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Do Competition, Size, and Development Indicators Matter for the Efficiency of BRICS Banks?

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Abstract This study investigates the effect of competition, size, and development indicators on efficiency using the panel data of 1137 BRICS (Brazil, Russia, India, China, South Africa) banks over sixteen years 2000-2015. The core finding of the two-step system generalized methods of moments (2GMM) are: (i) Both competition and size have a significant positive association with the efficiency of BRICS banks. (ii) No significant association between inflation and efficiency is observed; whereas, economic progression (gross domestic products) has a positive effect on the efficiency of revenue and inverse effect on cost efficiency. (iii) The interim term size and competition have a homogeneous effect on each type of efficiency; however, the outcomes are heterogeneous when efficiency measures change. Finally, the study evidences the nonlinear relationship of competition, size, and development indicators of BRICS banks.

Keywords: *Competition, Development indicators, Efficiency, BRICS banks, GMM estimator*

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1. Introduction

The impact of competition on banks' performance is a long-standing debated issue among researchers [1] in the last few years. The economic giants say Brazil, Russia, India, China, South Africa (henceforth BRICS) banks become worth considering as a field of study due to their successful survival in the global financial crisis 2007-2008 and fewer banking failure [2,3]. The competition was not treated as a critical factor for the financial sector as most of the nations were not interested in following the standard competition policy. However, in the last few decades, the financial market crisis forced the regulators and policymakers to strengthen the competition policy at the national level [4]. Mentioning competition as an essential factor of efficiency of banks, [5] summarizes six reasons why competition is worth considering factor for the financial system from their literature survey: firstly, to access the financial services for firms and households; secondly, for proper activity performance of financial sector; thirdly, for stability; fourthly, to confirm efficiency; fifthly, to settle a stable market rate and improved monetary policy; and finally, for economic growth and industrial development. Thus, the literature points out the importance of competition in banks' efficiency and the country's economic progress.

BRICS, the fastest growing economy (see Figure 1, the GDP over the years) in the world, contributes almost one-fourth of the world GDP and consists of about 42% of the world population [6]. Economic progress with a large segment of the world population draws the researchers attention to unfold their hidden momentum of fast growth and fewer failure in the crisis [2]. Rapid growth of BRICS nations, fuels researchers to investigate the relationship between risk, competition, and performance [2,7] and concentration risk and performance. However, rare work observed the connection between the competition and efficiency; and competition and development indicators of this region [3]. Figure 1 and Table 1 illustrate the snapshot of GDP and the market concentration of BRICS nations.

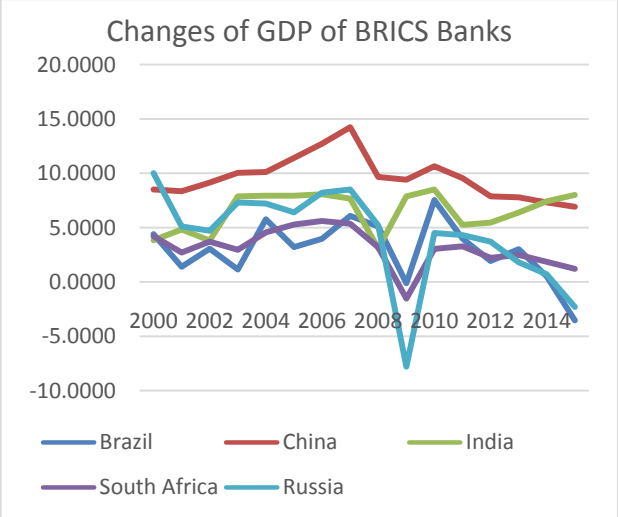

Figure 1. GDP at current USD of BRICS nations

Table 1. Different proxy measures of concentration and inverse measure of competition of BRICS banks

	Brazil			Russia			India			China			South Africa		
Year	LI	HHIA	HHIGL	LI	HHIA	HHIGL	LI	HHIA	HHIGL	LI	HHIA	HHIGL	LI	HHIA	HHIGL
2000	0.1674	0.1235	0.2109	0.3557	0.7419	0.6939	0.1868	0.0717	0.0706	0.2998	0.2623	0.2692	0.2205	n.a.	n.a.
2001	0.1997	0.1133	0.1973	0.3819	0.6569	0.6508	0.1798	0.1278	0.1351	0.3186	0.2623	0.2692	0.1988	n.a.	n.a.
2002	0.2356	0.1293	0.2306	0.2976	0.5975	0.5845	0.2246	0.0549	0.0563	0.3054	0.2623	0.2692	0.3010	n.a.	n.a.
2003	0.2506	0.1431	0.2456	0.2704	0.3383	0.3573	0.2604	0.0653	0.0689	0.3591	0.2623	0.2692	0.2136	n.a.	n.a.
2004	0.2374	0.1427	0.2276	0.2989	0.2551	0.2988	0.3103	0.0732	0.0764	0.3205	0.2623	0.2692	0.0612	0.2808	0.2544
2005	0.2657	0.1132	0.1990	0.2758	0.1701	0.2045	0.2865	0.0823	0.0816	0.3712	0.2268	0.1923	0.1376	0.1915	0.1810
2006	0.2725	0.1153	0.1827	0.2878	0.1117	0.1372	0.2643	0.0787	0.0730	0.3530	0.2255	0.1871	0.1534	0.2129	0.1998
2007	0.2793	0.1173	0.1578	0.2543	0.1128	0.1412	0.2612	0.1279	0.1289	0.3836	0.1671	0.1513	0.1592	0.2097	0.2050
2008	0.1629	0.1425	0.1444	0.2502	0.1021	0.1280	0.2530	0.1238	0.1238	0.3688	0.1550	0.1381	0.1349	0.1989	0.1813
2009	0.3047	0.1330	0.1508	0.0309	0.1000	0.1252	0.2635	0.1130	0.1164	0.3758	0.1318	0.1191	0.1485	0.2012	0.1945
2010	0.3078	0.1110	0.1212	0.0080	0.0975	0.1182	0.2799	0.0962	0.0987	0.4132	0.1178	0.1115	0.1684	0.3179	0.3704
2011	0.2720	0.0990	0.1083	0.0640	0.0981	0.1165	0.2911	0.0583	0.0543	0.3772	0.1114	0.1139	0.2025	0.2310	0.2107
2012	0.2947	0.0951	0.1033	0.0723	0.1101	0.1256	0.2674	0.1015	0.1079	0.3502	0.0969	0.1043	0.2231	0.1836	0.1762
2013	0.2236	0.0990	0.1072	0.0724	0.1108	0.1233	0.2527	0.0895	0.0954	0.3441	0.0930	0.1025	0.2334	0.2052	0.1956
2014	0.2057	0.1052	0.1155	0.0507	0.1185	0.1373	0.2452	0.0915	0.0927	0.3490	0.0886	0.1005	0.2505	0.2121	0.2115
2015	0.1956	0.1050	0.1154	0.0435	0.1230	0.1471	0.2328	0.3276	0.3399	0.3183	0.1077	0.1214	n.a.	0.1630	0.1723

Note: This table shows the different inverse measures of competition from the Year 2000 to 2015. The Lerner Index (LI), Herfindahl–Hirschman Index for (HHIA), and Herfindahl–Hirschman Index for the gross loan (HHIGL) are shown respectively for each of the BRICS country's Banking industry.

