THAMMASAT REVIEW
PRINT ISSN: 0859-5747 ONLINE ISSN: 2630-0303
Volume 20 No 1 (January-June) 2017 [Page 19-36]

Does Bank Competition Contribute to Financial Stability?

Sanhapas Laowattanabhongse * and Sorasart Sukcharoensin

School of Development Economics,
National Institute of Development Administration, Thailand

Received 28 May 2017; Received in revised form 7 September 2017
Accepted 5 October 2017; Available online 10 January 2018

Abstract

The relationship between bank competition and financial system stability is indeed very complex. At present, there is still a controversial debate on the two opposing views of the relationship. Under the traditional view called competition-fragility, the hypothesis suggests that a more competitive banking system is less stable. On the contrary, under the recent view called competition-stability, the hypothesis suggests that a more competitive banking system is more stable. This paper, therefore, attempts to fill in the literature gap by using a sample of 81 countries including both developed and developing countries from 2000 to 2013. The results reveal that the relationship between bank competition and financial system stability can vary across different market characteristics, specifically when the segmentation is based on accessibility to funding via financial market and size of credit relative to a country's GDP. These findings have significant policy implications and help to analyse the effect of competition in financial sector to its stability.

Keywords

Bank Competition, Financial System Stability, Market Power, Concentration, Efficiency

*** Corresponding author**: Sanhapas.Lao@gmail.com **DOI**: 10.14456/tureview.2017.2

Introduction

Existing theoretical frameworks still provide an inconclusive relationship between bank competition and financial system stability. This topic is still a controversial issue among researchers. On one side, the traditional hypothesis of competition-fragility suggests that a more competitive banking system is less stable. In other words, a less competitive banking system is more stable. That is because banks have more lending opportunities, and as a result, they can increase profits by increasing their lending volume. These profits can indeed be a buffer to help banks withstand more economic fluctuation and less incentivise the management to take excessive risky projects. Hence, the whole financial system is more stable. On the opposite side, the recent hypothesis of competition-stability suggests that a more competitive banking system is more stable. In other words, a less competitive banking system is less stable. One of the arguments under this hypothesis is that under a more concentrated market, banks are able to charge a higher interest rate to firms. As a result, this induces firms to take more risky projects, and the probability that the firms can default is higher. As the default risk is eventually shifted from firms to banks in this circumstance, it leads to higher a chance of bank failure.

To date, there are several empirical studies investigating the relationship under this competition-stability nexus. However, there are only a few papers documenting the relationship between them in different market segmentations. Therefore, this paper contributes to the existing literature gap by exploring the linkage between bank competition and financial system stability under different market segmentations.

In this paper, both micro bank-level and macro country-level data from a selected sample of 81 countries covering both developed and developing countries during from 2000 to 2013 are used. The empirical result reveals that the proxy for bank competition, specifically market pricing power, has a positive relationship with financial system stability. Therefore, the competition-fragility hypothesis is supported. However, this finding can vary across different market characteristics, especially when samplings are segmented based on accessibility to funding via the banking industry and size of the credit relative to a country's GDP.

The remaining parts of this paper are structured as follows. The next section summarizes the existing literature. Then, it is followed by data, variable specifications and methodology. After that, the empirical results are discussed. The last section concludes our findings with recommended policy implications.

Literature Reviews

There are two main subsections reviewing the evolution of research on bank competition and financial system stability, starting from the very early stage on how to

determine the proxy for bank competition. Then, the studies on the relationship between bank competition and stability are reviewed in the subsequent subsection.

Bank Competition Measurement

It has been known among researchers that there is no direct measurement for bank competition. Therefore, they need to identify a certain proxy to represent it. The development on the proxy of bank competition has evolved into two main approaches called the structural and non-structural approaches.

The structural approach focuses mainly on the Structure Conduct Performance (SCP) framework, which explores whether a highly concentrated market can achieve a superior performance compared to a less concentrated one or not. One of the important assumptions is that a superior performance can be achieved through collusive behavior among larger banks. Bain (1951) states that when the market concentration increases, the prices usually increase. As a result, firms have positive normal profits. However, Smirlock (1985) and Evanoff and Fortier (1988) argues that higher profits in concentrated markets can be the result of greater productivity. The competition under this structural approach can be measured by, for example, k-bank Concentration Index.

