also an increase of their share as we observed from the data

Similarly the CR_4 except few changes, follow almost the same trend as the CR_3 (see 4 and figure 1). The market is highly concentrated and level of concentration is always kept above 74% for the four largest banks. Particularly, the concentration for deposit market sustained over last seven years, with increase staring from 74% in 2010 and in 2016 the share goes to 78%. Likewise the market share based on assets and loan total for top four banks increased nearly by 10% and 6%. In short, the information shows the increasing level of concentration dominated by commercial bank of Ethiopia(or CBE) over time based on all measures, Though Ethiopia has significantly high level of market concentration, this happened because of commercial bank of Ethiopia. Hence Ethiopian banking market is dominated by commercial banks of Ethiopia; it alone took share of roughly 67% of the market in terms of total assets.

Table 4: Bank Concentration Ratios

CR3	2010	2011	2012	2013	2014	2015	2016
Total Deposits	74	76	78	78	78	78	78
Total Loans	69	73	77	76	75	76	76
Total Assets	74	76	77	77	76	77	76
CR4	2010	2011	2012	2013	2014	2015	2016
Total Deposits	74	76	78	78	78	78	78
Total Loans	74	76	78	78	78	78	78
Total Assets	74	76	77	77	80	78	78

Source: author's own estimation based on official figures reported in NBE

Figure 1: Concentration ratio four (CR_3) 2010-2016

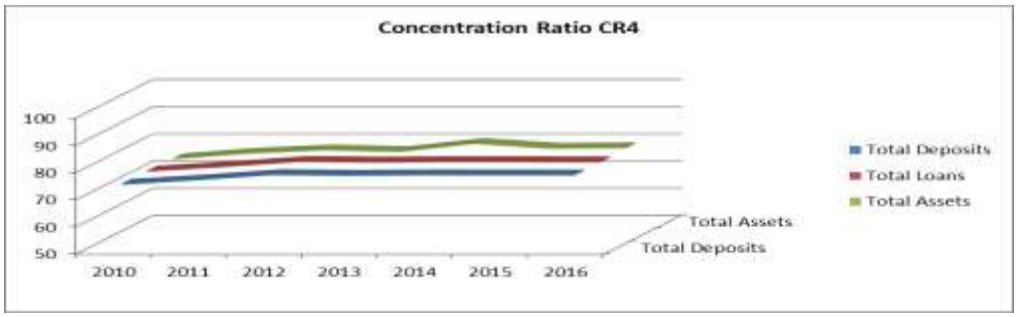
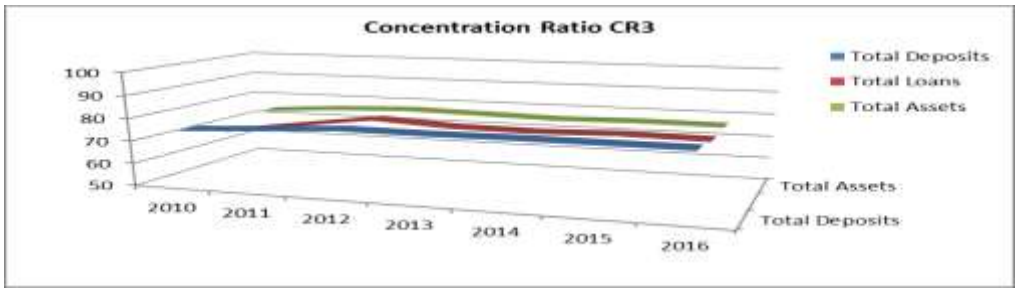


