

The Impact of Bank Regulation and Supervision on Competition: A Evolution in the Emerging Economies

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Abstract

This article empirically investigates the influence of bank regulation and supervision on the competitive landscape within banking systems. Using the information on 23 emerging economies from 1996 to 2016, we confirm banking system with lower activity restrictions and (foreign) bank entry barriers to be more competitive. The greater capital stringency and official supervisory power enhances the competition in banking industry. Our findings also highlight that grater explicit guidelines for asset diversification and deposit insurance coverage, and lower private-sector monitoring are associated with more intensive bank competition. A further examination concerning bank crisis reveals that during the bank crisis, the relationship between activity restriction, entry barriers, diversification guidelines and competition become more pronounced, and the positive effect of foreign bank limitation, capital stringency, official supervisory power, and private monitoring on competitive condition become less effective. Finally, we categorize our sample into foreign banks and domestic banks and find that foreign banks are more sensitive to the official supervisory power and private monitoring, and less sensitive to activity restrictions, foreign bank limitations and diversification guidelines.

Keywords: Bank regulation and supervision; Competition; Emerging Economies; Panzar-Rosse model

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1. Introduction

Banking system has subject to dramatic changes in the last two decades because of the development of information technology, globalization and deregulation. These changes decreased the profitability in traditional bank activities, and result in a massive mergers and acquisitions (M&A) among financial institutions both in developed countries and emerging economies. Different from the developed economies, the emerging economies have experienced considerable economic development and financial reforms, and exhibit different characteristics in banking system. While the changes in the financial market are the main driving forces for the bank consolidation in developed economies, the financial supervisory authorities plays an important role in the bank consolidation process in emerging economies (Gelos and Roldós, 2004). The overall differences of economic development, bank consolidation and regulation between developed economies and emerging economies lead to the distinctive features of competitive conditions in banking industry from emerging economies.

A series of study on the causes of credit crunch have highlighted the importance of deregulation and excessive competition in the bank crisis (Brunnermeier, 2009; Carletti, 2008; Fernández et al., 2013; Noman et al., 2018; Schaeck and Cihák, 2014). Following the recent global financial crisis, policymakers acted and reshaped bank regulation substantially. Although some literatures assess the relationship between bank regulation and competition, this research question has not yet addressed for banks from emerging economies. Based on this, this paper examines the impact of bank regulation and supervision on the competitive condition of banking sectors from emerging economies and check whether the unique characteristics of emerging markets shed light on the relationship between bank regulation and competition from different perspectives.

We use unbalanced annual financial data of 1629 banks from 23 emerging economies between 1996 and 2016. We first use the Panzar-Rosse model (Panzar and Rosse, 1982, 1987) (hereafter the “PR model”) and construct the competitive indicator ‘*H*-statistic’ as a measure of competition in banking system. We also compute the Lerner index as a measure of bank market power (see also Coccoresse (2009) and Koetter et al. (2012)) and the Herfindahl-Hirschman index (HHI) as a measure of market structure. We investigate how competition evolved under different bank

regulation and supervision. As our sample period covers several bank crises in some emerging economies and also the recent global financial crisis, we also check whether the relationship between bank regulation and competition changed during the bank crisis. Considering the different roles played by domestic banks and foreign banks, we also test whether the impact of bank regulation on foreign banks exhibits different patterns.

Our analysis shows that banking systems with higher concentration and few activity restrictions and entry barriers are more competitive. We also find reducing foreign bank limitations and increasing the capital stringency and official supervisory power also enhances the competition in banking sector. The results also provide evidence that competition in banking systems that have less government-owned banks and lower diversification guidelines tend to be more intensive. The results also confirm that higher private monitoring of banks and deposit insurance coverage are significantly contributed to increasing of bank competition.

During the bank crisis, the impact of activity restriction, entry barriers, diversification guidelines on the competitive conditions become more effective while foreign bank limitation, capital stringency, supervisory power, and private monitoring become less effective.

To further investigate whether the relationship between bank regulation and competition varies according to ownerships, we categorize the sample banks into two subsample groups: foreign banks and domestic banks. Our findings suggest that foreign banks are more sensitive to the official supervisory power and private monitoring, and less sensitive to activity restrictions, foreign bank limitations and diversification guidelines.

Our analysis extends the previous studies in several respects. First, while there have been numerous studies focusing on the effect of bank regulation on competitive conditions in developed economies, we carry out our research on emerging economies. In emerging economies, the cross-border mergers and acquisitions are the main reason of the consolidation in banking system and the financial authorities are deeply involved in the banking system and serve an important role in the banking system restructuring, these special features indicate that the bank consolidation and competitive conditions in emerging economies exhibit different characteristics. Secondly, financial reforms have been implemented across the emerging economies

during our sample period, including financial liberalization, bank privatization, widening access to foreign banks, and restructuring national banking systems, which intended to reshape the competitiveness of the banking sectors.¹ Our analysis enhances the previous studies as we cover the periods of financial reforms of the emerging economies and include the bank crisis experienced by each country. The unique institutional setting of the emerging economies can provide further insight to the previous research. Thirdly, we include both structural measure (HHI) and non-structure measures (*H*-statistic and Lerner index) of competition and incorporate bank regulatory and supervisory factors to examine the impact of bank regulation and supervision on competition in emerging economies, while controlling for a variety of bank-level and country-level characteristics that may affect bank competition. We also employ a series of robustness analysis using different model specifications and based on different subsamples.

The rest of the paper is structured as follows. Section 2 first provides a review of the previous studies on competition test, and then summaries the literatures on bank regulation and competition. Section 3 mainly addresses the estimation of competition indicators, sample selection, data statistics, and research methodology. Section 4 offers empirical analysis and also robustness checks, and Section 5 draws the final conclusions.

2. Literature Review

2.1 Previous Studies on Competition Test

In the previous literature, the empirical studies have measured industry competition through structural and non-structural approaches. The structural approach is based on the traditional structure-conduct-performance (SCP) paradigm and links concentration, competition, and firm performance. SCP assumes that the market structure, which is reflected in the level of concentration in the market, affects firm behavior, and then in turn determines firm performance (Bain, 1951). The problem is that the SCP analysis can't explicitly incorporate the effect of regulation and test whether the regulatory

¹ See, for example, Beck et al. (2005) analyze the impact of liquidation, federalization, privatization and reconstruction on the performances of state banks in Brazil; Fu and Heffernan (2009) investigate the effect of reforms of China's banking sector on market structure and performance; Brissimis et al. (2008) examine the impact of banking sector reform on bank performance in ten EU countries; Zhao et al. (2010) evaluate the impact of financial sector reforms on cost structure, ownership and competition of in Indian banking system; Tompson (2004) gives a detail analysis about the banking reform in Russia; and Williams and Nguyen (2005) examines the impact of financial liberalization and bank restructuring on bank performance of countries from South East Asia.

changes enhances or decreases the relationship between market structure and competitive behavior of the banking system.

A non-structural approach to measure competition is the new empirical industrial organization (NEIO) approach. Unlike the SCP paradigm that tries to determine competition from the market structure in a given industry, the NEIO models directly analyze firm conduct to detect the market power of firms. The NEIO models can rely on a comparative statics analysis as in the PR model. The PR model identifies the market power by using the index *H*-statistic. *H*-statistic is calculated as the sum of revenue elasticities with respect to input prices. It measures how much a change in factor prices affects the firm's equilibrium revenue.

The PR model was widely applied to measure competition in the banking industry (for the U.S. banking industry, see Shaffer (1982); for the Canadian banking industry; see Nathan and Neave (1989) and Shaffer (1993)). Vesala (1995) investigates how deregulation in the 1980s affected competition among Finnish banks. Coccoresse (2004; 2009) analyzes the competitive conditions in the Italian banking industry. Hempell (2002) analyzes competitive behavior of the German banking industry. Matthews et al. (2007) and Maudos and Solís (2011) employ the PR model and Lerner index to analyze competition in the British banking industry and in the Mexican banking industry, respectively. These findings mostly indicate that banks operate under monopolistic competition.

An alternative non-structural technique to the PR model is to estimate a parameter that directly measures firms' competitive behavior from the information on firm costs and demand. For example, the Lerner index is a relative mark-up of price over marginal cost and measures firm market power (Lerner, 1934). The higher the mark-up, the greater is the market power. The Lerner index ranges from 0 in the case of perfect competition to 1 in the case of monopoly. A number of studies (Bikker and Haaf, 2002; Shaffer, 1983a, 1983b) show empirically that the *H*-statistic and Lerner index are negatively correlated. That is, the relative price-cost mark-up (smaller Lerner index) decreases with higher competition (higher *H*-statistic). The Lerner index is widely used to estimate competition in the banking sector. Coccoresse (2009) points out that Lerner index is a true reflection of the bank's degree of market power. Angelini and Cetorelli (2003) assess the behavior of Italian regional banks and find that deregulation fostered a reduction in price-costs margins. Fu et al. (2014) use

Lerner index as measure of bank competition and investigate the influence of bank competition on individual bank fragility as measured, and Anginer et al. (2014a) use both *H*-statistic and Lerner index to measure the bank level competition and find a robust negative relationship between bank competition and systemic risk.