The non-structural approach, on the other hand, focuses mainly on the factors other than market structure and concentration that can affect the competitive behavior of the banks. Such factors include general contestability of the market, barrier to entry, market restrictions and so on. While the structural approach focuses on the structure of the market (i.e. Concentration Index) and relates this to the conduct (i.e. pricing policy) and performance of the banks (i.e. return of asset), the non-structural approach does not attempt to do so. Therefore, as documented by Goddard, Molyneux and Wilson (2001), the most important advantage of the non-structural approach is probably that it does not presume that the concentrated markets are, in general, not competitive. That is because contestability may depend on the competitive environment and not solely on the market structure. The competition under this non-structural approach can be computed by several empirical models. For example, Bresnahan's (1989) model uses the condition of general market equilibrium. The basic concept is that profit-maximizing firm in equilibrium will choose prices and quantities such that marginal cost is equal to their marginal revenue. The test statistic estimated from this model is quite simple to interpret as it provides a direct relationship to a natural measure of excess capacity. The alternative empirical model is developed by Panzar and Rosse (1987). This model investigates a change in factor input prices in response to a change in equilibrium revenue earned. More recently, there is another empirical model constructed under non-structural approach, called the Lerner Index. This index directly measures market pricing power, and it is calculated by taking the difference between price of

the output and the marginal cost then dividing by the price. The interpretation of this index is that when there is no mark-up, it means that the market is very competitive. On the contrary, when the mark-up is higher, it means the market is less competitive. One of the main advantages of this index is that it measures the degree of bank competition at bank level.

There are several empirical studies that investigate the degree of bank competition. For example, Shaffer (1989) adopts Bresnahan's model and finds a result that strongly rejects collusive behavior in the U.S. banking industry from 1965 to 1987. By applying the same methodology to the Canadian banking industry from 1965 to 1989, Shaffer (1993) later concludes that such market is competitive even though the concentration level is very high. By adopting Panzar and Rosse's model, Shaffer (1982) finds that the banking industry in New York is under monopolistic competition during 1979. Nathan and Neave (1989) investigate the Canadian banking industry and find a consistent result with that of Shaffer (1989). There are also several research papers, including Molyneux, Lloyd-Williams and Thornton (1994), Bikker and Groenevald (2000) and De Bandt and Davis (2000), that apply the Panzar and Rosse's model to the European banking industry. In general, the results reject both perfect competition as well as monopoly. They mostly find supporting evidence of monopolistic competition.

More recently, Bikker and Spierdijk (2008) study the level of competition using a sample of 101 countries from 1986 to 2004. They find that the level of competition declines for developed countries and increases for developing countries. Using the same methodology, Turk-Ariss (2009) investigates the level of competition in 12 Middle East and North African countries. He concludes that the level of competition is under monopoly for North African countries and under monopolistic competition for the others.

Bank Competition and Stability

After the researchers are able to identify the proxy for bank competition, they later perform an investigation on the relationship between such competition and financial system stability. Still, the existing economic frameworks provide an ambiguous conclusion on such relationship. At present, there are two main hypotheses regarding to this relationship, which are (1) competition-fragility and (2) competition-stability hypotheses. A research interest on the traditional competition-fragility view has been triggered by an article written by Keeley (1990), which concludes that one of the main reasons of bank failures in the U.S. during 1980s is resulted from various deregulation policies and market factors that lower monopoly rents (known as franchise value or charter value) of the banks. The franchise (charter) value model suggests that competition drives banks to take risky projects due to the contraction of their franchise value. The model also shows that a higher franchise (charter) value resulted

from an increase in market power from a concentrated market may decrease the excessive risk-taking behavior by the banks, which may improve the stability of the banks themselves.