Figure 2: Concentration ratio eight (CR_4) 2010-2016



4.3. Herfindahl-Hirschman Index

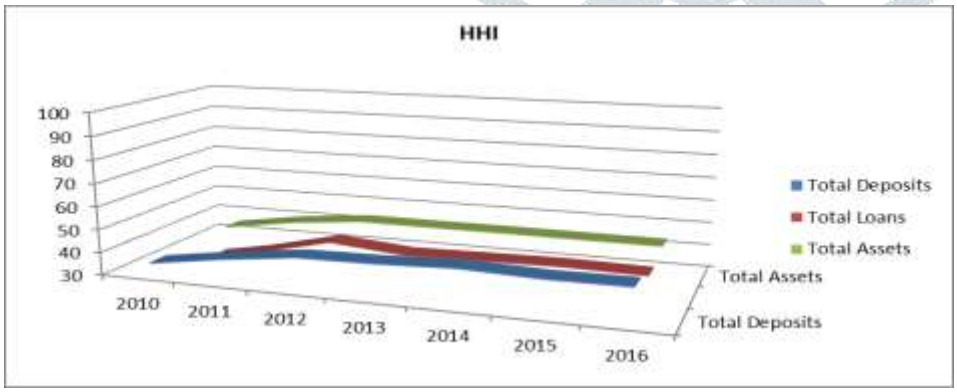
Last but not the least; we analyze the market concentration by making use of the Herfindahl-Hirschman Index (HHI). The HHI in Table 5 and Figure 3 shows apparently a small incremental trend in all aspects namely, loan, deposits and total assets and this increasing tendency in concentration clearly indicate the market monopoly of few banks in the Ethiopian industry. In conclusion the Ethiopian banking industry could be characterized as highly concentrated market, based on the classification from the Meehan and Duchesneau paper criteria.

Table 5: Herfindahl-Hirschman Index

HHI	2010	2011	2012	2013	2014	2015	2016
Total Deposits	34	39	43	43	45	44	44
Total Loans	28	34	41	39	39	40	39
Total Assets	35	40	43	43	43	43	43

Source: author's own estimation based on official figures reported in NBE

Figure 3: The HHI index 2010-2016



4.4. Panzar and Rosse Model: Equilibrium and Competition test

The estimated results using the entire panel data (2010-2016) for different specifications of the dependent variable are presented below.

4.4.1. Equilibrium Test

In order for the test results to be valid, the banking industry should be in the long run equilibrium during the period of test. Since the Panzar-Rosse methodology requires that banks are in a long-run equilibrium, the banking industry is examined by estimating the equations with ROA and ROE as dependent variables. Estimation of these models shows that Ethiopian banks are in equilibrium if value of E = 0. The results of this estimation are presented in Tables 6.

Table 6: Equilibrium test (2010-2016)

ROA				**ROE**		
	Coef.	**t-value**		**Coef.**	**t-value**	
PF	0.011971	2.7115	**	0.005842	0.2223	
PL	-0.00832	-1.6782	*	-0.10169	-3.4438	**
PK	-0.00152	-1.1337		-0.01286	-1.6077	
TL.TA	0.003767	0.4299		0.076324	1.4632	
E.TA	-0.00454	-1.1276		-0.18587	-7.7605	***
LLP.TL	0.00315	1.318		0.009393	0.6602	
T	0.000704	0.7366		0.010268	1.8041	.
R-Squared:	**0.30658**			**R-Squared:**	**0.49434**	
E	**ROA** = 0.002132			**ROE** = 0.108708		

Signif.codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The result of E = 0.002132 indicates that the long term equilibrium hypothesis is accepted for the banking sector in this period of analysis. The equilibrium test was performed to see any impact of explanatory variables on ROA or ROE. The coefficients of PF (unit cost of fund) and PL (price of labor) are the significantly positive coefficient at 0.011971 and -0.00832. On the other hand equilibrium test using ROE as dependent variables, price of labor (PL) and equity to total asset parameter is -0.102 and -0.186 respectively significant at a level of 5% and 1%. The significance of price of fund in the case of ROA shows mobilization of new deposit increase interest expense paid out to customer likewise the bank use the same to farther increase interest income by expanding credit market. So that an increase in price of fund increase loan return or increase return on assets.

The two significant and negative input and control variables coefficient, price of labor and equity to total asset ratio, have inverse relation with return on equity ratio. This relationship happen may be the bank spent on employee training and development or related outlay probably can reduce return on equity. Likewise return on equity reduction in response to equity total asset ratio is because an increase of equity capital reduces ROE because of an increase of equity related cost. In conclusion the estimated equation has good explanatory power because R Square shows the variables considered in the study explain 49.43% of the dependent variables. The hypothesis of equilibrium (E=0) is confirmed for our sample means that our sample data satisfy the long run equilibrium condition and this validate that the Ethiopian banking industry was in the long-run equilibrium over the period 2010 to 2016. Thus it is commendable to use Panzar-Rosse H statistics to undertake competition test for the banking industry.

4.4.2. Competition Tests

Panzar and Rosse (1987) model is one of the widely used techniques to assess competitive conduct of banking industry (Bikker et al., 2009b). This model assesses the impact of changes in factor prices on the revenue under the different market structure.