This paper aims to revisit the relationship between competition and efficiency of banks and extend the work of [4] on the developed and emerging financial markets. Most of the results examining the competition and performance are based on single countries [1,8] and cross countries [4,9]. Study of BRICS as a region observed in very few research works [3,5]. This literature gap builds our interest to investigate the effect of competition and economic progress on the BRICS nation. This study grounded to answer immediate questions such as (i) How competition and concentration affect banks' efficiency? (ii) How are efficiency and development indicators related? (iii) Do market competition and development indicators heterogeneously affect the efficiency of banks? This paper aims to contribute in the following manner: First, to shed light on the relationship between efficiency and competition (See in Table 1 different inverse proxy measure competition of BRICS banks) and efficiency and development indicators of BRICS banks. Second, to examine the linear and quadratic effect of competition and development indicators that rarely addressed in the literature [6]. Finally, to extend the work by examining the nonlinear impact of development indicators and market concentration, and by showing the size effect of explanatory variables concentration and development indicators to extend the model of [1,4,10].

The rest parts of the study are organized as follows. Section 2 describes the relevant literature of the study; Sections 3 illustrates the data & variables description. Section 4 describes the study's empirical methodology. Section 5 presents the analysis results explaining the relationship between competition and development indicators with nonlinear and quadratic effects. Finally, Section 6 contains the concluding remarks of the study.

2. Literature Review

Two dominant hypotheses explain the interrelationship between risk and efficiency. These are the 'competition efficiency' hypothesis and 'competition-inefficiency' hypothesis. Following the efficient structure of [11], the competition-efficiency hypothesis illustrated by [12]. The authors pinpoint that competition acts as an external force that stimulates banks to serve at a low cost and become cost-efficient. However, size gives banks extra benefits to cope with competition, operates the business in a cost-efficient manner, and have more market power. In a nutshell, the competition-efficiency hypothesis explains that competition leads banks to efficiency. Non-competitive market leads managers to enjoy a 'quiet life'[1] that makes the banks cost-inefficient as managers become unconscious about cost control.

The 'competition-inefficiency' hypothesis illustrates the inverse of the competition-efficiency hypothesis concept. It explains that market competition decreases the efficiency of banks [12]. [12] argue that competition-inefficiency becomes ostensible for several reasons. In the most competitive market, customers enjoy more choices and tend to switch banks to explore more benefits. So banks fall into the position of shorter bank-customer relationship that makes banks more unstable. In a competitive environment, banks are unwilling to involve more resources to have information regarding customers that require to hold existing customers and attract new customers, as they are not in a concern of relationship-building activities in the competitive market environment. Thus in a competitive market, banks need to incur more cost to hold old customers and attract new customers due to information asymmetry and aggressive market effort. Empirical evidence also supports the adverse effect of market competition on the efficiency of banks. For example, [13,14,15], among others, show the adverse effect of market competition over the efficiency of banks. [15] point out that with the increase of new entrants, the efficiency of banks decreases.

Delving the relationship between efficiency and competition, [16] opine that market competition inversely

[1] The "quiet life hypothesis (QLH)" postulates that due to weak monitoring, managers enjoy the market power at the cost of low level of profit and cost saving as they are reluctant to take risky decision.

related to banks' efficiency, whereas the positive association observed a link between market concentration and efficiency. Opposing this view, [17] depicts the positive rapport between market competition and banks' efficiency. The authors opine that market competition exerts a significant positive influence on banks' cost and technical efficiency. Again [18] mention that there is no significant relationship between market competition and banks' efficiency. The authors comment that market competition cannot be detrimental to banks' efficiency gain from the Chinese banking industry survey. But evidence of a significant relationship between market competition and efficiency are also available. [19] show the meaningful relationship between market competition and efficiency of banks. The authors stress that with the increase of efficiency, banks can achieve more market power, and market power also plays a conducive role in enhancing banks' efficiency. Thus literature supports the evidence of the relationship between competition and efficiency of banks. In examining the size effect, [20] comments that there is insufficient evidence regarding the relationship between banks' size and efficiency. The study of [4] also evidenced the association between competition and economic performance from the cross-countries empirical data. [21] opines that a competitive market shows the slow economic growth of a nation. On the contrary, [22] depict the positive association between development indicators like GDP and inflation with banks' performance. To delve, the relationship hypotheses of the study are:

H1: Market competition and development indicators have a significant impact on the cost-efficiency of banks.

H2: Market competition and development indicators have a significant impact on the revenue efficiency of banks.

H3: Impact of competition and development indicators have a heterogeneous effect on the efficiency of banks.

3. Data, Variables Description of the Study

This investigation uses bank-level, industry-level, and macroeconomic control variables. Bank-level controlled variables are collected from the bank-scope database; industry-level and macroeconomic data are collected from the world bank database. The monetary units are expressed in the US dollar and constant price. Finally, we have 9988 bank years' data from 1137 BRICS banks after excluding the dataset's missing data. The following are the details of the collected data.

	No. of Banks	Period	No. of observations
Brazil	131	2000-2015	1191
China	116	2000-2015	758
India	75	2000-2015	672
Russia	790	2000-2015	7221
South Africa	25	2004-2015	146
Total	1137	2000-2015	9988

In selecting data, we consider three years of consecutive data set for consistency. In this section, firstly, we discuss how the competition is measured and then provide the description of other variables.

3.1. Competition Measures

To determine the competition, we use three anti-proxy measures of competition and direct measurements of market power. These measures are Lerner index, Herfindahl– Hirschman Index for assets and Herfindahl–Hirschman Index for gross loan

3.1.1. Lerner Index

Lerner index is a widely used measure of competition in a different study [23,24,25,26]. Theoretically, the index value lies between zero (0) and one (1). The higher the index's value, the greater the market power (Pricing power) and less competitive conditions [6,19]. We also opted for the Lerner index as a proxy measure of market power and inverse measure of competition. The index is given as:

$$Lerner\ Index\left(LI_{jt}\right)=\frac{P_{jt}-MC_{jt}}{P_{jt}}$$

Where LI_{jt} refers the Lerner of j year t time. P_{jt} stands for the price of output of banks; MC_{jt} refers to the marginal cost. The index value we used is collected from the world banks database for the periods.