Contrary to the traditional view, the recent competition-stability view suggests that more competitive banking systems (or less concentrated markets) are more stable. Boyd and De Nicolo (2005) develop a theoretical framework documenting that less competition in the banking industry will eventually lead to financial instability. They begin their analysis by assuming that borrowing firms usually choose the risk of their projects that is corresponding to the loan rates set by banks entirely. Therefore, when there is less competition in the market, banks tend to impose higher interest rates on their loan, and that causes the borrowing firms to take riskier projects inevitably. At the higher degree of risk taken by the borrowers, the amount of non-performing loan (NPL) to banks will increase. So, the authors conclude that as the risk is eventually transferred from borrowers to banks in this circumstance, it leads to a higher probability of financial system instability.

Existing empirical studies on the effect of bank competition to financial system stability still shows mixed results. By investigating the markets in eight Latin American countries from 1993 to 2002, Yeyati and Micco (2007) find a positive relationship between bank risk and competition. Schaeck and Cihak (2008) examine the relationship between bank competition and financial stability using a sample of more than 3,600 banks from 10 European countries and more than 8,900 banks from the U.S. from 1995 to 2005. They conclude that competition increases stability by increasing efficiency. In addition, Schaeck, Cihak and Wolfe (2009) use the data from 31 systemic banking crises in 45 countries from 1980 to 2005 and find that competition decreases the likelihood of a crisis and increases the time to a crisis, which supports the competition-fragility view. Also, they conclude that competition and concentration capture different characteristics of banking systems, meaning that concentration is an inappropriate proxy for competition.

Uhde and Heimeshoff (2009) use aggregated data of 25 European countries from 1997 to 2005 and show that national banking market concentration has a negative impact on the stability of European banking systems. Berger, Klapper and Turk-Ariss (2009) analyse 8,235 banks in 23 developed countries from 1999 to 2005 and conclude a neutral view that competition and concentration can (1) coexist and (2) simultaneously induce financial stability or fragility. They show that banks with more market power have less overall risk exposure. This result supports the traditional competition-fragility view. On the other hand, they find that banks with a higher market power have a riskier loan portfolio. This result supports the competition-stability view.

Furthermore, Liu, Molyneux and Nguyen (2012) investigate four South East Asian countries (Indonesia, Malaysia, Philippines and Vietnam) from 1998 to 2008 and find that competition is inversely related to most risk indicators including NPL ratio, Loan Loss

Reserve ratio, volatility of bank after-tax return on asset, except natural logarithm of Z-score Index. Additionally, they find that bank concentration has a negative effect on bank stability, whereas regulatory restrictions positively influence bank fragility. Therefore, they conclude that bank concentration and competition can coexist, and they may affect financial stability through different channels. Anginer, Demirguc-Kunt and Zhu (2012) study a sample of 1,872 listed banks in 63 countries from 1997 to 2009 and find a positive relationship between bank competition and systemic stability.

According to the above empirical investigations, it can be concluded that the relationship between bank competition and financial system stability is very complicated. The results can actually vary according to the proxy specifications and sampling groups.

Data and Variable Specifications

This paper uses both micro bank-level and macro country-level data from 2000 to 2013. The micro bank-level data is taken from the Bankscope database. All data are reported in USD and are expressed in constant prices where appropriate. The sample is limited to commercial banks, and countries with less than ten banks in the industry are excluded. Also, in order to align the analysis at country level, bank-level data are aggregated into country level. The macro country-level data is mainly obtained from the latest update of the World Development Indicators Database (WDID) and Global Financial Development Database (GFDD) from the World Bank. Table 1 summarizes the variables used in this paper.

Table 1 Summary of Variables

Variable	Description	Sample Period	Data Source
Group A: Competition Measure			
LI	Lerner index	2000-2013	Global Financial Development Database, World Bank
Group B: Stability Measure			
LNZI	Logarithmic form of Z-score index	2000-2013	Global Financial Development Database, World Bank
Group C: Bank-Specific Control Variables			
CIR	Cost to income ratio	2000-2013	Global Financial Development Database, World Bank
RDI	Revenue diversification index	2000-2013	Bankscope Database, Bureau Van Dijk
NPL	Non-performing loan to total loan ratio	2000-2013	Global Financial Development Database, World Bank
LNTA	Logarithmic form of total asset	2000-2013	Bankscope Database, Bureau Van Dijk
LTA	Loan to asset ratio	2000-2013	Bankscope Database, Bureau Van Dijk
Group D: Country-Specific Control Variables			
CI3	Concentration index of 3 largest banks	2000-2013	Bankscope Database, Bureau Van Dijk
GDPG	GDP Growth Rate	2000-2013	World Development Indicators Database, World Bank
CPI	Inflation Rate	2000-2013	World Development Indicators Database, World Bank