Hausman test was conducted to choose between fixed and random effect model. In Hausman test, accepted of the alternative hypothesis (p-value: 0.656) validates the assumption that fixed effects model selected as a preferred model. The results of the fixed effect estimates are reported in Table 7. The value of R square demonstrates that the model is statistically significant and it has sufficient explanatory power. All the input price variables coefficients are statistically significant. The sum of the elasticity of factor prices is negative for all dependent variables which suggest that monopoly prevails in the Ethiopian banking industry.

Parera et al., (2006) also reported similar result in a study of African banking sector. The H - tests for perfect competition (H =1) and for monopoly (H =0) are rejected suggesting the presence of monopolistic competition. The coefficients of price elasticity of funds, labor and capital are positive for scaled revenue and statistically significant. Whereas for un-scaled revenue taken as dependent variables as we can see on Table 4 all input factor are negative and PF and PL are statistically significant. The value of H-statistic indicates a there is a monopoly in the Ethiopian banking sector.

Table 7: Competition Test using scaled revenue

	Scaled Revenue				**Un-scaled Revenue**				
	IR.TA		**TR.TA**		**IR**		**TR**		
	Coef.		**Coef.**		**Coef.**		**Coef.**		
PF	-0.26392075	**	-0.510508	**	-0.651033	*	-0.5044515	*	
	(4.1327)		(6.0875)		(0.07527)		(-1.1596)		
PL	0.058129	*	0.1581353	**	0.290677	**	0.3906844	**	
	(1.1045		(0.5383		(0.71014		(-0.5256		
PK	0.01180296		0.01322		-0.053231		-0.0783	.	
	(2.2479)		(-3.4019)		(3.10E-06)		(-8.6964)		
TL.TA	0.87760006	**	0.02623		2.323513	***	1.4721463		
	(6.7761)		(0.1294)		(2.27E-06)		(3.9591)		
E.TA	-0.25017481	***	-0.10237		-2.727544	***	-2.580	***	
	(-7.2535)		(-1.6649)		(1.34E-12)		(-7.7242)		
LLP.TL	-0.03718553		0.025804		0.251505		0.314492		
	(-1.2364)		(0.8978)		(0.23038)		(1.5247)		
T	0.06200201	***	0.006742		0.425515	***	0.370256	***	
	(403.4336)		(1.4105)		(1.90E-08)		(5.2566)		
R-Squared:	0.73854		0.55869		R-Squared	0.66125	0.62635		
H statistics	**-0.194**		**- 0.339**		**-0.414**		**-0.192**		

The values in parentheses are t-statistics.

* Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

In table 7, un-scaled revenue is presented in the first two columns as endogenous variables with regard to competition and the last two column show result of scaled revenue as dependent variables. Moreover, differences in estimated parameters between interest revenue and total revenue can be compared as well. It is worth noticing that alternative specifications generally report similar estimated parameters. The only difference between the choices of scaled or un-scaled revenue and interest revenue or total revenue is the magnitude and significance level of the estimated parameters when we compare estimation results for different pairs of specifications.

Overall as we can see from the table the panzar-Rosse model brought result that shows clear but consistent H statistics estimate. The un-scaled regression both for IR and TR, H-statistics are negative -0.414 and -0.192 respectively. Indeed, this would suggest that the banking industry in Ethiopia operates in monopoly environment during the sample period. As we can see from the estimated values of the H statistic are significantly different from both zero and unity.

Negative H statistics is unexpected parameter for un-scaled revenue. The reason for this is that state owned banks hold the sheer share of Interest revenue and total revenue and much of their income comes from interest earning services. This absolute figure drag the H statistics to negative value of long term monopoly equilibrium or oligopoly discarding the hypothesis of monopolistic competitions or perfect competitions in the short term. This allows us to conclude that total bank revenues appear to be earned in conditions of monopoly or oligopoly market structure. Consequently, any form of conjectural variation monopolistic competitions or perfect competitions can be rejected during the period 2010 to 2016.

Similarly for scaled revenue the H statistics are negative -0.194 and -0.339 for IR to TA ratio and TR to TA ratio respectively. Monopoly power and perfect competitions hypothesis are rejected because none of the result is zero or one. Thus the results show consistency with un-scaled revenue and lead us to conclude that Ethiopian commercial banks operate under the condition of long term monopoly equilibrium during our estimation period (2010-2016), which is not common type of market structure found in other countries by the previous empirical literature. Our conclusion is in line with the result reported by Celik, T. (2006), Trivieri (2012) that also employed the Panzar-Rosse method to analyze the competition condition for commercial banks in Ethiopia for the period of 2008-2012.