2.2 Bank Regulation and Effects on Bank Competition

Under the traditional theory, bank deregulation is positively associated with the efficiency because of the reduction of regulatory cost imposed on the banking system. Based on the theoretical model and empirical evidence, Keeley (1990) points out that the deregulation in the US banking system reduces the bank market power. Jayaratne and Strahan (1998) find that deregulation resulted in a lower losses in loan and Dick (2006) confirms higher loan loss provisions following the deregulation. Matutes and Vives (2000) study the links between competition for deposits and risk-taking incentives, and conclude that the welfare performance of the market and the appropriateness of alternative regulatory measures depend on the degree of rivalry and the deposit insurance regime. Hellmann et al. (2000) analyze the relationship between competition for deposits and capital regulation in a dynamic framework where banks choose privately their asset risk and compete for deposits, and find that capital requirement regulation is not an optimal choice for controlling risk-taking incentives.

A number of studies have investigated the effect of regulations and factors which presumed related to the competition in banking systems. Based on the survey of the bank regulation and supervision in banking systems, Barth et al. (2004) find that higher entry barriers reduce the bank efficiency and also lead to the increase of interest rate margin and personnel expense, which provides empirical support that entry restrictions reduce bank competition. By using the across countries sample, Claessens et al. (2001) examine the impact of foreign banks on domestic banking sectors and confirm that the introduction of foreign banks increase the efficiency of domestic banking systems.

In a cross-country study based on the bank financial data from 72 countries, Demirguc-Kunt et al. (2004) confirms that bank concentration has a negative and significant effect on the efficiency of the banking system, and this relationship is more pronounced for countries with less developed financial systems and economic freedoms. The results also provide support that tighter bank entry restrictions and activity restrictions are negatively related to the banking system efficiency, especially

for foreign banks. Gelos and Roldós (2004) examines the evolution of market structure in emerging markets banking system and argue that lower entry barriers mitigated a decline in competition driven by consolidation. Claessens and Laeven (2004) investigate the competitive conditions across 50 banking systems, they find that systems with greater foreign bank entry and few entry and activity restrictions to be more competitive. Delis et al. (2011) examines the relationship between the regulatory and supervision framework, and the productivity of banks in 22 transmission countries, and find that private monitoring and activity restrictions have significant impact on productivity.

3 Estimation Methodology and Data

3.1 Estimation of Competition Indicators

3.1.1 Panzar-Rosse model

In our analysis, we first define the competitive indicator by using the Panzar-Ross model (Panzar and Rosse, 1987). The PR model constructs the H -statistic to measure the market power, where H -statistic is defined as the sum of the elasticity of revenue with respect to input prices. Panzar and Rosse (1987) and Vesala (1995) show that H -statistic which is equal to or smaller than zero indicates a collusive or joint monopoly equilibrium or monopolistic competition without the threat of entry, and a value between zero and one means monopolistic competition, and a value equals to one indicates perfect competition.

Based on the study of Demirguc-Kunt et al. (2004) and Anginer et al. (2014b), we employ the following reduced-form revenue equations and estimate H -statistic for each country at each year:²

$$\ln OPI_{it} = \alpha + \sum_{j=1}^3 \beta_j \ln w_{jit} + \sum_k \pi_k \text{Controls}_{kit} + \alpha_i + \varepsilon_{it} \quad (1)$$

where OPI_{it} is the operating income (as a measure of the revenue) of bank i at year t .³ We define w_1 as the ratio of annual interest expenses to total funding and use it as a proxy of the average funding rate; w_2 is the ratio of personnel expenses to total assets and used as an proxy of the price of personnel expense; and w_3 is the ratio of

² Bikker, Shaffer, and Spierdijk (2012) indicates that a scaled revenue function leads to a significant upward bias and incorrectly measures the degree of competition, so in our analysis we employ the unscaled revenue equation to reduce the estimation bias.

³ For robustness check, we also use total revenue as another measure of revenue for robustness check and the findings are consistent.

other non-interest expense to fixed assets and employed as a proxy of the price of physical capital. We also add a set of control variables: *Customer Loan* which is defined as the ratio of customer loans to total assets to control for credit risk; *NEA* which is defined as the ratio of other nonearning assets to total assets to control for the composition of the asset; *Customer Deposit* which is defined as the ratio of customer deposits to the sum of customer deposits and short-term funding to captures funding structure of the bank; and *Equity Ratio* which is defined as the ratio of equity to total assets to accounts for the leverage of the bank. Similar to Coccoresse (2009), all bank-specific factors that may have potential effect on the level of operating income, but are not included in equation (1), are captured through the insertion of dummy variables associated with banks (denoted by α_i). We winsorize all variables at the 1st and 99th percentile levels to reduce the influence of outliers. The *H*-statistic, which is defined as the sum of the elasticities of revenues with respect to input prices, is then given by $\beta_1 + \beta_2 + \beta_3$.

As we use the unscaled revenue equation as shown in equation (1), one potential caveat is that the scale differences across banks may introduce heteroskedastic standard errors of the coefficients, which in turn inflates *H*-statistic. In our analysis, we estimate the unscaled PR revenue model by pooled feasible generalized least squares (FGLS) to cope with the heteroskedasticity problem, and use clustered standard errors to account for general heteroskedasticity and cross-sectional correlation in the model errors (Arellano, 1987).

An important feature of the *H*-statistic is that the PR model must be based on firms that operate in a long-run equilibrium (Panzar and Rosse, 1987). We follow the analysis of Shaffer (1982) and Bikker, et al. (2012) and employ an equilibrium ROE test to check whether banks operate in a long-run equilibrium. By using ROE instead of operating income (OPI) as independent variable in (1), the *H*-statistic under ROE test equals to zero if the banking system operates in a long-run equilibrium.

3.1.2 Lerner index

We also employ Lerner index as an alternative measure of competition and measure firms' competitive behavior based on the information on firm costs and demand. Based on the definition of Lerner index, the Lerner index is calculated as following:

$$\text{Lerner Index}_{it} = (P_{it} - MC_{it})/P_{it} \quad (2)$$

In our analysis, P_{it} is the output price proxied by the ratio of total revenue to total assets for bank i at time t and MC_{it} is the marginal cost of bank i at time t .⁴ The marginal cost is derived from the total cost function. That is,

$$MC_{it} = \frac{TC_{it}}{Q_{it}} (\alpha_1 + \alpha_2 \ln Q_{it} + \alpha_9 \ln w_{1it} + \alpha_{10} \ln w_{2it} + \alpha_{11} \ln w_{3it}) \quad (3)$$

where the translog total cost function is

$$\begin{aligned} \ln TC_{it} = & \alpha_0 + \alpha_1 \ln Q_{it} + (\alpha_2/2)(\ln Q_{it})^2 + \alpha_3 \ln w_{1it} + \alpha_4 \ln w_{2it} + \alpha_5 \ln w_{3it} + \\ & (\alpha_6/2)(\ln w_{1it})^2 + (\alpha_7/2)(\ln w_{2it})^2 + (\alpha_8/2)(\ln w_{3it})^2 + \alpha_9 \ln w_{1it} * \ln Q_{it} + \\ & \alpha_{10} \ln w_{2it} * \ln Q_{it} + \alpha_{11} \ln w_{3it} * \ln Q_{it} + \alpha_{12} \ln w_{1it} * \ln w_{2it} + \alpha_{13} \ln w_{2it} * \\ & \ln w_{3it} + \alpha_{14} \ln w_{3it} * \ln w_{1it} + \alpha_i + \varepsilon_{it} \end{aligned} \quad (4)$$

TC_{it} denotes the total operating expenses and Q_{it} represents the output, measured by the total assets of bank i at time t . w_1 , w_2 , and w_3 represent the input prices of the bank as defined previously in the PR model. We winsorize all variables at the 1st and 99th percentile levels to reduce the influence of outliers. Following Fu et al. (2014), Koetter et al. (2012), and Kumbhakar and Lovell (2000), we use the stochastic cost frontier analysis to estimate (4) for each country at each year.

3.1.3 Concentration ratio

A number of studies also have measured banking competition through structural approach. Based on structure-conduct-performance (SCP) paradigm, the structural approach connects the concentration, competition, and performance between banks. We also use the Herfindahl-Hirschman index (HHI), which is defined the sum of the squares of the market shares of the firms in the market, as a measure of bank concentration.