The variables used in this paper can be categorized into four main groups. The first group is the competition measurement or market pricing power, which is represented by the Lerner Index. The second group is the stability measure, which is represented by the logarithmic form of Z-score Index. The bank-specific control variables, which include efficiency, revenue diversification index, portfolio risk and bank size, are illustrated in the third group. The last group presents the country-specific control variables, which include concentration, GDP growth rate and inflation rate.

Group A: Competition Measure

The Lerner Index (denoted as LI hereafter) provides a direct measure of competition. It represents the mark-up of price over marginal cost and is calculated by taking the difference between price of the output and the marginal cost that produces such output and then dividing by the price. Empirical studies that have used this measure include Berger, Klapper and Turk-Ariss (2009), Liu, Molyneux and Nguyen (2012), Anginer, Demirguc-Kunt and Zhu (2012), Beck, Jonghe and Schepens (2013), Amidu and Wolfe (2013), etc.

The interpretation of this index is that when there is no mark-up (LI = zero), it means the market is very competitive. When LI is higher, it means higher market power. As a result, competition is lower. LI can be computed as the following.

$$LI_t = \frac{P_{it} - MC_{it}}{P_{it}} \tag{1}$$

where:

P_{it} is the price of each bank i at time t, which is calculated by the number of total revenue divided by total asset.

MC_{it} is the marginal cost of each bank i at time t, which is derived from a translog cost function that includes three costs and control variables as in equation 2.

$$\ln TC_{i,t} = \alpha_o + \alpha_1 \ln TA_{it} + \alpha_2 (\ln TA_{it})^2 + \sum_{j=1}^{3} \beta_j \ln w_{it}^j + \sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk} \ln w_{it}^j \ln w_{it}^k + \sum_{j=1}^{3} \gamma_j \ln w_{it}^j \times \ln TA_{it} + \varepsilon_{it} \tag{2}$$

where:

TC_{it} is the total cost of each bank i at time t.

w_{it} is the price of three inputs, which are deposit fund, labor and fixed asset.

w_{it}^1 is the price of deposit, which is the ratio of interest expense to total deposit.

w_{it}^2 is the price of labor, which is the ratio of personal expense to total asset.

w_{it}^3 is the price of fixed asset, which is the ratio of operating expense to fixed asset.

TA_{it} is the total asset.

In order to obtain a valid cost function, the following restrictions need to be imposed.

$$\sum_{j=1}^{3} \beta_j = 1 \tag{3}$$

$$\sum_{j=1}^{3} \gamma_j = 0 \tag{4}$$

$$\sum_{j=1}^{3} \beta_{jk} = 0 \text{ for } \forall k \in \{1,2,3\} \tag{5}$$

After imposing the above restrictions, marginal cost can be obtained as the following.

$$MC_{it} = \frac{\partial TC_{it}}{\partial TA_{it}} = \frac{TC_{it}}{TA_{it}} \left(\widehat{\alpha}_1 + 2\widehat{\alpha}_2 \ln TA_{it} + \sum_{j=1}^{2} \gamma_j \ln \frac{w_{it}^j}{w_{it}^3} \right) \tag{6}$$

Group B: Stability Measure

The logarithmic form of Z-score Index (denoted as LNZI hereafter) can assess the overall stability at the bank-level and combine the aspect of profitability, leverage and return volatility into one variable. This proxy is well recognized as the measure of bank soundness. The empirical studies that have used this measure include Schaeck and Cihak (2008), Laeven and Levine (2009), Beck, Demirguc-Kunt and Levine (2010), Cihak and Hesse (2010), Anginer, Demirguc-Kunt and Zhu (2012), Beck, Jonghe and Schepens (2013), Amidu and Wolfe (2013), etc.