3.1.2. Hirschman Index (HHI)

By following the study of [1,6,27], among others, we opted for Herfindahl-Hirschman Index as an alternative inverse measure of competition based on assets and gross loans. The index's value is zero (0), which means homogenous firms are operating in the market and vice versa. That means the lower the value, the less the market power and more competitive conditions.

$$HHI=\sum_{i=1}^{n}\left(Market\ share_i\right)^2$$

The market share refers to the particular firm proportion to its total industry value; by adding the square term of the ratio, the index is derived. Using the formula, we determine two market power measures, the HHIA-Herfindahl-Hirschman Index for Assets and HHIL-Herfindahl-Hirschman Index for gross loans for the study.

3.2. Efficiency Measure

We opt for SFA to determine cost and revenue efficiency using the Bankscope database's information. SFA is also used by different empirical study say [3,4,7,28,29], among others. Using SFA FRONTIER - Version 4.1c, we determine the efficiency value of cost and revenue; and uses values derived in further examination of the relationship. The details of the estimation are given in Appendix A. Table 2 explains the detailed description and sources of all variables.

Table 2. Description of variables of the study

Classification	Variables	Description	Reference/source
Dependent Variable			
Efficiency of cost	Eff_cost	Efficiency of cost measured through SFA	[4,30,31]
Efficiency of Revenue	Eff_Rev	Efficiency of revenue measured through SFA	[32,33]
Independent variable			
Macroeconomic Variable:			
Growth of gross domestic product	GDP	Gross domestic product at current USD.	World Bank data: World development indicators (web: http://databank.worldbank.org)
Inflation	Inflation	Inflation, consumer prices (annual %) in each country	World Bank data: World development indicators (web: http://databank.worldbank.org)
Bank-level control variables:			
Risk	NPL	Amount of non-performing loans over total loans.	[2,34,35,36,37]
Capitalization	Cap to TA	Owner's equity to total assets	Bankscope database
Profitability	ROA	Return on assets	[4,38,39]
Revenue diversification	RD	Revenue diversification = Non-interest income to Total operating income ratio	[3,40,41].
Size	SIZE	Natural logarithm of total assets	Author's Calculation
Industry-Level variables:			
Banking sector Development	BSD	Banking industry asset to gross domestic product	World Bank data: Global Financial Development (web:http://databank.worldbank.org)
Lerner Index	LI	The inverse measure of competition	World Bank data: Global Financial Development (web:http://databank.worldbank.org)
Herfindahl– Hirschman Index for Assets	HHIA	The sum of squared market share based on bank assets	[2,6,8]
Herfindahl– Hirschman Index for Gross Loans	HHIGL	The sum of squared market share based on loans and advances	[2,42]

Source: Authors' compilation using the literature and source mentioned in the fourth column of the table.

4. Research Framework

This study opted for the System Generalized Method of Moments (GMM) approach to investigate the effect of competition and development in the cost and revenue efficiency of BRICS banks. Using the panel data, we run the regression equations and observe the endogeneity and heteroskedasticity problems. System GMM suggested by [43] and [44] is applied for our dynamic panel data to address the endogeneity and unobserved heteroskedasticity and autocorrelation problems of the model [2,30,45,46]. The empirical model of the study is structured as follows:

$$Y_{i,t} = \beta_0 + \beta_1 Y_{i,t-1} + \sum_{j=3}^{4} \beta_j X_{i,j,t} + \sum_{l=5}^{6} \beta_l X_{i,l,t} + \sum_{k=7}^{9,10} \beta_k X_{i,k,t} + \varepsilon_{i,t} \quad (1)$$

Where the dependent variable $Y_{i,t}$ presents cost and revenue efficiency. In the Equation, 'i' subscript refers to the cross-sectional dimension across banks, and subscript *j*, *l*, *k* indicates macro-economic, industry-level, and bank-level control variables, respectively. '*t*' denotes the time dimension (i.e., t = 2000, 2001, 2002,…., 2015). One year lagged dependent variable represented by $Y_{i,t-1}$.

The $X_{i,j,t}$ are the macroeconomic control variables: the gross domestic products (GDP) and inflation. The $X_{i,j,t}$ represents the industry level control variables: banking sector development (BSD) and Competition measures (LI, HHIA, HHIGL) at t period. The $X_{i,k,t}$ present the banks level control variables of bank '*i*' at '*t*' period. Bank-level control variables are capital to total assets (Cap to TA), return on assets (ROA), size for the efficiency of cost, revenue diversification (RD), risk (NPL), return on assets (ROA), and size for the efficiency of revenue measures.

We extend our baseline model to address the size effect and nonlinear effect on bank competition and development indicator.

Assuming the heterogeneous behaviour of bank in a competitive environment and size, the extended model is as follows:

$$Y_{i,t} = \beta_0 + \beta_1 Y_{i,t-1} + \sum_{j=2}^{3} \beta_j X_{i,j,t} + \sum_{l=4}^{5} \beta_l X_{i,l,t} + \sum_{o=6}^{7} \beta_o S * Com_{i,o,t} + \sum_{p=8}^{9} \beta_p S * Com_{i,p,t}^2 + \sum_{q=10}^{11} \beta_q S * GDP_{i,q,t} + \sum_{r=12}^{13} \beta_r S * GDP_{i,r,t}^2 + \sum_{k=14}^{15,16} \beta_k X_{i,k,t} + + \varepsilon_{i,t} \quad (2)$$

Where the variable *Com* and $Com_{i,t}^2$ refer 'Competition measure' and 'the squared term of competition' and *S* indicates 'large and small bank size' (Large bank derived by the subtracting average industry assets from the particular bank asset whereas Small bank derived by subtracting particular bank asset from the average industry assets).

Small and Large banks labelled as *Model I* and *Model II* respectively in extended results. Product of size and competition (nonlinear effect of competition) denote by, $S * Com_{i,o,t}\left(S * Com_{i,p,t}^2\right)$. Inverse competition measure (LI, HHIA, HHIGL) refers to the market concentration,

and the greater value of coefficient indicates the highly concentrated market and less competitive. $S*GDP_{i,q,t}$ $\left(S*GDP_{i,r,t}^{2}\right)$ denote the interactive term between size and gross domestic products (nonlinear effect). A higher positive (negative) value of this coefficient refers to the increasing (decreasing) efficiency of different size banks through economic progress.