3.2 Data Source, Sample Selection and Variable Definition

3.2.1 Data Source

Based on the definition of emerging economies from IMF, we focus our analysis on 23 emerging markets.⁵ We obtained the data from different sources. The financial data of each bank is collected from Bankscope. To avoid double counting, we use the consolidated financial information of each bank if available, and unconsolidated

⁴ Based on the earlier studies, we define the output price P_{it} as the ratio of total revenues to total assets, see also Angelini and Cetorelli (2003), Maudos and Fernandez de Guevara (2004), Carbó et al. (2009), Koetter et al. (2012), and Fu et al. (2014).

⁵ See detail information of the emerging economies on *World Economic Outlook: Adjusting to Lower Commodity Prices*, International Monetary Fund (October 2015).

report otherwise. We obtained the bank regulation and supervision data from Barth, Caprio, and Levine (2013), and the country economy development variables are collected from World Bank Development Indicator Database.

3.2.2 Sample selection

Based on the complete sample of banks obtained from Bankscope, we apply the following selection criteria: (1) we delete observations where the data on one of the variables employed in estimating H -statistic and Lerner index is missing; (2) for the estimation of H -statistic and Lerner index, we set the minimum number of observations to 20 for each year at each country, thus we delete countries with less than 20 bank-year observations; (3) we also delete the observations where the data on one of the bank-level and country-level control variables is missing.

We use the unbalanced data between 1996 and 2016, and our sample consists of commercial banks, saving banks, cooperate banks, and bank holding companies. There are 1629 banks included in our analysis and total number of bank-year observations is 12,856, with the largest number of 914 observations in 2010 and the lowest number of 236 in 1996.^{6,7} All of the data are inflation adjusted and expressed in USD.

3.2.3 Variable Definition

As we are interested in the impact of bank regulation and supervision on the competition of the banking industry, we collect the information of bank regulation and supervision from Barth et al. (2013) and define a set of variables to measure the bank regulation and supervision of the banking system from different aspects.

For the banking structure variables, we define *Bank concentration*, which indicates the degree of concentration of deposits in the 5 largest banks in a given country, and *Government-owned banks*, which measures the extent to which the banking system's assets are government owned, to examine the impact of market structure on competition in a given country. For the restriction of bank activity in a given country,

⁶ In our database, banks in Bangladesh and South Africa change the accounting standard from local GAAP to international accounting standards during 2005-2006. In order to include as long sample period as possible, we also include all bank observations (including the ones before the implementation of international accounting standards). Thus, for those two countries, we have two different accounting standards in our sample period: local GAAP (before 2005 or 2006) and international accounting standards (after 2005 or 2006). We use the fixed effect model and include the year dummy variables to control for the effect of the changes of accounting standards in the sample period.

⁷ Our sample seems not to be prone to survivorship bias. The banks are included in the sample even if they exited (e.g. through bankruptcy or through M&A) during the sample period.

we define *Activity restriction* and measure a bank's ability to engage in securities, insurance and real estate activities, which ranges from 0 to 12 and a higher score indicates more restrictions on banks to engage in such activities.

To measure the bank competition regulatory, we define two variables: variable *Foreign bank limitation* which measures whether foreign banks may own domestic banks and whether foreign banks may enter a country's banking industry, and lower values indicate greater stringency, and variable *Entry barriers* which indicates that various types of legal submission are required to obtain a banking license, and higher values indicates grater stringency. We use variable *Capital regulatory* to indicate the capital regulatory stringency, and higher value indicates greater stringency. Variables *Official supervisory power* and *Diversification index* are defined to measure the official supervisor action, and *Private monitoring index* is used to as a proxy of private monitoring. We also employ *Deposit insurance ratio*, which is defined as the size of deposit insurance fund relative to total bank assets, as a measure of the deposit insurance coverage in a given country.

We use several variables to control for bank-specific time-varying effects on competition. We define *TCD* as the ratio of total customer deposits to total assets to control for the deposit size, *LLP* as the ratio of loan loss provision to gross loans to control for the loan quality, *NIIC* as the ratio of non-interest income to total operating income, *ROA* as a proxy of profitability, and use $\log(TA)$, defined as the logarithm of gross total assets, to control for bank size. All financial variables are winsorized at the 1st and 99th percentile level to reduce the influence of outliers and potential data errors.

As country control variables, we include *GDP per capita*, *GDP growth* and *Inflation* in a country to account for economic cycles. We also add *Interest rate* and the *Market capitalization to GDP* to control for the changes of monetary policy and the capital market size in a given country.

In our analysis, the competition indicators including *H*-statistic, Lerner index, and HHI are estimated for each country at each year, bank-level financial data and country-level control variables are also collected for each calendar year. For the bank regulation and supervision information that provided by Barth et al. (2013), however, the surveys were conducted in 1999, 2002, 2006, and 2011. Following the study of Anginer et al. (2014a), we employ the previously survey data until the new survey

data becomes available for matching the bank regulation and supervision variables with bank-specific variables and country control variables: the survey data conducted in 1999 for years 1996 to 2001, the survey data conducted in 2002 for years 2002 to 2005, the survey data conducted in 2006 for years 2006 to 2010, and the survey data conducted in 2011 years 2011 to 2016. Table 1 summarizes the definition of the variables and data sources employed in this analysis.

<Insert Table 1 here>

3.3 Summary Statistics

We provide the data statistics of variables included in our analysis in Panel A of Table 2. First, we present the results of competition indicators. The average *H*-statistic is 0.575, ranges from 0.165 to 0.816, Lerner index has the mean of 0.225 with the standard deviation 0.374, and the average HHI is 0.107, ranging from 0.042 to 0.354.

Then we report the results for bank-specific variables. The average ratio of customer deposits to total assets (TCD) is 54%, and loan loss provision (LLP) has an average approximately 1.6% of the gross loans. Non-interest income (NIIC) accounts for roughly 31.1% of the total operating income, and the average ROA is 1.4%. The average value of log TA is 14.86, but the size of the banks in our sample varies quite substantially. This implies that any analysis needs to account for the size effect. In our sample, 17.9% of the banks are foreign-owned.

We include five country-level variables (Market capitalization to GDP, GDP per capita, GDP growth, Inflation, and Interest rates) to control for the changes of stock market and macroeconomic factors. An average emerging market in the sample has market capitalization to GDP ratio of 62.9, GDP per capita of \$5280, GDP growth of 4.58%, inflation of 8.32%, and interest rate of 18.47%.

<Insert Table 2 here>

Finally, we report descriptive statistics of bank regulation and supervision variables. An average country in our sample has bank concentration of 56.68%, government-owned banks of 30.79%, activity restriction of 7.7, foreign bank limitation of 3.67, entry barriers of 7.51, capital regulatory index of 6.46, official supervisory power of 11.58, diversification index of 1.27, private monitoring index of 8.57, and deposit insurance coverage ratio of 12%.

In Panel B of Table 2, we report the sample distribution by calendar year and by

country. The number of banks ranges from 236 to 914, with the largest number in 2010 and the lowest number in 1996.

The Pearson correlations between variables are shown in Table 3. Panel A presents the correlation between competition indicators and bank-level variables. The correlation results between *H*-statistic and bank-level variables suggest that the competition between banks is higher if there are larger banks, banks with higher customer deposit and lower loan loss provisions in a banking system. The correlation results between Lerner index and bank-level variables indicate that larger banks, banks that have higher customer deposits to total assets ratio, banks that have lower loan loss provisions, and banks are reliant on non-interest income have higher market power measured by Lerner index. The results also suggest that three competition indicators, *H*-statistic, Lerner index, and HHI are significantly correlated with each other.

Panel B of Table 3 provides the information of Pearson correlations between competition indicators and country-level variables. We find that countries with higher competitive banking industries have higher GDP growth and inflation, lower interest rate, more concentrated banking industries, lower activity restriction and lower banking sector entry barriers. The results also provide evidence that countries with higher competitive banking industries have more strict stringency on capital requirement, higher supervisory power, and higher deposit insurance coverage.