Mathematically, this proxy measures the number of standard deviation that a bank's profit must fall to drive it into insolvency. Therefore, the higher LNZI, the lower probability of insolvency risk. The computation is illustrated as the following.

$$LNZI_{it} = Ln\left(\frac{ROA_{it} + ETA_{it}}{SD(ROA)_{it}} \right) \tag{7}$$

where:

ROA_{it} is the 1-year average return on asset of each bank i at time t.

ETA_{it} is the 1-year average of equity over total asset of each bank i at time t.

$SD(ROA)_{it}$ is the standard deviation of ROA from 3-year rolling period.

Group C: Bank-Specific Control Variables

This group contains five main variables. The first one is cost to income ratio (denoted as CIR hereafter). This variable is one of the most popular efficiency measurements of the bank. It is calculated as total cost over total income. So, it measures how well the expense is utilized per one unit of revenue. The higher the ratio is, the less efficient the bank becomes.

The second one is revenue diversification index (denoted as RDI hereafter), which is calculated by using the Hirschman Herfindahl approach for each bank. It accounts for the diversification between interest and non-interest income. A higher RDI ratio means higher revenue concentration and hence lower revenue diversification.

$$RDI_{it} = \left(\frac{NII_{it}}{TR_{it}}\right)^2 + \left(\frac{FI_{it}}{TR_{it}}\right)^2 + \left(\frac{TI_{it}}{TR_{it}}\right)^2 \quad (8)$$

where:

TR_{it} is the total revenue of each bank i at time t.

NII_{it} is the net interest income of each bank i at time t.

FI_{it} is the fee income of each bank i at time t.

TI_{it} is the trading income of each bank i at time t.

The third one is non-performing loan ratio (denoted as NPL hereafter), which is used to proxy for loan portfolio risk. It can be computed as NPL over total loan, and the higher ratio means higher portfolio risk. The fourth one is the bank size, which is the total asset held by each bank. It is presented in logarithmic form (denoted as LNTA hereafter). The last one is the loan to asset ratio, which is the percentage of total loan to total asset of each bank (denoted as LTA hereafter).

Group D: Country-Specific Control Variables

This group contains three main variables. The first one is Concentration Index (denoted as CI hereafter). The component of this measure is based mainly on the number of

banks and the distribution of banks in a certain market. The general form can be illustrated as the following.

$$CI_t = \sum_{i}^{n} s_{it} w_{it} \tag{9}$$

where:

s_{it} is the market share of bank i at time t.

w_{it} is the weight that the index attaches to the corresponding market share.

n is the number of banks in the market under consideration.

The weights attached to the individual market shares determine the sensitivity of the indices towards changes in the shape of the bank distribution. By summing the market shares of the k largest banks in the market, the k-bank Concentration Index can be constructed as the following.

$$CI_{kt} = \sum_{i=1}^{k} s_{it} \tag{10}$$

Even though there is no specific rule to determine the optimal number of k, in order to align with other existing literatures, such as Bikker and Haaf (2000), Claessens and Laeven (2004) and so on, k=3 is arbitrarily applied in this paper (denoted as CI3 hereafter). The index is in a range between zero and one, and it can be interpreted as the following. If it is equal to one, it means that the banks included in the computation make up the entire industry. On the other hand, if it approaches zero, it means that there exists an infinite number of very small banks in the market given that the k chosen banks for the computation is relatively small comparing to the total number of banks.

The second variable in this group is the rate of real GDP growth (denoted as GDPG hereafter). It reflects general economic development, macroeconomic stability and institutional framework as these are likely to affect banking system performance in a country. The third and last variable is the inflation rate, and it is computed based on the consumer price index (denoted as CPI hereafter).

Methodology

The methodology can be divided into two subsections. The first subsection explains the construction of the empirical model. The second part illustrates how the overall samplings can be segmented.