5. Analysis of the Study

This section discusses the descriptive statistics (see Table 3) of variables and evaluates the multicollinearity through the correlation matrix (see Table 4). Subsequently, we explain the empirical finding to the study regarding the impact of competition and development indicators on bank efficiency (see Table 5 - Table 6). Nonlinear and quadratic effect of development indicators and competition by considering size discuss in Table 7 and Table 8. Small and large-sized banks are labelled as Model I and Model II, respectively, in Table 7 and Table 8. All Tables (Table 5 - Table 8) present the regression results of the two-step system GMM by applying different competition measures.

5.1. Descriptive Statistics and Correlation Analysis

Summary statistics of the variables are presented in Table 3. The mean value of Efficiency of cost is 6.94, and the efficiency of revenue is about 0.32. The competition measure LI shows the mean value of 0.1630 refers to the fact that the BRICS banks are less concentrated and more competitive. The average value of HHIA and HHIGL is also less than 0.20, which means that banks are gaining less market power over the asset and gross loan in the BRICS region. That means the competitive condition exists in the bank. The average value of LI, HHIA, HHIGL of the latest three years is getting less than the overall mean value of concentration in all countries (see Appendix B). Thus it is confirmed that the market competition of BRICS countries is increasing day by day.

The average of small size and large size banks are 11593 and 11594 million USD, respectively. Capital to total assets that means a proportion of equity to total asset shows the average figure of about 22.21%, which depicts that BRICS banks are higher capitalized over European [18], Asian [2,47] and developing economies [5]. The average values of other variables are also presenting in the 2nd column of the table.

Table 3. Descriptive Statistics of variables

	Mean	Minimum	Maximum
Eff_cost	6.9395	1.0071	2194.4
Eff_Rev	0.3201	0.0003	0.9702
Size	5.7081	-1.9743	15.0455
Small bank	11593	0.0000	311962
Large bank	11594	0.0000	3181862
ROA	1.601	-46.0140	58.436
NPL	264.137	0.0000	112100
Cap to TA	0.2221	0.0000	39.2852
BSD	37.6097	13.3163	64.4129
LI	0.163	0.0080	0.4132
HHIA	0.1204	0.0549	0.7419
HHIGL	0.1411	0.0543	0.6939
Inflation	10.7476	-0.2105	37.6979
GDP	2001596	228590	11016000
No. of Observations		9988	

Note(s): This table presents the mean, minimum, and maximum value of the variables used in regression models. The efficiency of Cost (Eff_cost) and Efficiency of Revenue (Eff_Rev) are dependent variables, and The Lerner Index (LI), Herfindahl-Hirschman Index for assets (HHIA), Herfindahl-Hirschman Index for gross loans (HHIGL) are used as an inverse proxy measure of competition. All figures are in million USD, whereas applicable.

Table 4. Correlation matrix

	Eff_Cost	Eff_Rev	size	BSD	LI	HHIA	HHIGL	Inflation	GDP	ROA	RD	Cap to TA	NPL
Eff_Cost	1												
Eff_Rev	-0.0194*	1											
Size	0.0787***	0.4005***	1										
BSD	0.1268***	0.0925***	0.4871***	1									
LI	-0.0055	-0.0198**	0.3719***	-0.0192*	1								
HHIA	0.1272***	-0.0817***	-0.0256***	-0.2478***	0.2641***	1							
HHIGL	0.0926***	-0.1565***	-0.1219***	-0.3365***	0.2418***	0.9378***	1						
Inflation	-0.0460***	-0.1670***	-0.3300***	-0.5641***	0.0397***	0.1780***	0.2334***	1					
GDP	-0.0714***	0.4119***	0.4293***	0.2501***	0.2764***	-0.1996***	-0.3048***	-0.3191***	1				
ROA	0.0154	0.0131	-0.0799***	-0.0469***	0.0183*	0.0283***	0.0575***	0.0515***	-0.0575***	1			
RD	-0.0294***	0.1196***	-0.4707***	-0.2503***	-0.5229***	-0.1309***	-0.1211***	0.1198***	-0.1753***	0.0875***	1		
Cap to TA	-0.0061	-0.0144	-0.0666***	0.019	0.0013	0.0029	0.0289	0.0037	-0.0366*	-0.0646***	0.0129	1	
NPL	0.0683***	0.2160***	0.2882***	0.0880***	0.1001***	0.0466***	0.013	-0.0801***	0.1005***	-0.0209**	-0.0976***	-0.0181	1

Note(s): ***,**, * Pearson's Correlation is significant at 1%, 5%, and 10% respectively (2-tailed). The efficiency of cost and Efficiency of revenue are used as dependent variables in the regression models. The Lerner Index (LI), Herfindahl-Hirschman Index for assets (HHIA) and Herfindahl-Hirschman Index for gross loans (HHIA) are used as an inverse measure of competition.

Pearson's correlation coefficients matrix is presented in Table 4. In Table 4, we observe no coefficient value possess a high degree of correlation between the independent variables, so it can be assumed that our models are free from significant multicollinearity problems.

Table 5. Effect of competition and development indicators on Efficiency of cost

Variable	Competition measure		
	LI	HHIA	HHIGL
	Coefficient		
Cap to TA	0.052585***(14.66819)	0.046424***(14.10678)	0.058565***(10.22582)
LI	-2.365152***(-4.96015)		
HHIA		-8.0748***(-6.67515)	
HHIGL			-11.60123***(-4.70267)
ROA	0.10626***(7.822306)	0.096283***(8.553134)	0.107206***(7.918169)
BSD	0.02979***(4.679907)	0.013619*(1.78925)	0.003721(0.336527)
SIZE	0.059931***(3.307963)	0.048164***(3.048319)	0.026063*(1.779657)
Inflation	1.29E-02(0.747357)	-2.02E-03(-0.11746)	-2.03E-02(-0.79196)
GDP	-9.46E-14***(-4.41764)	-1.73E-13***(-8.96683)	-2.30E-13***(-7.1547)
Eff_cost (-1)	0.787875***(278.5416)	0.790724***(306.5174)	0.790508***(361.3652)
C	-0.23222(-0.50395)	1.374262**(2.378424)	2.963185***(3.326836)
Adjusted R-squared	0.9881	0.988942	0.988876
Hausman test, F (p-value)	9.191395(0.0000)	34.06087(0.0000)	25.6701(0.0000)
White test of Heteroskedasticity, F(p-value)	5.466228(0.0000)	7.218615(0.0000)	6.226901(0.0000)
Serial correlation LM test (p-value)	0.0000	0.0000	0.0000
Sargan test (p-value)	0.197252	0.152906	0.217001
Panel Fixed/Random effect (p-value)	1.0000	1.0000	1.0000
No. of Banks	1137	1137	1137
Observations	8851	8851	8851

Note(s): Empirical results of the GMM panel estimator present in the table. The efficiency of cost is the dependent variable measured through SFA. LI, HHIA, HHIGL are the inverse competition measures. The values show in parenthesis are t-values, ***, ** and * indicates significant at 1%, 5% and 10% respectively. For the Hausman-test and White test of Heteroskedasticity, p-values are in parentheses. Serial correlation LM test, Sargan test, and Panel-Fixed/Random effect test results are presented by the p-values.