<Insert Table 3 here>

3.4 Determinates of Bank Competition

To examine the impact of bank regulation and supervision on competition, we regress the competition variables against a set of bank-specific variables, country variables, and bank regulation and supervision variables. The regression model is given as follows:

$$\begin{aligned}
 Competition_{it} = & \beta_0 + \sum_{n=1}^N \beta_n bank_controls_{nit} + \sum_{j=1}^J \alpha_j country_controls_{jkt} + \\
 & \gamma bank_regulation_{kt} + v_i + \mu_t + \varepsilon_{i,t}
 \end{aligned}
 \tag{5}$$

The dependent variable *Competition* is one of the bank competition indicators: *H*-statistic, Lerner index, or HHI. Variables *bank_controls* indicate a set of

bank-specific control variables: *TCD*, *LLP*, *NIIC*, *ROA*, and *log TA*. Variables *country_controls* include the country-level control variables: *Market capitalization to GDP*, *GDP per capita*, *GDP growth*, *Inflation*, and *Interest rate*. Variable *bank_regulation* indicates the bank regulation and supervision variables: *Bank concentration*, *Government-owned banks*, *Activity restriction*, *Foreign bank limitation*, *Entry barriers*, *Capital regulatory index*, *Official supervisory power*, *Diversification index*, *Private monitoring index*, or *Deposit insurance ratio*. ε represents an error term. Standard errors are heteroskedasticity-consistent and are clustered at the bank level. We follow Gormley and Matsa (2014) and employ bank-specific fixed effects to control for unobserved time-invariant heterogeneity across banks that might affect competition. Regressions include year fixed effects to control for macroeconomic factors and monetary policy that may vary over time.

4. Empirical Results

4.1 Bank Regulation, Supervision, and *H*-statistic

In this section, we investigate how bank regulation and supervision affect competition in banking industry from emerging markets, after controlling for the effects of bank-level and country-level characteristics. As *H*-statistic and Lerner index with standard errors are generated from the first-stage regressions as defined in section 3.1, to increase the accuracy of our second-stage estimation, we follow the study of Doidge et al. (2006) and Chue and Cook (2008) and weigh each observations by the inverse of the standard error of *H*-statistic and Lerner index for each country at each year obtained in the first-stage. With this procedure, the *H*-statistic and Lerner index of observations that are estimated more precisely in the first-stage regressions receive a higher weigh in the second-stage analysis.

We first examine impact of bank regulation and supervision on *H*-statistic and the results reported in Table 3. Considering the impact of market structure on competition, the result in Column (1) of Table 4 indicates that bank concentration is positively and statistically correlated with the *H*-statistic, which indicates banks in a more concentrated system are exposed to higher level of competition. This positive relationship between *H*-statistic, which measures bank competition based on the new empirical industrial organization (NEIO) approach, and bank concentration, which

defines the market structure based on structure-conduct-performance (SCP) paradigm, suggests that level of competition is not necessarily related to market structure. We also include the degree of government bank ownership, to measure the level of banking system's assets owned by government. The result indicates that higher government bank ownership seems to reduce the competition of banking industry.

Column (2) of Table 4 tests the impact bank activity regulatory on competition. As higher value *Activity restriction* indicates more restrictions on banks to engage in securities, insurance, and real estate activities, the result indicates higher activity restrictions result in lower competition. This confirm that although activity restrictions reduce the potential risk of the banking industry (Anginer and Demircuc-Kunt, 2014), but this also lead to the reduce of competition in banking system. The positively significant coefficient of *Foreign bank limitation* and negatively significant coefficient of *Entry barriers* confirms that less foreign bank entry or ownership limitations and lower banking entry requirement are positively affecting the competition in banking system. These findings suggest that lower foreign bank limitation and banking entry requirements increase banking system competition.

To examine the impact of capital regulation, we include the variable *Capital regulatory index*. As higher *Capital regulatory index* indicates greater stringency, our result provide evidence that competition in banking system will be more intensive if the capital stringency was more pronounced in the country. Previous studies (e.g., Agoraki et al. (2011), Chortareas et al. (2012)) indicate that strengthening capital restrictions can improve the efficient operations of banks, which in turn enhances the competition between banks.

In terms of official supervisory power, the results are present in Columns (6) and (7) of Table 4. We find that the cross-country difference in bank competition can be explained by the differences in official supervisory power and explicit guidelines for asset diversification, with higher official supervisory power increases competition and grater explicit guidelines for asset diversification reduce competition.

Next we explore the relationship between private monitoring and bank competition. If the banks have higher incentives or ability for the private monitoring, then we would expect that that the greater private monitoring index to be associated with higher competition. The result for private monitoring is provided in Column (8) in Table 4. Consistent with our expectations, higher private monitoring index significantly

increases the bank competition in a given country.

Finally, we test the impact of deposit insurance on bank competition. While deposit insurance provides guarantee for banks when the banks fail and prevents banks runs, this also leads to moral hazard and excessive risk-taking (Anginer, et al., 2014b), which may in turn enhances the competition between banks. In Colum (9) of Table 4, we include the variable *Deposit insurance ratio*, which is defined as the size of the deposit insurance fund relative to total bank assets, to examine the impact of deposit insurance on competition in banking system. The positive and significant coefficient of *Deposit insurance ratio* confirms deposit insurance increases the competition of banking system.

For bank-level control variables, we find customer deposits (*TCD*) and profitability (*ROA*) positively and significantly related to bank competition in all specifications, and higher non-interest income (*NIIC*) indicates lower competition in banking system. In terms of country-level variables, we find that the development of stock market has negatively significant impact on the competitiveness of the banking system, higher GDP per capita, GDP growth, inflation, and interest rate are statistically and positively significant. This suggests that for the emerging economies, the development of economies and stock market show the same patterns and are main factors driven the competition of banking system.

<Insert Table 4 here>

4.2 Alternative Measures of Competition

We also consider whether our results are robust across different measures of competition, and the regression results are present in Table 5. First, we use the Lerner index as a measure of competition. The results in Panel A of Table 5 shows that *Activity restriction* is positively and significantly related to the Lerner index, indicating higher activity restrictions reduces the bank competition; *Foreign bank limitation* is negatively and significantly related to the Lerner index, which suggests that lower foreign bank limitations leads to higher competition in banking system. The negatively and significantly coefficients of *Capital regulatory index* and *Official supervisory power* provide evidence that higher capital stringency and supervisory power result in higher competition between banks in a given country. Variable *Diversification index* is positively and statistically significantly related to the Lerner

index, which confirms that grater explicit guidelines for asset diversification increase the market power of banks and thus reduces competition in banking system. We also find that *Private monitoring index* and *Deposit insurance ratio* are negatively and statistically significantly associated with the Lerner index. The negative relationship indicates that higher private monitoring index and deposit insurance coverage reduce the market power of banks and increase the bank competition.

For robustness check, we also use the Herfindahl-Hirschman index (HHI) as another alternative measure of competition. The regression results are reported in Panel B of Table 5. As expected, we find that higher *Government-owned banks* in banking system indicates higher HHI and lower bank competition. Variable *Activity restriction* is positively and negatively associated with HHI, indicating higher activity restriction increases the market concentration, and reduces bank competition. Variable *Foreign bank limitation* is negatively and statistically significantly related to HHI and variable *Entry barriers* is positively and statistically significantly related to HHI, this provides evidence that lower foreign bank stringency and banking entry stringency leads to lower marker concentration and higher competition in banking industry. Higher official supervisory power, private monitoring index, and deposit insurance ratio reduces the bank market concentration, and grater explicit guidelines for asset diversification is associated with higher market concentration and lower bank competition.

We also notice that the variable *Bank concentration* is positively and statistically significantly associated with HHI, implying that higher degree of concentration of deposits of the top 5 largest banks indicates higher market concentration and lower competition. This finding is inconsistent with the result of *H*-statistic, this is because variable *Bank concentration* and HHI are both defined based on SCP paradigm and measure the market structure of banking industry, thus, these two concentration measurements are highly and positively related.

<Insert Table 5 here>

4.3 Impact of financial Crisis

Following the recent global financial crisis, policymakers reshaped bank regulation substantially. We are concerned about how does the crisis affect the competition in the banking system and whether the relationship between bank regulation and

competition shows different pattern during the crisis. In this section, we use the bank-crisis information for individual countries from a database compiled by Laeven and Valencia (2010), and include the interaction terms between country-level regulation variables and *Bank Crisis* as additional explanatory variables. *Bank Crisis* is a dummy variable that equals one if the country is going through a systemic crisis in a given year, and zero otherwise. The results with the bank crisis interactions are provided in Table 6.

<Insert Table 6 here>

The coefficient on the interaction variable for bank concentration is negative (Column (1) in Table 6), suggestion that the competition in a higher concentration banking system is lower during the bank crisis; for the banking system that has more government-owned banks, the competition between banks is much higher during the bank crisis. We also notice the negative relationship between *Activity restrictions* and bank competition is more pronounced during the bank crisis, the results of *Entry barriers* and *Diversification index* also indicate similar findings, indicating the effect of *Activity restrictions*, *Entry barriers*, and *Diversification index* in reducing bank competition is more pronounced during bank crisis.

The coefficients of the interaction terms for *Foreign bank limitation*, *Capital regulatory index*, *Official supervisory power*, *Private monitoring index*, and *Deposit insurance ratio* are significantly negative, indicating the lowering of foreign bank limitation, and increasing of capital stringency, supervisory power, and private monitoring are more effective to enhance bank competition in normal time than during the bank crisis.