Model Specifications

The following baseline equation is used to test the relationship between bank competition and financial system stability. In principle, financial stability is a function of bank competition and a series of bank-specific control variables as well as country-specific control variables.

$$Stability = f(Competition, BankContrds, CountryControls) \quad (11)$$

The empirical model can be illustrated as the following**.**

$$Z_{it} = \beta_0 + \beta_1 C_{it} + \sum_{j=2}^{k} \beta_j X_{ij} + \varepsilon_{it} \quad (12)$$

Also, in order to account for a period fixed effect, a time variable is added into equation 12. The final baseline model is illustrated as the following in which *D* is the time dummy variable.

$$Z_{it} = \beta_0 + \beta_1 C_{it} + \sum_{j=2}^{k} \beta_j X_{ij} + D + \varepsilon_{it} \quad (13)$$

where:

Z_{it} is a measure for bank stability of each country i at time t

C_{it} is a measure for bank competition of each country i at time t

X_{ij} is a set of bank-specific and country-specific variables

Segmentation Specifications

In order to explore whether the relationship between competition and stability can vary across different market characteristics, the segmentation analysis is explored. The analysis is designed by segregating the total 81 sampled countries into four different groups by using two important dimensions that may reflect different market characteristics.

The first dimension is accessibility to funding via the banking industry. The proxy for this accessibility dimension is the percentage of firms using banks to finance their working capital. The data is obtained from the Global Financial Development Database (GFDD), the World Bank. After obtaining the data, the total 81 samplings are separated by using the median of this variable to classify the countries into High and Low accessibility to capital.

The second dimension is the size of credit relative to a country's GDP. This dimension can be represented by the ratio of credit to private sector over GDP. Similarly, the data is obtained from the Global Financial Development Database (GFDD), the World Bank. After obtaining the data, the total 81 samplings are separated by using the median of this

variable to classify the countries into Big and Small size of credit relative to country's GDP. We separate samples containing different dimensions of characteristics. They are partitioned to get four groups by allowing two crossly intersections between dimensions based on accessibility and credit size.

Table 2 documents the list of countries in each segmented group. Subgroup 1 includes countries that are identified as high accessibility and big credit size. The total samplings are 19 countries. Subgroup 2 includes countries that are identified as high accessibility and small credit size. The total samplings are 21 countries. Subgroup 3 includes countries that are identified as low accessibility and big credit size. The total samplings are 21 countries. The last subgroup consists of countries that are identified as low accessibility and small credit size. The total samplings are 20 countries.

Table 2 List of Countries in each Segment

Accessibility	**High**	**High**	**Low**	**Low**
Size	**Big**	**Small**	**Big**	**Small**
	Bosna	Argentina	UAE	Angola
	Bulgaria	Bangladesh	Austria	Azerbaijan
	Brasil	Belarus	Australia	Canada
	Chile	Colombia	Belgium	Egypt
	German	CostaRica	Bahrain	Georgia
	Spain	Czech	Switzerland	Ghana
	Honduras	Dominican	China	Guatemala
	Croatia	Ecuador	Denmark	Indonesia
	South Korea	Hungary	France	Mexico
	Lebanon	India	England	Nigeria
	Latvia	Kenya	Hong Kong	Norway
	Mauritius	Kazakhstan	Italy	New Zealand
	Malaysia	Sri Lanka	Jordan	Philippines
	Nepal	Peru	Japan	Russia
	Panama	Poland	Luxembourg	Tanzania
	Slovenia	Paraguay	Netherlands	Uruguay
	Thailand	Romania	Portugal	Uzbekistan
	Turkey	Serbia	Sweden	Venezuela
	Vietnam	El Salvador	Ukraine	Uganda
		Armenia	United States	Zambia
		Moldavia	South Africa	
Total	**19**	**21**	**21**	**20**

Results and Discussion

Table 3 presents the overall descriptive statistics of all variables across time and across countries. For group A, the mean of LI is at 0.24 and in the range of -0.62 to 0.84.

This means that on average a banking industry can do the pricing 24% higher than their marginal cost. For stability measure in group B, the sample mean of LNZI is at 2.18, and it varies between -1.33 to 3.71. For bank-specific control variables in group C, the sample mean of CIR is at 0.57. This can be interpreted that on average, banks spend 57% of their revenue to the expense. For revenue diversification measure, the mean of RDI is at 0.59 and in the range between 0.38 (much diversified revenue source) to 1.00 (perfect concentrated revenue source). For portfolio risk, the mean of NPL is at 0.05, which can be implied that on average banks have 5% of NPL in their portfolio. Lastly, for country-specific control variables in group D, the mean of CI3 is at 0.69. This can be interpreted that the market share of top-three banks covers 69% on average.