Table 6. Effect of competition and development indicators on Efficiency of Revenue

Variable	Competition measure		
	LI	HHIA	HHIGL
	Coefficient		
NPL	-6.28E-07***(-9.59301)	-5.91E-07***(-6.77712)	-5.59E-07***(-6.25839)
LI	-2.03E-02***(-6.85875)		
HHIA		-0.017786***(-2.83805)	
HHIGL			-0.035932***(-9.25033)
ROA	-0.000322***(-5.63345)	-0.000434***(-5.10551)	-0.000373***(-4.51994)
BSD	-4.27E-04***(-13.5129)	-0.000453***(-15.5044)	-0.000492***(-22.7514)
SIZE	2.72E-04**(1.997224)	0.000163(0.861366)	-1.50E-05(-0.09289)
Inflation	2.16E-05(0.851177)	-6.48E-05(-0.79302)	-9.91E-05(-1.28866)
GDP	7.77E-16***(4.161155)	3.36E-16*(1.761659)	1.68E-16(1.069612)
RD	0.000671***(3.302339)	0.001138***(3.740582)	0.001123***(3.943303)
Eff_rev(-1)	1.004412***(653.1881)	1.004189***(505.2775)	1.004646***(592.744)
C	0.027274***(14.85897)	0.028423***(8.426583)	0.03512***(13.9713)
Adjusted R-squared	0.997487	0.99722	0.997422
Hausman test, F (p-value)	211.3542(0.0000)	261.0412(0.0000)	272.6308(0.0000)
White test of Heteroskedasticity, F (p-value)	526631.8(0.0000)	876130(0.0000)	290955(0.0000)
Serial correlation LM test (p-value)	0.0000	0.0000	0.0000
Sargan test (p-value)	0.087315	0.111472	0.125051
Panel Fixed/Random effect (p-value)	1.0000	1.0000	1.0000
No. of Banks	1137	1137	1137
Observations	8851	8851	8851

Note(s): Empirical results of the GMM panel estimator present in the table. The efficiency of revenue is the dependent variable measured through SFA. LI, HHIA, HHIGL are the inverse competition measures. The values show in parenthesis are t-values, ***, ** and * indicates significant at 1%, 5% and 10% respectively. For the Hausman-test and White test of Heteroskedasticity, p-values are in parentheses. Serial correlation LM test, Sargan test and Panel-Fixed/Random effect test results are presented by the p-values.

5.2. Effect of Competition and Development Indicator over Efficiency of Banks

Two alternative measures of bank efficiency are used to examine the effect of competition and development indicators. Table 5 - Table 6 portrays the GMM estimators of Equation (1) by applying an alternative measure of competition LI, HHIA, and HHIGL. Table 5 - Table 6 presents the effect of competition and development indicators over the efficiency of cost and revenue, respectively. The coefficient of lagged dependent variable of efficiency is significant, which implies the dynamic nature of the model and persistently determined from one year to year (Table 5 - Table 6). In Table 5(6), we observe the coefficients of LI, HHIA, and HHIGL are significant and negatively related to the efficiency of cost (revenue), indicating a negative impact of market power over the efficiency of BRICS banks. The coefficient of HHIA and HHIGL refers that both asset and loan concentration decreases the efficiency of BRICS banks. That means increased market competition leads the BRICS banks toward revenue and cost-efficiency. These results are in line with the finding of [2], [10], and [6] and also reinforce the 'quiet life' hypothesis on BRICS countries.

The coefficient of industry-level control variable BSD shows the positive (negative) association with the efficiency of cost (revenue) in Table 5(6). It signifies that with the banking sector development, the efficiency of cost (revenue) increases (decreases). These results support the previous study of [2] and [6]. The macro-economic variable-inflation shows no significant relationship with banks' efficiency, whereas economic progression-GDP shows a significant negative (positive) association with the efficiency of cost (revenue). One possible reason for such association is that with economic progression, banks' overall loan exposure increases, positively affecting their revenue efficiency and inversely affects the cost efficiency due to low monitoring of loans and advance and proportionate growth of non-performing loans.

Moreover, additional fund demand may stimulate banks to aggressive banking that increases the cost of the fund. These results are analogues with the empirical studies of [4]. With the increase of assets exposure, i.e., banks' size efficiency also increases, denoted by the significant positive coefficient of size. In explaining other bank-level control variables in the efficiency of the cost model, we observe that capitalization (cap to TA) and profitability (ROA) enhance the cost efficiency of banks. It means that capitalized banks are more cost-efficient than low capitalized counterparts. Again performance through return on assets also amplifies the efficiency of banks.

Like the previous study of [39,48,49,50,51], the finding of this study also spectacles a negative association of risk and efficiency (see Table 6) of banks. [39,49] support the moral hazard hypothesis[2] against the negative relationship between efficiency and risk. Again, [50] opine that banks' risk is subject to low cost and revenue efficiency. The negative coefficient of ROA in the revenue model's efficiency depicts banks having more profit but are gaining less revenue efficiency than other counterparts. Diversified sources of income act positively in banks' efficiency, denoted by RD's significant positive coefficient in the efficiency of revenue model [30].

5.3. The Nonlinear and Quadratic Effect of Competition and Development Indicators

Following the study of [2,9,10], we also use square terms of market competition and development indicators to delve into the nonlinear relationship between competition, development indicators, and banks' efficiency. Table 7 - Table 8 presents the GMM estimators having a nonlinear impact using Equation (2).

In examining the size and competition impact, we observe that size and market competition have a homogeneous effect on the efficiency of cost. The interim term Small × Com (Large × Com) coefficients in all inverse competition measures (HHIA and HHIGL measures) have found positive and significant. It refers to the increase in market competition; the cost efficiency of BRICS banks decreases irrespective of size. However, in the long run, the efficiency increases, denoted by the size × competition square term (a square measure of competition) at HHIA in Model I and HHIA & HHIGL in Model II. The efficiency of cost behaves just in the opposite pattern of competition in the economic progression. In the economic progress, i.e., with the increase of GDP, the cost efficiency of BRICS banks initially increases (observed through the interim term of size and GDP) and subsequently decreases (observed through square term of size and GDP) at Model I-II in HHIA and HHIGL measures.