Our findings confirms that during the bank crisis, the impact of activity restriction, entry barriers, diversification guidelines on competitive conditions become more effective while foreign bank limitation, capital stringency, supervisory power, and private monitoring become less effective.

4.4 Further Test: Foreign Banks vs Domestic Banks

In this subsection, we further investigate whether the relationship between bank regulation and competition differs between domestic banks and foreign banks. Foreign banks have better performance in profitability than domestic banks in developing countries (Claessens, et al., 2001), and foreign banks not only subject to

host countries regulations but also the parent country. De Haas and Van Lelyveld (2006) and Ongena et al. (2013) also find that foreign banks are more sensitive to the strictness of parent country regulation rather than to the institutional conditions in host countries, and the impact of institutional reforms can have less significant impact on foreign banks (Fang et al., 2014).

To test the above question, we introduce a binary variable *Foreign dummy* which equals one if the bank is a foreign subsidiary and zero otherwise. The results including the interaction terms between bank regulation variables and *Foreign dummy* are provided in Table 7. The results of *Activity restriction*, *Foreign bank limitation*, and *Diversification index* indicates that the changes of competition in banking industry with activity restrictions, foreign bank limitation, and diversification guidelines are more pronounced to domestic banks than to foreign banks, and the impact of official supervisory power and private monitoring on competition are greater for foreign banks than domestic banks. Our findings suggestion that foreign banks are more sensitive to the official supervisory power and private monitoring, and less sensitive to activity restrictions, foreign bank limitations and diversification guidelines than domestic banks.

<Insert Table 7 here>

4.5 Robustness Check

To assess the reliability of our results, in this section we conduct a battery of robustness checks considering alternative econometric model and different subsamples.

We consider alternative regression specification to assess whether our findings are consistent under different estimations. Specifically, instead of controlling for the bank fixed effects, we include country fixed effects in the regression to control for the country difference and also year fixed effects to control for time-varies effects. The results are present in Panel A of Table 8. The relationships between bank regulation variables and *H*-statistics are consistent with our findings, except variable *Government-owned banks* and *Deposit insurance ratio* become insignificant. Thus, the results confirm that our results on bank regulation and competition are robust under alternative regression specifications.

As a robustness check, we also performed our analysis across different subsamples.

First, we replicate the analysis on the subsample of commercial banks only. The result in Panel B of Table 8 shows that our main findings are still holds for commercial banks. Secondly, as our sample countries covers the BRICS countries, it is therefore interesting and warranted to perform our analysis on the subsamples of banks in BRICS countries and check whether the impact of bank regulation on competition is unchanged in these five biggest and fastest growing emerging market economies. The results in Panel C of Table 8 show that the findings of bank regulation variables are consistent with our previous conclusion. Third, Bonin et al. (2005) show that data from Bankscope suffer from several problems, and are less accurate especially for transition countries from the former Soviet Republics. To check that our results are not driven by potential data problems, we perform an analysis on the subsample without banks from the former Soviet Republics (see Panel D in Table 8). The results were largely unchanged. Based on the subsample analysis, we can conclude that our results are robust based on alternative sample selection criteria.

<Insert Table 8 here>

5. Conclusion

This study examines the influence of bank regulation and supervision on the competitive condition using cross-country data from 23 emerging economies between 1996 and 2016. Both structural and non-structural approaches are employed to measure the competition in banking system. The main results indicate that banking systems with higher concentration and fewer activity restrictions and entry barriers are more competitive. The results also confirm that lowering foreign bank limitations and increasing the capital stringency and official supervisory power also enhances the competition in banking sector. Our evidences also highlight that banking systems with lower government-owned banks and diversification guidelines, and higher private monitoring of banks and deposit insurance coverage tend to more competitive.

In addition, our analyses indicate the relationship between activity restrictions, entry barriers, diversification guidelines and competition become more pronounced while the positive effect of foreign bank limitation, capital stringency, official supervisory power, and private monitoring on competitive condition become less effective during the bank crisis. Moreover, by examining the impact of bank regulation and supervision on foreign vs domestic banks, our findings show that foreign banks are

more sensitive to the official supervisory power and private monitoring, and less sensitive to activity restrictions, foreign bank limitations and diversification guidelines.

Our findings highlight several important policy implications for financial regulator in emerging economies. First, in order to increase the competition in banking system, regulators need to implement a more cautious approach to evaluating and approving the consolidation between banks in order to prevent the excessive concentration of banking system at the country level. Financial authorities should also reduce the policy interventions in the banking system. Second, to improve the efficiency of the capital allocation in the banking system, regulators also should seek to reduce the activity restrictions and also (foreign) bank entry barriers. Third, certain level of capital stringency and official supervisory power also should be maintained to reduce bank's risk-taking behaviour and enhance the effective risk-management, and this is more important for foreign banks who seek to take advantage of regulation differences between parent country and host countries. Finally, deposit insurance fosters the competition between banks and increasing the deposit insurance coverage should be encouraged to promoting the competition and efficiency of the banking system.

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Table 1: Variable Definition and Data Sources

This table reports the definitions and data sources of the variables included in our analysis

Variables	Definitions	Data Sources
Dependent variables		
<i>H</i> -statistic	<i>H</i> -statistic is calculated as the sum of the elasticity of revenue with respect to three input prices for each country at each year between 1996 and 2016 based on the Panzar and Rosse (1987) model.	Own calculation
Lerner index	Lerner index is equal to the difference between asset price and marginal cost, normalized by asset price	Own calculation
HHI	Hirschmann-Herfindahl index (HHI) of concentration of total assets, which is the sum of the squares of the market shares (assets) of each bank in each country at each year	Own calculation
Bank control variables		
TCD	The ratio of total customer deposits to total assets	Bankscope
LLP	The ratio of loan loss provision to gross loans	Bankscope
NIIC	Non-interest income divided by total operating income	Bankscope
ROA	Net income divided by total assets	Bankscope
log TA	Logarithm of total asset in \$ thousand	Bankscope
Bank Crisis	A dummy variable that equals one if the country is going through a systemic crisis in a given year, and zero otherwise	Laeven and Valencia (2010)
Foreign Dummy	A binary variable which equals one if the bank is a foreign subsidiary and zero otherwise	Bankscope
Country control variables		
Market capitalization to GDP	Stock market capitalization to GDP.	World Bank Development Indicator Database
GDP per capita	GDP per capital in \$ thousand	World Bank Development Indicator Database
GDP growth	Annual growth rate of GDP at market prices based on constant local currency	World Bank Development Indicator Database
Inflation	Inflation rate	World Bank Development Indicator Database
Interest rate	The interest rate charged by banks on loans to prime customers	World Bank Development Indicator Database
Regulation and supervision variables		
Bank concentration	The degree of concentration of deposits in the 5 largest banks	Barth, Caprio, and Levine (2013).
Government-owned banks	The extent to which the banking system's assets are government owned	Barth, Caprio, and Levine (2013).
Activity restriction	A variable measures a bank's ability to engage in securities, insurance, and real estate activities. The ranges from 0 to 12, and a higher score indicates more restrictions on banks to engage in such activities.	Barth, Caprio, and Levine (2013).
Foreign bank limitation	A variable measures whether foreign banks may own domestic banks and whether foreign banks may enter a country's banking industry. The variable ranges from 0 to 4, and lower values indicate greater stringency.	Barth, Caprio, and Levine (2013).
Entry barriers	A variable which indicates that whether various types of legal submissions are required to obtain a banking license. The variable ranges from 0 to 8, and higher values indicate greater stringency.	Barth, Caprio, and Levine (2013).
Capital regulatory index	A variable that captures both the overall capital stringency and the initial capital stringency based on answers to eight questions. It ranges from zero to eight, with a higher value indicating higher capital stringency.	Barth, Caprio, and Levine (2013).
Official supervisory power	A variable that ranges from zero to fourteen, with fourteen indicating the highest power of the supervisory authorities.	Barth, Caprio, and Levine (2013).
Diversification index	A variable that ranges from zero to two, with higher values indicating more diversification.	Barth, Caprio, and Levine (2013).
Private monitoring index	A variable that measures whether there incentives/ability for the private monitoring of firm, with higher values indicating more private monitoring.	Barth, Caprio, and Levine (2013).
Deposit insurance ratio	The size of the deposit insurance fund relative to total bank assets.	Barth, Caprio, and Levine (2013).

Table 2: Summary Statistics

This table reports summary statistics of the variables for the full sample, and sample distribution according to year and country. Our sample period is 2000–2015. All data are inflation-adjusted and bank-specific variables are winsorized at the 1st and 99th percentile level to reduce the influence of outliers.