Table 3 Descriptive Statistics

Variable	Observation	Mean	Median	Max	Min	Stdev	Skewness	Kurtosis
Group A: Competition Measure								
LI	1,134	0.2392	0.2427	0.8351	-0.6232	0.1326	-0.5437	6.4776
Group B: Stability Measure								
LNZI	1,114	2.1755	2.2558	3.7075	-1.3310	0.7645	-0.5715	3.2057
Group C: Bank-Specific Control Variables								
CIR	1,134	0.5707	0.5682	2.1809	0.0325	0.1328	1.5815	22.4192
RDI	1,042	0.5922	0.5808	1.0000	0.3830	0.0986	0.5827	3.3989
NPL	1,134	0.0521	0.0300	0.3730	0.0041	0.0623	2.0874	7.7924
LNTA	1,134	1,112	178	74,021	0	7,537	9	80
LTA	1,044	0.5441	0.5587	0.9326	0.1724	0.1288	-0.3292	3.4102
Group D: Country-Specific Control Variables								
CI3	1,044	0.6921	0.6827	1.0000	0.2475	0.1751	0.0540	2.2076
GDPG	1,134	0.0415	0.0403	0.3450	-0.1480	0.0406	0.6950	11.0044
CPI	1,134	0.0683	0.0386	3.2500	-0.0369	0.1465	12.4035	225.1541

* Panel unit roots are also performed, and all variables are free from unit root problem.

Table 4 presents the fixed effect panel regression results from the total 81 sampled countries and segmented samplings. The table includes five empirical models. The first model, S11-ALL, is the one that uses 81 sampled countries, while the other four models, specifically S11-HB, S11-HS, S11-LB and S11-LH, use the sampled countries as described in Table 2. The main findings can be discussed as follows.

Table 4 Regression Results from Total Samplings and Segmented Samplings

Model	**S11-ALL**	**S11-HB**	**S11-HS**	**S11-LB**	**S11-LH**
Stability	**LNZI**	**LNZI**	**LNZI**	**LNZI**	**LNZI**
Competition	**LI**	**LI**	**LI**	**LI**	**LI**
Concentration	**CI3**	**CI3**	**CI3**	**CI3**	**CI3**
			Co-efficient		
C	2.8050***	3.7699***	2.0694***	2.9536***	2.9364***
	(0.1533)	(0.3671)	(0.3302)	(0.3567)	(0.2928)
LI	0.6054***	-0.5124**	1.2025***	0.4492	0.9605***
	(0.1068)	(0.2419)	(0.2004)	(0.2931)	(0.1897)
CIR	-0.4013***	-1.1371***	0.4920**	-0.1632	-0.4449**
	(0.1089)	(0.2071)	(0.2353)	(0.2397)	(0.2155)
RDI	-0.3736***	-0.5116*	-0.8216***	-0.4086	-0.1477
	(0.1416)	(0.2954)	(0.2964)	(0.3648)	(0.2582)
NPL	-0.9933***	-1.3856***	-0.9405***	-1.2656***	-1.9446***
	(0.1923)	(0.5360)	(0.2948)	(0.4958)	(0.4264)
LNTA	0.0000	-0.0001	0.0008*	0.0000	-0.0009***
	(0.0000)	(0.0003)	(0.0004)	(0.0000)	(0.0003)
LTA	-0.2177	-0.4575	-0.1209	-0.2727	-0.3900
	(0.1372)	(0.3527)	(0.2605)	(0.2914)	(0.2656)
CI3	-0.3213***	-0.4226**	-0.3498	-0.1237	-0.7427***
	(0.0869)	(0.1850)	(0.2203)	(0.1879)	(0.2037)
GDPG	0.8035***	0.5101	0.9466*	1.9024**	0.3886
	(0.2762)	(0.6433)	(0.5551)	(0.8619)	(0.4041)
CPI	-0.0227	0.2287	0.0241	0.4107	-0.3285**
	(0.0953)	(0.3680)	(0.1601)	(0.7449)	(0.1405)
R-squared	0.91	0.94	0.93	0.82	0.93
Adj. R-squared	0.90	0.93	0.91	0.79	0.91
F-stat	91.45	74.70	64.85	25.16	56.52
F-stat (prob.)	0.00	0.00	0.00	0.00	0.00
AIC	0.05	-0.05	0.09	0.19	-0.12
SIC	0.56	0.57	0.68	0.75	0.51
No. Countries	81	19	21	21	20

Standard errors are in parentheses.