The revenue efficiency measure discloses some interesting facts of BRICS banks (see Table 8). Market competition and development indicators (GDP) have a meaningful association with small banks' revenue efficiency. Large banks have shown a significant association with revenue efficiency in LI measure. However, no significant association is observed between GDP and revenue efficiency of large banks. Small banks' revenue efficiency of BRICS nations in competitive market situation initially increase and decrease in the long run where large banks also show the same trend in the short-run. With the GDP growth, small banks' revenue efficiency initially decreases then increases in the long run.

Thus, competition and development indicators have a homogeneous effect on different size of BRICS banks in each efficiency measures; however, their effect is heterogeneous when the efficiency measure is different.

Few studies address that competition influences the performance, measured through efficiency [6,9]. We extend their works by introducing size, competition, and development indicators effect through linear and quadratic examination. Moreover, this study covers the GDP of examining joint effect competition and development indicators in different BRICS banks' efficiency exposure.

[2] Moral hazard hypothesis holds that low capital ratio induces banks to take riskier project resulting increased credit risk in future.

Table 7. Quadratic Effect of Competition and Development indicator on Efficiency of cost

Variable	Competition measure LI		Competition measure HHIA	
	Model I	Model II	Model I	Model II
	Coefficient		Coefficient	
Cap to TA	0.030051**(2.296996)	0.041074***(6.131207)	0.032111***(4.080931)	0.046945***(7.64974)
Comp	-0.9576(-0.79443)	-1.76394(-1.18093)	-12.1297**(-1.98233)	-2.40258(-0.65337)
ROA	0.068733***(3.753042)	0.084141***(4.362952)	0.073127***(5.050591)	0.067236***(4.684741)
BSD	0.009644*(1.727543)	0.026183***(4.286154)	0.002029(0.284754)	0.008245(0.976525)
Inflation	0.008688(0.864588)	0.006686(0.418142)	0.003251(0.224986)	-0.02636(-1.07675)
GDP	-4.54E-15(-0.07292)	-1.04E-13**(-2.15995)	-3.41E-14(-0.85068)	-1.53E-13***(-6.5046)
Eff_cost(-1)	0.789171***(250.3706)	0.789193***(225.7462)	0.789968***(334.7987)	0.790262***(297.1646)
Small × Com	0.000114***(3.437289)		0.000875***(3.081812)	
Large × Com		4.87E-05(1.041831)		0.000528***(5.213531)
Small × Com^2	-2.42E-04(-1.4358)		-0.0025**(-2.10783)	
Large × $Comp^2$		-0.00016(-0.9263)		-0.00241***(-3.38341)
Small × GDP	-1.11E-17(-0.70627)		-2.48E-17***(-3.76475)	
Large × GDP		7.81E-19(0.056457)		-6.86E-18***(-4.5932)
Small × GDP^2	7.47E-31(0.624418)		1.78E-30***(3.281972)	
Large × GDP^2		-4.32E-32(-0.04208)		3.98E-31**(2.359171)
C	0.624683(1.945874)	0.386725(0.954908)	2.364308***(2.899516)	1.385973*(1.85459)
Adjusted R-squared	0.988185	0.98811	0.989097	0.989246
White test of Heteroskedasticity, F(p-value)	7.271755(0.0000)	3.338444(0.0000)	9.882223(0.0000)	5.300833(0.0000)
Serial correlation LM test (p-value)	0.0000	0.0000	0.0000	0.0000
Sargan test (p-value)	0.094258	0.106985	0.061646	0.0645001
Panel Fixed/Random effect (p-value)	1.0000	1.0000	1.0000	1.0000
No. of Banks	1137	1137	1137	1137
Observations	8851	8851	8851	8851

Variable	Competition measure HHIGL	
	Model I	Model II
	Coefficient	
Cap to TA	0.041524***(4.581654)	0.04237***(2.733631)
Comp	-11.455***(-3.3693)	20.77235(1.013025)
ROA	0.093805***(5.125188)	0.034966(0.650103)
BSD	-0.00088(-0.10209)	0.006695(0.417513)
Inflation	-0.00213(-0.11395)	-0.06096(-1.11557)
GDP	-1.60E-13***(-4.40407)	-8.50E-14(-1.12064)
Eff_cost(-1)	0.789796***(281.3946)	0.790161***(194.8097)
Small × Com	0.00053**(2.067485)	
Large × Com		0.002019**(2.432194)
Small × Com^2	-0.00159(-1.33209)	
Large × $Comp^2$		-0.01186**(-2.04617)
Small × GDP	-1.71E-17***(-3.40885)	
Large × GDP		-1.31E-17***(-3.22383)
Small × GDP^2	1.29E-30***(2.897197)	
Large × GDP^2		4.99E-31(1.064401)
C	3.089282***(4.933981)	-1.60724(-0.52917)
Adjusted R-squared	0.988956	0.987648
White test of Heteroskedasticity, F(p-value)	12.00296(0.0000)	4.626419(0.0000)
Serial correlation LM test (p-value)	0.0000	0.0000
Sargan test (p-value)	0.069711	0.063954
Panel Fixed/Random effect (p-value)	1.0000	1.0000
No. of Banks	1137	1137
Observations	8851	8851

Note(s): Empirical results of GMM panel estimator present in the table by using Equation (2). The efficiency of cost is the dependent variable measured through SFA. LI, HHIA, HHIGL are the inverse competition measures denoted by comp in the variable list. Size of banks categorized by small and large size of banks. Small × Com (Large × Com) and Small × Com^2 (Large × Com^2) denotes the quadratic term of size and market competition. Small × GDP (Large × GDP) and Small × GDP^2 (Large × GDP^2) are used as the quadratic term of size the development of indicators. The values show in parenthesis are t-values, ***, ** and * indicates significant at 1%, 5% and 10% respectively. For the Hausman-test and White test of Heteroskedasticity, p-values are in parentheses. Serial correlation LM test, Sargan test, and Panel-Fixed/Random effect test results are presented by the p-values.