Panel A: Data Statistics								
Variable	N	Mean	STD	Min	Max	P25	Median	P75
<i>Dependent variables</i>								
H-statistic	12856	0.575	0.534	0.165	0.816	0.269	0.527	0.791
Lerner index	8792	0.225	0.374	0.192	0.901	0.287	0.258	0.716
HHI	12856	0.107	0.045	0.042	0.354	0.073	0.094	0.128
<i>Bank control variables</i>								
TCD	12856	0.535	0.256	0.031	0.816	0.335	0.613	0.760
LLP	12856	0.016	0.018	0.000	0.057	0.002	0.009	0.023
NIIC	12856	0.311	0.233	0.045	0.882	0.122	0.260	0.437
ROA	12856	0.014	0.013	-0.003	0.043	0.005	0.011	0.019
log TA	12856	14.862	2.660	10.284	19.537	12.831	14.581	16.499
Bank Crisis	12856	0.081	0.273	0	1	0	0	0
Foreign Dummy	12856	0.179	0.383	0	1	0	0	0
<i>Country control variables</i>								
Market capitalization to GDP (%)	12856	62.929	53.275	0.850	321.984	26.753	46.601	78.822
GDP per capita (\$ thousand)	12856	5.280	3.587	0.395	16.007	2.400	4.596	7.736
GDP growth (%)	12856	4.580	4.172	-13.127	14.231	3.005	5.094	7.107
Inflation (%)	12856	8.320	8.824	-5.016	75.271	3.525	6.859	8.778
Interest rate (%)	12856	18.469	15.716	3.536	67.083	7.470	12.134	23.685
<i>Regulation and supervision variables</i>								
Bank concentration (%)	10677	56.683	18.385	4.000	93.000	52.000	57.000	65.000
Government-owned banks (%)	11333	30.787	23.439	0.000	75.000	11.000	32.000	44.000
Activity restriction	12714	7.702	2.013	4	12	6	8	10
Foreign bank limitation	12693	3.670	0.674	0	4	3	4	4
Entry barriers	12856	7.511	0.905	3	8	7	8	8
Capital regulatory index	12645	6.455	2.263	2	10	5	6	8
Official supervisory power	12856	11.578	2.356	4	16	10	12	13
Diversification index	11559	1.269	0.757	0	2	1	1	2
Private monitoring index	12465	8.565	1.239	6	11	8	9	9
Deposit insurance ratio	7441	0.120	0.325	0	1	0	0	0
Panel B: Sample distribution by Year and by Country								
Sample Distribution by Year			Sample Distribution by Country					
Year	Frequency	Percentage	Country	Frequency	Percentage			
1996	236	1.84	Argentina	819	6.37			
1997	263	2.05	Bangladesh	201	1.56			
1998	419	3.26	Brazil	1,490	11.59			
1999	476	3.70	Bulgaria	203	1.58			
2000	574	4.46	Chile	384	2.99			
2001	537	4.18	China	1,307	10.17			
2002	520	4.04	Colombia	354	2.75			
2003	482	3.75	Hungary	300	2.33			
2004	608	4.73	India	853	6.64			
2005	710	5.52	Indonesia	897	6.98			
2006	741	5.76	Malaysia	975	7.58			
2007	755	5.87	Mexico	164	1.28			
2008	763	5.93	Pakistan	435	3.38			
2009	817	6.36	Peru	346	2.69			
2010	914	7.11	Philippines	468	3.64			
2011	884	6.88	Poland	470	3.66			
2012	743	5.78	Romania	247	1.92			
2013	666	5.18	Russia	1,247	9.70			
2014	591	4.60	South Africa	532	4.14			
2015	585	4.55	Thailand	359	2.79			
2016	572	4.45	Turkey	451	3.51			
			Ukraine	120	0.93			
			Venezuela	234	1.82			
Total	12856	100	Total	12856	100			

Table 3 Correlations Between Variables

This table provides the information of correlation between variables. Panel A presents the correlation between bank-level variables, and Panel B reports the correlation between country-level variables. All variables are defined as in Table 1. Superscripts ***, **, * indicate correlation between variables are significance 1%, 5%, and 10% respectively.

Panel A: Correlation matrix between bank-level variables																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)								
<i>H</i> -statistic (1)	1																
HHI (2)	-0.133***	1															
Lerner index (3)	-0.0708***	-0.0352***	1														
TCD (4)	0.102***	0.0112	-0.0547***	1													
LLP (5)	-0.0353***	0.0965***	0.0500***	-0.128***	1												
NIIC (6)	0.00870	0.0953***	0.0666***	-0.117***	-0.00217	1											
ROA (7)	-0.0210**	0.0826***	0.427***	-0.200***	-0.00874	0.0124	1										
log TA (8)	0.0197**	-0.284***	0.0456***	0.191***	-0.173***	-0.0742***	-0.120***	1									
Bank crisis (9)	-0.00545	0.243***	-0.108***	-0.00653	0.163***	0.0603***	-0.0988***	-0.176***	1								
Foreign dummy (10)	-0.0320***	0.0127	0.00277	-0.0336***	-0.0420***	-0.00687	-0.0424***	0.0743***	-0.0164*								
Panel B: Correlation matrix between country-level variables																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
<i>H</i> -statistic (1)	1																
HHI (2)	-0.133***	1															
Lerner index (3)	-0.0708***	-0.0352***	1														
Market capitalization to GDP (4)	-0.0108	-0.428***	0.0685***	1													
GDP per capita (5)	0.00369	-0.0505***	0.113***	0.0939***	1												
GDP growth (6)	0.0900***	-0.163***	0.109***	0.143***	-0.182***	1											
Inflation (7)	0.0543***	0.384***	-0.139***	-0.321***	-0.0359***	-0.350***	1										
Interest rate (8)	-0.159***	0.0865***	-0.182***	-0.280***	0.0694***	-0.398***	0.323***	1									
Bank concentration (9)	0.195***	0.231***	0.140***	0.251***	0.197***	-0.0298***	-0.102***	-0.317***	1								
Government-owned banks (10)	0.0105	-0.0445***	-0.0995***	-0.385***	-0.192***	0.253***	0.165***	0.209***	-0.352***	1							
Activity restriction (11)	-0.120***	0.0265***	0.0334***	-0.0864***	-0.388***	0.413***	0.0607***	-0.338***	0.0559***	0.278***	1						
Foreign bank limitation (12)	0.00893	0.123***	-0.120***	-0.275***	-0.122***	0.123***	0.178***	0.241***	-0.145***	0.425***	0.105***	1					
Entry barriers (13)	-0.0574***	0.0327***	0.0336***	-0.0911***	0.0933***	-0.0468***	0.139***	0.230***	-0.104***	0.00430	-0.171***	-0.148***	1				
Capital regulatory index (14)	0.0295***	-0.159***	0.0870	-0.160***	-0.116***	0.0745***	-0.158***	-0.220***	0.0397***	0.0982***	0.189***	0.0830***	-0.0133	1			
Official supervisory power (15)	0.0463***	-0.110***	-0.0387*	-0.140***	-0.0962***	0.103***	-0.116***	0.158***	-0.160***	-0.0798***	0.0992***	0.00536	0.201***	-0.0190**	1		
Diversification index (16)	0.0965	-0.142***	-0.0199*	0.303***	-0.156***	0.210***	-0.160***	-0.366***	-0.00141	-0.0712***	0.120***	-0.260***	-0.125***	-0.190***	-0.200***	1	
Private monitoring index (17)	0.142***	-0.308***	-0.0584**	0.170***	-0.276***	0.242***	-0.150***	-0.131***	-0.00796	0.309***	0.287***	0.102***	0.0953***	0.169***	0.146***	0.215***	1
Deposit insurance ratio (18)	0.0943***	0.00874	-0.117***	-0.0559***	0.357***	-0.197***	-0.0245**	0.312***	0.307***	0.111***	-0.670***	0.0337***	0.150***	-0.259***	0.218***	-0.466***	-0.103***