In addition the H statistics estimate values for IR ratio is equivalent with TR ratio. This suggests bank do business more on traditionally dominated deposit - loan than other operations that provide non interest earning service. The same situation was also presented in papers by Mamatzakis et al. (2005), Gunalp(2006). Though traditional business is the core activities for commercial banks in Ethiopia, banks fight for deposits and loans, there is substantial increase in fee-based revenue. In general the Ethiopian banking market is characterized by short term monopoly equilibrium during the period of 2010-2016.

When we come to the input price coefficients, price of fund is the first to come. Based on the analysis of price of fund, the author found that using both un-scaled revenue and scaled revenue is accepted at 5% significance level. We notice also the size of parameters of price of fund for total revenue is slightly higher than interest revenue ratio. This reflects both balance sheet activity contribute more than off balance sheet activity to the total revenue, as total revenue include both core business and off balance sheet activities such as fee-based services and other operating revenues. The same case was also found in Italy by Coccorese (2004) and Trivieri (2012) as well as Mamatzakis et al. (2005) in Southern Eastern Europe.

I did also observe a positive and significant level at 5% in all alternative cases for price of labor (PL) and revenue. This suggest that higher labor cost drive bank revenue and also it meant more and better staff expertise lead to quality services that support bank to generate more revenue.

In the case of price of capital (PK), the parameters are positive except IR. But the effect on both the un-scaled revenue and scaled revenue appears to be negligible compared to other two input prices, as the level of parameters is minimal and it is statistically insignificant in all specifications. These results are consistent with previous studies, which found that the impact of the capital factor input price varied by countries and it was the least important component of the H statistic (Molyneux et al. (1996), Bikker and Haaf, (2002), Coccorese(2004) and Matthews et al. (2007)).

Shaffer (2004) found out insignificant effect from the price of capital, and similar results were reported when the factor was excluded. This actually is consistent with the fact that fixed asset investments for banks often take up a very small portion of total asset and the poor quality of capital expenses and fixed assets data. Therefore, the price of capital may not contribute to the explanatory power of the bank revenue, as the major source of revenue is from deposit, loan and other operating activities.

Next control variables TL/TA, E/TA, LLP/TL and dummy T are seen beside the input variables. Total loan to Total Asset ratio increase expected to raise revenue of banks. More loan increase bank credit risk of loss at the same time raise interest revenue. So that we noticed that we need a positive relationship with revenue. The results show that the ratio of total loans to total assets(TL/TA) have the expected positive sign and are significant at 5% for both un-scaled and scaled interest revenue and as dependent variable except for total revenue and TR/TA . This significant positive effect indicates that higher fraction of loans to total assets generate greater interest income though we cannot seen the impact on total revenue and to its asset ratio. This is because the interest income earned slightly higher than income from non-earning assets.

The great uncertainty for the possibility of default make bank loan risky; the more loans reflect more risks associated with banks, so higher revenue should be compensated for the higher risk bear by bank. This result is consistent with the findings reported by Mamatzakis et al (2005), Gunalp and Celik (2006) and Trivieri (2007).

Parameter of equity to total assets ratio (E/TA) is reported with the expected negative sign and also moderately significant at 5% except for total revenue to total asset ratio. Gunalp and Celik (2006) also found significant negative relationship with the absolute level of revenue in Turkey. The negative sign reflects that higher ratio of equity to total asset generate less revenue. More equity in bank reserve, might result less fund to lend or equity related cost increased, thus smaller leverage or cost of equity reduces the revenue bank generate.

As we can see on table 4, the value of R square generally ranged from 55 up to 73% that indicates the good fit of our models and this indicates that explanatory variables can better explain the change in the dependent variables both scaled and un-scaled revenue. Broadly speaking, although there are some variations in R squares for models with different specifications, our regressions generally explain well for all the specifications.

5. Conclusion

This paper examines the competitive condition in the Ethiopian banking industry using concentration ratio, Herfindahl Hirschman and the Panzar-Rosse model. As there is much debate about the choice between the use of scaled and un-scaled revenue as dependent variable, both of them are employed in our model.