Table 8. Quadratic effect of competition and Development indicator on efficiency of revenue

Variable	Competition measure LI		Competition measure HHIA	
	Model I	Model II	Model I	Model II
	Coefficient		Coefficient	
NPL	-5.39E-07***(-3.06216)	7.51E-06***(2.371084)	-5.45E-07*(-1.93869)	8.23E-06**(2.477942)
Com	-0.03352***(-6.8532)	0.004582(0.115414)	-0.06532(-0.83963)	0.012564(0.225084)
ROA	-0.00026***(-3.43016)	-8.77E-06(-0.03408)	-0.00033***(-4.06384)	7.06E-05(0.646821)
BSD	-0.00041***(-7.97424)	-0.00036***(-5.1953)	-0.00038***(-6.41729)	-0.00031***(-2.85445)
Inflation	2.56E-05(0.310416)	2.96E-05(0.39952)	-1.76E-05(-0.14509)	7.86E-05(0.453028)
GDP	1.84E-15**(2.182885)	2.10E-15*(1.913837)	9.73E-16(0.884562)	2.79E-15***(3.074944)
RD	0.003279***(2.638523)	0.003118(0.620128)	0.001438***(3.080782)	-0.00174(-1.39176)
Eff_rev(-1)	0.999479***(256.0875)	0.991488***(69.82438)	0.998148***(153.2188)	0.997426***(99.11662)
Small × Com	-4.72E-07**(-2.43274)		-5.77E-06(-1.18486)	
Large × Com		‘-2.94E-06*(-1.67409)		-5.89E-07(-0.09529)
Small × Com^2	1.93E-06*(1.912079)		2.78E-05(0.976571)	
Large × Com^2		3.70E-06(0.420968)		-7.83E-06(-0.28292)
Small × GDP	-4.10E-20(-0.44856)		9.26E-20**(2.541106)	
Large × GDP		1.40E-19(0.766254)		1.93E-20(0.195325)
Small × GDP^2	1.85E-33(0.293031)		-6.32E-33**(-2.11957)	
Large × GDP^2		-9.34E-33(-0.69713)		-2.21E-33(-0.33869)
C	0.03069***(10.77878)	0.019006*(1.730561)	0.032038**(3.273905)	0.012285(1.590834)
Adjusted R-squared	0.997585	0.981414	0.996657	0.974725
White test of Heteroskedasticity, F(p-value)	48.90579(0.0000)	11.38525	48.82645(0.0000)	7.627213(0.0000)
Serial correlation LM test (p-value)	0.0000	0.0000	0.0000	0.0000
Sargan test (p-value)	0.055645	0.983943	0.062541	0.401338
Panel Fixed/Random effect (p-value)	1.0000	1.0000	1.0000	1.0000
No. of Banks	1137	1137	1137	1137
Observations	8851	8851	8851	8851

Variable	Competition measure HHIGL	
	Model I	Model II
	Coefficient	
NPL	-3.87E-07**(-2.02097)	1.27E-05**(2.159026)
Com	-0.02071(-0.58022)	0.036853(0.523409)
ROA	-0.00031***(-2.72061)	0.000129(0.800235)
BSD	-0.00042***(-7.65875)	-0.00029**(-2.07152)
Inflation	-9.93E-05(-1.02121)	7.63E-05(0.365216)
GDP	4.86E-16(0.550678)	3.47E-15*(1.860748)
RD	0.004168***(2.893348)	-0.00308(-1.51478)
Eff_rev(-1)	1.001265***(299.3078)	0.986163***(85.57545)
Small × Com	-2.91E-06(-1.08771)	
Large × Com		-4.54E-06(-0.80542)
Small × Com^2	9.93E-06(0.701255)	
Large × Com^2		5.42E-06(0.188697)
Small × GDP	9.59E-20***(3.325809)	
Large × GDP		9.76E-20(1.004896)
Small × GDP^2	-7.41E-33***(-3.46019)	
Large × GDP^2		-7.25E-33(-1.08793)
C	0.028686***(4.051497)	0.009002(0.419438)
Adjusted R-squared	0.997378	0.959471
White test of Heteroskedasticity, F(p-value)	49.22236(0.0000)	9.409764(0.0000)
Serial correlation LM test (p-value)	0.0000	0.0000
Sargan test (p-value)	0.058004	0.874494
Panel Fixed/Random effect (p-value)	1.0000	1.0000
No. of Banks	1137	1137
Observations	8851	8851

Note(s): Empirical results of GMM panel estimator present in the table by using Equation (2). The efficiency of revenue is the dependent variable measured through SFA. LI, HHIA, HHIGL are the inverse competition measures denoted by comp in the variable list. Size of banks categorized by small and large size of banks. Small × Com (Large × Com) and Small × Com^2 (Large × Com^2) denotes the quadratic term of size and market competition. Small × GDP (Large × GDP) and Small × GDP^2 (Large × GDP^2) are used as the quadratic term of size the development of indicators. The values show in parenthesis are t-values, ***, ** and * indicates significant at 1%, 5% and 10% respectively. For the Hausman-test and White test of Heteroskedasticity, p-values are in parentheses. Serial correlation LM test, Sargan test and Panel-Fixed/Random effect test results are presented by the p-values.

6. Concluding Remarks

Bank, the well-known dominant and significant player of the financial system, actively plays a role in circulating economic flow and economic progression. Hence, it is worth considering the factors that affect the efficiency of banks.

Our study differentiates from existing literature in several aspects. Firstly, most of the works are done by examining the competition, performance & inefficiency of banks based on single countries [4]. So we fill up the gap of existing literature by introducing the effect of size, competition & development indicators in the efficiency of BRICS banks. Secondly, this study is original in the sense that it shows the impact of competition & development indicators on the efficiency of revenue & cost by using the two-step system GMM of BRICS banks. In analyzing descriptive statistics, it is found that market competition of BRICS countries banks is increasing day by day as the mean of Linder Index (LI) & Hirschman Index (HHI) of latest 3 years are getting less than the overall mean value of all concentration in all countries. Aftermaths of baseline and extended regression results, it is observed that bank competition & development indicators substantially impact the efficiency in the region. The main results find that the coefficient of LI, HHIA & HHIGL, i.e., market power have a negative impact over the efficiency of BRICS banks. It indicates that the increase of market competition leads the BRICS banks to revenue & cost efficiency, which confirms the "Competition–efficiency" hypothesis.

The findings also suggest that there is a nonlinear relationship between competition, development indicators, and efficiency. Extended results also depict that competition has a similar effect on the different size of banks on each type of efficiency; however, the competition and size heterogeneously affect banks' efficiency. Moreover, the quadratic effect of competition also found heterogeneity on the efficiency of BRICS banks.

In economic progression, the revenue and cost efficiency also behave differently. With economic progress, the cost efficiency decreases and revenue efficiency increases. By examining the size & competition impact, it is shown that size and market competition have a homogeneous effect on the efficiency of cost and efficiency of revenue. However, the results are heterogeneous in different efficiency measures. The nonlinear relationship also suggests that small and large banks become more revenue efficient initially in a competitive market than in the long run. Thus it can be said that competition & development indicators heterogeneously affect the efficiency of banks. Finally, further study can be extended by focusing on developed regions on the tilted study. Other efficiency measures like human capital efficiency and stability efficiency can also be absorbed to extend further research.

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Appendix A

Determination of Cost and Revenue Efficiency Using Stochastic Frontier Analysis (SFA).

The stochastic frontier analysis originated by [52] is used to calculate each bank's efficiency based on the production frontier. On this production frontier model, the stochastic cost frontier model was developed (For details, see [39,53]). According to this methodology, due to inefficiency and random noise, a bank's observed cost is formulated to deviate from the cost-efficient frontier [54].