Table 4: Impact of Bank Regulation and Supervision on H-statistic

The dependent variable is *H*-statistic which is estimated based on Panzar and Rosse (1987) model as defined in equation (1). Our sample period is 1996-2016. Bank-level controls include *TCD*, *LLP*, *NIIC*, *ROA*, and *log TA*. Country control variables include *Market capitalization*, *GDP per capita*, *GDP growth*, *Inflation*, and *Interest rate*. Regulation and supervision variables include *Bank concentration*, *Government-owned banks*, *Activity restriction*, *Foreign bank limitation*, *Entry barriers*, *Capital regulatory index*, *Official supervisory power*, *Diversification index*, *Private monitoring index*, and *Deposit insurance ratio*. All variables are defined in Table 1. Reported *t*-statistics (in parentheses) are based on standard errors that are heteroskedasticity consistent and clustered at the bank level. Significance levels at 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank control variables									
TCD	0.261*** (3.62)	0.264*** (3.67)	0.239*** (3.36)	0.245*** (3.50)	0.259*** (3.64)	0.273*** (3.81)	0.261*** (3.67)	0.261*** (3.59)	0.144* (1.84)
LLP	0.0122 (1.18)	0.0118 (1.14)	0.0123 (1.19)	0.0109 (1.08)	0.0130 (1.25)	0.0129 (1.22)	0.0128 (1.23)	0.0146 (1.36)	0.0102 (1.27)
NIIC	-0.0104* (-1.94)	-0.0105* (-1.95)	-0.0103* (-1.94)	-0.0105** (-1.96)	-0.00993* (-1.88)	-0.0109** (-1.97)	-0.00994* (-1.83)	-0.0102* (-1.91)	-0.00917* (-1.89)
ROA	0.397*** (2.88)	0.407*** (2.89)	0.377*** (2.79)	0.423*** (2.99)	0.366*** (2.71)	0.386*** (2.85)	0.462*** (3.26)	0.430*** (2.97)	0.493*** (3.69)
log TA	-0.0235 (-1.29)	-0.0243 (-1.34)	-0.0210 (-1.17)	-0.0229 (-1.29)	-0.0266 (-1.48)	-0.0305* (-1.75)	-0.0302* (-1.69)	-0.0323* (-1.87)	-0.0158 (-0.85)
Country control variables									
Market capitalization	-0.00784*** (-16.96)	-0.00794*** (-17.00)	-0.00772*** (-17.24)	-0.00831*** (-17.72)	-0.00766*** (-16.75)	-0.00741*** (-15.33)	-0.00822*** (-17.48)	-0.00728*** (-14.78)	-0.0124*** (-15.73)
GDP per capita	0.0694*** (7.92)	0.0679*** (7.58)	0.0734*** (8.68)	0.0739*** (9.73)	0.0740*** (8.11)	0.0679*** (7.45)	0.0641*** (7.80)	0.0772*** (7.81)	0.161*** (32.20)
GDP growth	0.00993*** (4.71)	0.0106*** (5.32)	0.00955*** (4.50)	0.0133*** (6.93)	0.00721*** (3.69)	0.00967*** (4.59)	0.0120*** (5.53)	0.00865*** (4.20)	0.0280*** (16.03)
Inflation	0.00709*** (4.73)	0.00763*** (4.86)	0.00666*** (4.37)	0.00844*** (5.86)	0.00691*** (4.72)	0.00585*** (4.13)	0.00837*** (5.52)	0.00551*** (3.81)	0.00681** (2.32)
Interest rate	0.0218*** (9.89)	0.0224*** (11.05)	0.0221*** (10.25)	0.0243*** (11.96)	0.0200*** (9.16)	0.0222*** (9.78)	0.0212*** (10.17)	0.0220*** (9.41)	0.0446*** (17.39)
Regulation and supervision variables									
Bank concentration	0.00371*** (13.35)								
Government-owned banks	-0.00522*** (-4.29)								
Activity restriction		-0.0161** (-2.22)							
Foreign bank limitation			0.0528*** (3.11)						
Entry barriers				-0.0937*** (-10.00)					
Capital regulatory index					0.0336*** (3.69)				
Official supervisory power						0.0360*** (4.49)			
Diversification index							-0.137*** (-6.68)		
Private monitoring index								0.0827*** (4.74)	
Deposit insurance ratio									0.105* (1.83)
Constant	0.250 (0.99)	0.369 (1.36)	0.0435 (0.17)	0.911*** (3.32)	-0.0345 (-0.13)	-0.0929 (-0.33)	0.649** (2.54)	-0.571* (-1.66)	-0.583** (-1.97)
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	9365	12714	12693	12856	12645	12856	11559	12465	7441
R-squared	0.186	0.130	0.131	0.134	0.130	0.139	0.141	0.168	0.292

Table 5: Impact of Bank Regulation and Supervision on Competition. Alternative Measure of Competition

The dependent variables are *Lerner index* and HHI in Panel A and Panel B, respectively. Our sample period is 1996-2016. Bank-level controls include *TCD, LLP, NIIC, ROA*, and *log TA*. Country control variables include *Market capitalization, GDP per capita, GDP growth, Inflation*, and *Interest rate*. Regulation and supervision variables include *Bank concentration, Government-owned banks, Activity restriction, Foreign bank limitation, Entry barriers, Capital regulatory index, Official supervisory power, Diversification index, Private monitoring index*, and *Deposit insurance ratio*. All variables are defined in Table 1. Bank-level control variables and country-level variables are also included in the regressions but not reported for brevity. Reported *t*-statistics (in parentheses) are based on standard errors that are heteroskedasticity consistent and clustered at the bank level. Significance levels at 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Lerner index									
Bank concentration	0.000498 (1.15)								
Government-owned banks	0.00212 (1.52)								
Activity restriction		0.00735* (1.91)							
Foreign bank limitation			-0.0188* (-1.85)						
Entry barriers				-0.00534 (-0.50)					
Capital regulatory index					-0.0140** (-2.29)				
Official supervisory power						-0.00555* (-1.95)			
Diversification index							0.0257** (2.43)		
Private monitoring index								-0.0239*** (-3.25)	
Deposit insurance ratio									-0.188** (-2.56)
Constant	0.525** (2.23)	0.567** (2.46)	0.456* (1.93)	0.556** (2.36)	0.413* (1.72)	0.574** (2.47)	0.608*** (2.68)	0.706*** (2.95)	0.0290 (0.10)
Bank and country control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	6456	8773	8816	8907	8725	8907	8218	8631	5361
R-squared	0.201	0.199	0.193	0.195	0.201	0.195	0.198	0.200	0.275
Panel B: HHI									
Bank concentration	0.000342*** (28.85)								
Government-owned banks	0.000997*** (15.69)								
Activity restriction		0.00122*** (2.90)							
Foreign bank limitation			-0.00303*** (-3.87)						
Entry barriers				0.00375*** (7.29)					
Capital regulatory index					-0.000194 (-0.68)				
Official supervisory power						-0.000572*** (-2.88)			
Diversification index							0.00352*** (3.86)		
Private monitoring index								-0.00376*** (-12.22)	
Deposit insurance ratio									-0.0108*** (-12.08)
Constant	0.0857*** (11.64)	0.0766*** (8.92)	0.0722*** (9.59)	0.114*** (13.01)	0.0878*** (11.06)	0.0920*** (11.89)	0.0955*** (12.02)	0.105*** (13.19)	0.0683*** (14.98)
Bank and Country Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	9365	12714	12693	12856	12645	12856	11559	12465	7441
R-squared	0.353	0.204	0.189	0.193	0.313	0.200	0.201	0.249	0.650

Table 6: Bank Regulation, Supervision, Bank Crisis, and H-statistic

The dependent variable is *H*-statistic which is estimated based on Panzar and Rosse (1987) model as defined in equation (1). Our sample period is 1996-2016. Bank-level controls include *TCD*, *LLP*, *NHC*, *ROA*, and *log TA*. Country control variables include *Market capitalization*, *GDP per capita*, *GDP growth*, *Inflation*, and *Interest rate*. Regulation and supervision variables include *Bank concentration*, *Government-owned banks*, *Activity restriction*, *Foreign bank limitation*, *Entry barriers*, *Capital regulatory index*, *Official supervisory power*, *Diversification index*, *Private monitoring index*, and *Deposit insurance ratio*. All variables are defined in Table 1. Reported *t*-statistics (in parentheses) are based on standard errors that are heteroskedasticity consistent and clustered at the bank level. Significance levels at 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank crisis, regulation, and supervision variables									
Bank concentration	0.00321***								
	(10.94)								
Bank concentration * Bank Crisis	-0.00988***								
	(-8.92)								
Government-owned banks	-0.00628***								
	(-5.41)								
Government-owned banks * Bank Crisis	0.00802***								
	(3.94)								
Activity restriction		-0.0157**							
		(-2.17)							
Activity restriction * Bank Crisis		-0.0288***							
		(-6.18)							
Foreign bank limitation			0.0470***						
			(2.81)						
Foreign bank limitation * Bank Crisis			-0.0354***						
			(-3.15)						
Entry barriers				-0.0937***					
				(-9.77)					
Entry barriers * Bank Crisis				-0.0227***					
				(-5.11)					
Capital regulatory index					0.0330***				
					(3.61)				
Capital regulatory index * Bank Crisis					-0.0196***				
					(-4.16)				
Official supervisory power						0.0352***			
						(4.37)			
Official supervisory power * Bank Crisis						-0.0146***			
						(-4.08)			
Diversification index							-0.152***		
							(-7.21)		
Diversification index * Bank Crisis							-0.198***		
							(-6.96)		
Private monitoring index								0.0829***	
								(4.78)	
Private monitoring index * Bank Crisis								-0.0220***	
								(-5.75)	
Deposit insurance ratio									0.113*
									(1.95)
Deposit insurance ratio * Bank Crisis									-0.195***
									(-6.56)
Constant	0.225	0.305	0.0325	0.882***	-0.0636	-0.101	0.685***	-0.617*	0.113*
	(0.89)	(1.13)	(0.13)	(3.23)	(-0.23)	(-0.36)	(2.72)	(-1.81)	(1.95)
Bank and Country Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	9365	12714	12693	12856	12645	12856	11559	12465	7441
R-squared	0.191	0.135	0.134	0.136	0.133	0.141	0.141	0.172	0.292