As show by the indices of concentration ratios and Herfindahl Hirschman, the market concentration is steady in the Ethiopian banking industry with in the study periods. The attest suggests that the banking industry show little change in terms of concentrations and the revenue behavior is estimated by PR model with an H statistics value indicates the presence of monopoly in the Ethiopian banking industry.

The PR model estimation results revels that all the alternative specifications give clear and consistent values of H statistic with variation in the magnitude. The values of H statistic are significantly different from both zero and unity. The hypothesis of monopoly and perfect competition are strongly rejected for scaled and un-scaled revenue, thus the Ethiopian banking market is characterized by long term equilibrium monopoly or oligopoly structure.

The results are robust to different model specifications and estimation techniques. To assess the validity and objectivity of data statistical test such as Wooldridge test2 has been conducted. Results of those measurements show that it is worthy to use the data and conduct the analysis. Nevertheless, as indicated by the value of H-statistic, there is room for improvement in competitive behavior of Ethiopian commercial banks. Hence, the regulators should give continuity to the ongoing financial sector reformation that may help to increase competitive market behavior. A major policy implication derived from this analysis relates to the fact that the Ethiopian banking system should be subject to transformation. The government works with different stallholders to develop strategies to permit economies of scale in the production and distribution of services and increased risk diversification. These forces have led to competitive environment that lower costs and undoubtedly, increase efficiency.

6. Reference

I. Al-Muharrami, S. and Matthews, K. (2009),'Market power versus efficient-structure in Arab GCC banking',Applied Financial Economics, vol. 19, no. 18, 1487 – 1496.

II. Arrawatia, R. and Misra, A. (2014), Competition, concentration and the relevance of new banks' entry in theIndian banking sector, Global Business Review, 15 (2), 223-236.

III. Bikker, J. A. and Groeneveld, J. M. (1998), 'Competition and concentration in the EU banking industry',Kredit und Kapital, vol.33, no.1, 62–98.

IV. Bikker, J. A. and Haaf, K. (2002), 'Competition, concentration and their relationships: An empirical analysis of the banking industry', Journal of Banking and Finance, vol.26, 2191–2214.

V. Bikker, J.A., Spierdijk, L. and Finnie, P. (2006), 'Misspecification of the Panzar-Rosse Model: Assessing Competition in the Banking Industry', DNB working paper no.114.

VI. Bikker, J.A., Shaffer, S. and Spierdijk, L. (2009a), Assessing competition with the Panzar-Rosse model: The role of scale, costs, and equilibrium, Working Paper. 27/2009, De Nederlandsche Bank, The Netherlands, October, 2009.

VII. Bikker, J.A., Shaffer, S. and Spierdijk, L. (2009b), The Panzar-Rosse revenue test: to scale or not to scale. Paper presented at 22nd Australasian Finance and Banking Conference, August 2009, Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1458889 (accessed 19 November 2014)

VIII. Bikker, J. A., and Bos, J.W.B. (2016), 'Bank Performance: a theoretical and empirical framework for the analysis of profitability, competition and efficiency, London, Routledge.

IX. Bresnahan, T. F. (1982), 'The oligopoly solution concept is identified', Economics Letters, vol.10, 87–92. Casu, B. and Girardone, C. (2009), 'Competition Issues in European Banking', Journal of Financial Regulation and Compliance, vol. 17, no. 2, 119-133.

X. Claessens, S. and Laeven, L. (2004), 'What drives bank competition? Some international evidence', Journal of Money, Credit and Banking, vol. 36, no.3, 563-583.

XI. Coccorese, P. (2004), 'Banking competition and macroeconomic conditions: a disaggregate analysis', Journal of International Financial Markets, Institutions and Money, vol. 14, 203–219.

XII. De Bandt, O. and Davis, P. (2000), 'Competition, contestability and market structure in European banking sectors on the eve of EMU', Journal of Banking and Finance, vol. 24, 1045–1066.

XIII. Gajurel, D.P. and Pradhan, R.S. (2012), Concentration and competition in Nepalese banking, Journal of Business, Economics and Finance, 1 (1), 5-16.

XIV. Gunalp, B. and Celik, T. (2006), 'Competition in the Turkish banking industry', Applied Economics, vol. 38, 1335-1342.

XV. Kashi, F.K. and Beynabadi, J.Z. (2013), the degree of competition in Iranian banking industry: Panzar- Rosse approach, African Journal of Business Management, 7 (43), 4380-4385.