For the nth Bank,

$$Ln\ TC_n = f\left(ln\ Q_i, lnP_j\right) + \varepsilon_n \quad (1)$$

Where TC_n represents total operating cost, including financial costs, Q_i indicates three outputs, i.e. Q_1=Gross loans and advances, Q_2= Deposit and short-term funding, Q_3= Total security. Pj stands for two input prices, i.e. P_1= price of the fund, which is the ratio of total interest expenses to total deposit, P_2= Price of physical capital, which is non-interest

expenses to fixed assets. ε_n shows the deviation of the actual total cost of a bank from the cost-efficient frontier, and it has two disturbance terms given as below:

$$\varepsilon_n = V_n + U_n$$

Where V_n is the random error term, and we assume that this is independent and identically distributed N $(0,\sigma_v^2)$. U_n represents cost inefficiency and assumed to be distributed independently of V_n and a half-normal distribution, i.e. N $(0,\sigma_u^2)$.

By using the intermediation approach [55] and by following [54], we have developed the following multiproduct translog cost function to specify the cost function:

$$\begin{aligned} LnTC = \alpha + \sum_i \alpha_i lnQ_i + \sum_j \beta_j lnP_j + 1/2 \sum_i \sum_k \gamma_{ik} lnQ_i lnQ_k \\ + 1/2 \sum_j \sum_h \delta_{jh} lnP_j lnP_h + \sum_i \sum_j \lambda_{ij} lnQ_i lnP_j + \varepsilon \end{aligned} \quad (2)$$

According to [56], the expected value of U_n, on conditional ε_n, represents the cost-inefficiency of bank n (which is defined as C_n).

$$C_n = E\ U_n / \varepsilon_n = \left[\sigma\lambda/(1+\lambda^2)\right]\left[\varphi(\varepsilon_n\lambda/\sigma)/\phi(\varepsilon_n\lambda/\sigma) + \varepsilon_n\lambda/\sigma\right] \quad (3)$$

Where λ is the ratio of the standard deviation of U_n to standard deviation of V_n, φ is the cumulative standard normal density function, and ϕ is the standard normal density function. C_n can be estimated by using Equation (3).

We also use the alternative revenue efficiency specification, where the dependent variable is Rev_n = Pre-tax profit of all banks in the sample. Inputs and outputs are the same as used in cost efficiency. The composite error term is now defined as $V_n - U_n$. The general procedure for estimating production inefficiency in Equation (3) is to estimate coefficients and the error term $\varepsilon_n = V_n - U_n$ first, and then calculate the efficiency for each observation in the sample. We just alter the error term to $V_n - U_n$ from $V_n + U_n$ to use the Equation as a production function [57]. And here U_n represents human capital inefficiency and assumed to be distributed independently of V_n and a half-normal distribution, i.e. N $(0,\sigma_u^2)$. We use computer software called Frontier Version 4.1c developed by, [57] for Stochastic Frontier Production and Cost function estimated by the method of maximum likelihood.

Appendix B

Competition measures of BRICS countries

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Overall mean	Mean (latest 3 years)
Brazil																		
LI	0.1674	0.1997	0.2356	0.2506	0.2374	0.2657	0.2725	0.2793	0.1629	0.3047	0.3078	0.2720	0.2947	0.2236	0.2057	0.1956	0.2422	0.2007
HHIA	0.1235	0.1133	0.1293	0.1431	0.1427	0.1132	0.1153	0.1173	0.1425	0.1330	0.1110	0.0990	0.0951	0.0990	0.1052	0.1050	0.1180	0.1051
HHIGL	0.2109	0.1973	0.2306	0.2456	0.2276	0.1990	0.1827	0.1578	0.1444	0.1508	0.1212	0.1083	0.1033	0.1072	0.1155	0.1154	0.1636	0.1155
Russia																		
LI	0.3557	0.3819	0.2976	0.2704	0.2989	0.2758	0.2878	0.2543	0.2502	0.0309	0.0080	0.0640	0.0723	0.0724	0.0507	0.0435	0.1884	0.0471
HHIA	0.7419	0.6569	0.5975	0.3383	0.2551	0.1701	0.1117	0.1128	0.1021	0.1000	0.0975	0.0981	0.1101	0.1108	0.1185	0.1230	0.2403	0.1208
HHIGL	0.6939	0.6508	0.5845	0.3573	0.2988	0.2045	0.1372	0.1412	0.1280	0.1252	0.1182	0.1165	0.1256	0.1233	0.1373	0.1471	0.2556	0.1422
India																		
LI	0.1868	0.1798	0.2246	0.2604	0.3103	0.2865	0.2643	0.2612	0.2530	0.2635	0.2799	0.2911	0.2674	0.2527	0.2452	0.2328	0.2537	0.2390
HHIA	0.0717	0.1278	0.0549	0.0653	0.0732	0.0823	0.0787	0.1279	0.1238	0.1130	0.0962	0.0583	0.1015	0.0895	0.0915	0.3276	0.1052	0.2096
HHIGL	0.0706	0.1351	0.0563	0.0689	0.0764	0.0816	0.0730	0.1289	0.1238	0.1164	0.0987	0.0543	0.1079	0.0954	0.0927	0.3399	0.1075	0.2163
China																		
LI	0.2998	0.3186	0.3054	0.3591	0.3205	0.3712	0.3530	0.3836	0.3688	0.3758	0.4132	0.3772	0.3502	0.3441	0.3490	0.3183	0.3505	0.3336
HHIA	0.2623	0.2623	0.2623	0.2623	0.2623	0.2268	0.2255	0.1671	0.1550	0.1318	0.1178	0.1114	0.0969	0.0930	0.0886	0.1077	0.1771	0.0982
HHIGL	0.2692	0.2692	0.2692	0.2692	0.2692	0.1923	0.1871	0.1513	0.1381	0.1191	0.1115	0.1139	0.1043	0.1025	0.1005	0.1214	0.1742	0.1110
South Africa																		
LI	0.2205	0.1988	0.3010	0.2136	0.0612	0.1376	0.1534	0.1592	0.1349	0.1485	0.1684	0.2025	0.2231	0.2334	0.2505	n.a.	0.1871	0.2505
HHIA	n.a.	n.a.	n.a.	n.a.	0.2808	0.1915	0.2129	0.2097	0.1989	0.2012	0.3179	0.2310	0.1836	0.2052	0.2121	0.1630	0.2173	0.1875
HHIGL	n.a.	n.a.	n.a.	n.a.	0.2544	0.1810	0.1998	0.2050	0.1813	0.1945	0.3704	0.2107	0.1762	0.1956	0.2115	0.1723	0.2127	0.1919