Table 7: Bank Regulation, Supervision, Foreign Ownership, and H-statistic

The dependent variable is *H*-statistic which is estimated based on Panzar and Rosse (1987) model as defined in equation (1). Our sample period is 1996-2016. Bank-level controls include *TCD*, *LLP*, *NIIC*, *ROA*, and *log TA*. Country control variables include *Market capitalization*, *GDP per capita*, *GDP growth*, *Inflation*, and *Interest rate*. Regulation and supervision variables include *Bank concentration*, *Government-owned banks*, *Activity restriction*, *Foreign bank limitation*, *Entry barriers*, *Capital regulatory index*, *Official supervisory power*, *Diversification index*, *Private monitoring index*, and *Deposit insurance ratio*. All variables are defined in Table 1. Reported *t*-statistics (in parentheses) are based on standard errors that are heteroskedasticity consistent and clustered at the bank level. Significance levels at 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank crisis, regulation, and supervision variables									
Bank concentration	0.00370*** (12.55)								
Bank concentration * Foreign Dummy	0.0000592 (0.23)								
Government-owned banks	-0.00495*** (-3.53)								
Government-owned banks * Foreign Dummy	-0.000912 (-0.48)								
Activity restriction		-0.0232*** (-2.78)							
Activity restriction * Foreign Dummy		0.0215** (1.98)							
Foreign bank limitation			0.0701*** (3.75)						
Foreign bank limitation * Foreign Dummy			-0.108*** (-3.28)						
Entry barriers				-0.0918*** (-9.16)					
Entry barriers * Foreign Dummy				-0.0358 (-1.11)					
Capital regulatory index					0.0335*** (3.59)				
Capital regulatory index * Foreign Dummy					0.000396 (0.05)				
Official supervisory power						0.0263*** (3.02)			
Official supervisory power * Foreign Dummy						0.0455** (2.47)			
Diversification index							-0.150*** (-7.35)		
Diversification index * Foreign Dummy							0.0765*** (2.80)		
Private monitoring index								0.0690*** (3.86)	
Private monitoring index * Foreign Dummy								0.0754** (2.30)	
Deposit insurance ratio									0.105* (1.83)
Deposit insurance ratio * Foreign Dummy									0.000341 (0.04)
Constant	0.244 (0.96)	0.404 (1.48)	0.0385 (0.15)	0.941*** (3.45)	-0.0347 (-0.13)	-0.107 (-0.38)	0.635** (2.47)	-0.574* (-1.68)	-0.583** (-1.97)
Bank and Country Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	9365	12714	12693	12856	12645	12856	11559	12465	7441
R-squared	0.186	0.130	0.132	0.134	0.130	0.140	0.142	0.168	0.292

Table 8: Impact of Bank Regulation and Supervision on Competition: Robustness Check

The dependent variable is *H-statistic* which is estimated based on equation (1). Our sample period is 1996-2016. Bank-level controls include *TCD*, *LLP*, *NIIC*, *ROA*, and *log TA*. Country control variables include *Market capitalization*, *GDP per capita*, *GDP growth*, *Inflation*, and *Interest rate*. Regulation and supervision variables include *Bank concentration*, *Government-owned banks*, *Activity restriction*, *Foreign bank limitation*, *Entry barriers*, *Capital regulatory index*, *Official supervisory power*, *Diversification index*, *Private monitoring index*, and *Deposit insurance ratio*. All variables are defined in Table 1. Bank-level control variables and country-level variables are also included in the regressions but not reported for brevity. Reported *t*-statistics (in parentheses) are based on standard errors that are heteroskedasticity consistent and clustered at the bank level. Significance levels at 10%, 5%, and 1% are indicated by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Alternative Specification									
Bank concentration	0.00414*** (15.33)								
Government-owned banks	-0.00168 (-1.44)								
Activity restriction		-0.0148** (-2.48)							
Foreign bank limitation			0.0757*** (4.72)						
Entry barriers				-0.0987*** (-12.45)					
Capital regulatory index					0.0377*** (4.43)				
Official supervisory power						0.0347*** (4.88)			
Diversification index							-0.153*** (-8.25)		
Private monitoring index								0.0781*** (5.18)	
Deposit insurance ratio									0.0236 (0.48)
Constant	-0.281*** (-2.87)	-0.192 (-1.61)	-0.571*** (-5.15)	0.333*** (3.30)	-0.704*** (-4.76)	-0.559*** (-4.25)	0.0737 (0.68)	-1.123*** (-4.92)	-1.084*** (-7.07)
Bank and Country Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	9365	12714	12693	12856	12645	12856	11559	12465	7441
R-squared	0.307	0.194	0.193	0.199	0.194	0.201	0.267	0.237	0.335
Panel B: Commercial Banks									
Bank concentration	0.00346*** (11.07)								
Government-owned banks	-0.00226* (-1.65)								
Activity restriction		-0.0201*** (-2.61)							
Foreign bank limitation			0.0684*** (3.46)						
Entry barriers				-0.109*** (-11.00)					
Capital regulatory index					0.0316*** (2.73)				
Official supervisory power						0.0261** (2.57)			
Diversification index							-0.122*** (-4.87)		
Private monitoring index								0.0547** (2.28)	
Deposit insurance ratio									0.0305 (0.46)
Constant	0.521* (1.92)	0.667** (2.33)	0.236 (0.89)	1.265*** (4.42)	0.246 (0.80)	0.257 (0.80)	0.875*** (3.21)	-0.0517 (-0.12)	-0.731** (-2.35)
Bank and Country Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Bank and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	5712	8100	8112	8236	8043	8236	7378	7934	4391
R-squared	0.196	0.168	0.170	0.168	0.168	0.173	0.129	0.183	0.334
Panel C: BRICS									
Bank concentration	0.000580*								
	(1.71)								
Government-owned banks	-0.0961***								
	(-15.33)								
Activity restriction		-0.0838***							
		(-4.74)							
Foreign bank limitation			0.216***						
			(4.74)						
Entry barriers				-0.0775***					
				(-4.74)					
Capital regulatory index					0.0368***				
					(4.74)				
Official supervisory power						0.0366***			
						(4.74)			
Diversification index							-0.195***		
							(-4.74)		
Private monitoring index								0.129***	
								(4.74)	
Deposit insurance ratio									0.442***
									(-4.14)
Constant	6.139***	6.853***	6.004***	6.326***	6.067***	5.587***	4.111***	8.230***	-128.5***
	(15.66)	(18.68)	(13.97)	(15.91)	(14.35)	(11.58)	(5.66)	(18.89)	(-217.35)
Bank and Country Control Variables									
Bank and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	3947	5429	5429	5429	5429	5429	4343	5429	3044
R-squared	0.684	0.550	0.545	0.543	0.539	0.539	0.578	0.538	0.805
Panel D: Subsample without Transition Countries									
Bank concentration	0.00375***								
	(9.29)								
Government-owned banks	-0.00474								
	(-1.52)								
Activity restriction		-0.0194***							
		(-2.69)							
Foreign bank limitation			0.0510***						
			(3.09)						
Entry barriers				-0.0971***					
				(-10.54)					
Capital regulatory index					0.0347***				
					(3.40)				
Official supervisory power						0.0397***			
						(4.94)			
Diversification index							-0.144***		
							(-6.80)		
Private monitoring index								0.0916***	
								(5.18)	
Deposit insurance ratio									0.271***
									(5.36)
Constant	0.284	0.425	0.0522	0.979***	-0.115	0.145	0.607**	-0.289	0.955***
	(0.96)	(1.37)	(0.18)	(3.10)	(-0.34)	(0.48)	(2.09)	(-0.81)	(3.35)
Bank and Country Control Variables									
Bank and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	8810	11967	11946	12109	11898	12109	10812	11718	6756
R-squared	0.197	0.136	0.137	0.139	0.136	0.145	0.153	0.172	0.322