XVI. Hempell, H. (2002),'Testing for competition among German banks', Discussion Paper 04, Economic Research Centre of the Deutsche Bundes bank.

XVII. Hondroyiannis, G., Lolos, S. and Papapetrou, E. (1999), 'Assessing competitive conditions in the Greek banking system', Journal of International Financial Markets, Institutions and Money, vol. 9, 377– 391.

XVIII. Mamatzakis, E., Staikouras, C. and Koutsomanoli-Fillipaki, N. (2005), 'Competition and concentration in the banking sector of the South Eastern European region', Emerging Markets Review, vol. 6, 192-209.

XIX. Mercan, M. (2012), Competitive conditions in the banking industry of Georgian economy: PR H Model, Procedia - Social and Behavioral Sciences, 62, 1260-1264.

XX. Matthews, K. Murinde, V. and Zhao, T. (2007), 'Competitive conditions among the major British banks', Journal of Banking and Finance, vol. 31, 2025-2042.

XXI. Maudos, J. and J. F. de Guevara (2009), 'The Cost of Market Power in Banking: Social Welfare Loss vs. Cost Inefficiency', Journal of Banking and Finance, vol. 31.

XXII. Molyneux, P., Lloyd-Williams, D.M. and Thornton, J. (1994), 'Competitive conditions in European banks, Journal of Banking and Finance, vol. 18, 445– 459.

XXIII. Molyneux, P., Thornton, J. and Lloyd-Williams, D.M. (1996), 'Competition and market contestability in Japanese commercial banking, Journal of Economics and Business, vol. 48, 33– 45.

XXIV. Molyneux, P. and William Forbes (1995), 'Market Structure and Performance in European Banking', Applied Economics, vol. 27,155-159.

XXV. Molyneux, P., Altunbas, Y. and Gardener, E. and Moore, B. (2013), 'Efficiency in European banking', European Economic Review, vol. 45, no. 10, 1931-1955.

XXVI. Nathan, A. and Neave, E. (1989), 'Competition and contestability in Canada's financial system: empirical results', Canadian Journal of Economics, vol. 22, 576–594.

XXVII. Panzar, J.C., and Rosse, J.N. (1987), Testing for monopoly equilibrium, Journal of Industrial Economics, 35 (4), 443-456.

XXVIII. Papadopoulos, S. (2004), 'Market Structure, Performance and Efficiency in European Banking', International Journal of Commerce and Management, vol. 14, no. 1, 79-97.

XXIX. Perera, S., Skully, M. and Wickramanayake, J. (2007), 'Cost Efficiency in South Asian Banking: The Impact of Bank Size, State Ownership and Stock Exchange Listings', International Review of Finance, vol. 7, no. 1, 35-60.

XXX. Shaffer, S. (1994), 'Bank competition in concentrated markets', Federal Reserve Bank of Philadelphia, Business Review.

XXXI. Shaffer, S. (2002), 'Conduct in a banking monopoly', Review of Industrial Organization, vol. 20, no. 3, 221–238.

XXXII. Staikouras, C. and A. Koutsomanoli-Fillipaki (2006), 'Competition and concentration in the new European banking landscape', European Financial Management, vol. 12, no. 3, 443-482.

XXXIII. Trivieri, F. (2012), 'Does cross-ownership affect competition?: Evidence from the Italian banking industry', Journal of International Financial Markets, Institutions and Money, vol. 17, 79-101.

XXXIV. Uddin, S.M.S., & Gupta, A.D. (2012), Concentration and competition in the non- banking sector:

XXXV. Evidence from Bangladesh, Global Journal of Management and Business Research, 12 (8), 81-88.

XXXVI. Vesala, J. (1995), 'Testing for Competition in Banking: Behavioral Evidence from Finland', Bank of Finland Studies, E1, Bank of Finland.

XXXVII. Vives, X. (2001), Competition in the changing world of banking, Oxford Review of Economic Policy, 17 (4), 535-547.

XXXVIII. Weill, L. (2004), 'Measuring Cost Efficiency in European Banking: A Comparison of Frontier Techniques', Journal of Productivity Analysis, vol. 21, 133-152.

XXXIX. Yildirim, H.S. and Philippatos, G.C. (2007),'Competition and contestability in Central and Eastern European banking markets', University of Tennessee, Working Paper, September.