*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels.

Firstly, from the model S11-ALL, the coefficient of LI is positive and statistically different from zero, this means that as the market pricing power is higher, it increases the

stability. In other words, when the market is less competitive, the stability increases. Therefore, this result supports the traditional competition-fragility hypothesis. In addition, the coefficient of bank-specific control variables, such as CIR, RDI and NPL is negative and statistically different from zero. This means that (1) when banks become more efficient, their stability increases, (2) when banks diversify more sources of revenue, their stability is enhanced and (3) when banks have a higher portfolio risk, their stability decreases. Moreover, the coefficient of CI3 is negative and statistically different from zero. This can be interpreted that when the market becomes less concentrated, it is associated with higher stability.

Secondly, after segmenting the total samplings into four main subgroups based on accessibility and credit size, the results from the segmented models, specifically S11-HB, S11-HS, S11-LB and S11-LH, are almost the same as those from model S11-ALL. Nevertheless, there is one interesting result obtained from model S11-HB. Even though almost all of the coefficients of each measure in this model are the same as in other models, the coefficient of competition, specifically LI, is negative and statistically different from zero, which can be interpreted that as the market pricing power is higher, it decreases the stability. In other words, when the market is less competitive, the stability decreases. Therefore, this result supports the recent competition-stability hypothesis. Also, as the coefficient of LI of model S11-HB differs from the others, it can be concluded that the relationship between competition and stability can vary across different market characteristics. Therefore, before launching a policy that may affect the competitive environment of the financial industry, a proper segmentation analysis should be done.

Conclusion

This paper contributes to the existing literature by exploring the linkage between bank competition and financial system stability under different market segmentations. In this study, both micro bank-level and macro country-level data from a selected sample of 81 countries including both developed and developing countries from 2000 to 2013 are used. The data at bank-level is aggregated to be at country-level. Then, a panel regression with cross-section and period fixed effects technique is conducted to analyse cross-country information. The stylized facts obtained from the study can be summarized as follows.

Firstly, when using the total 81 sampled countries, the proxy for bank competition, specifically market pricing power or LI, has a positive relationship with financial system stability. That is, when banks have higher pricing power, it is associated with a stable financial system. So, this empirical evidence supports the competition-fragility hypothesis.

Secondly, this measure of competition together with three bank-specific control variables; bank efficiency, revenue diversification and portfolio risk, can explain the variation

of financial system stability in the sampled countries and periods. The results show that bank efficiency and revenue diversification have a positive relationship with financial system stability. On the other hand, portfolio risk has a negative relationship with system stability, intuitively.

Thirdly, when all the countries are segmented into four main groups based on their accessibility to funding via the banking industry and size of credit relative to country's GDP, the results from three subgroups, specifically (1) high accessibility and a small credit size, (2) low accessibility and a big credit size and (3) low accessibility and a small credit size, are the same as those from the total 81 sampled countries. However, the coefficient of competition in one subgroup, specifically high accessibility and big credit size, is negative, and it is different from other models. This can be interpreted that the relationship between competition and stability can vary across different market characteristics.

From the above findings, it can be concluded that the relationship between competition and stability can actually vary across market characteristics. Therefore, before launching any policy that may affect the competitive environment in the financial industry, a proper in-depth analysis should be performed.

References

Amidu, M., & Wolfe, S. (2013). Does Bank Competition and Diversification Lead to Greater Stability? Evidence from Emerging Markets. *Review of Development Finance*, 3, 152-166.

Anginer, D., Demirguc-Kunt, A., & Zhu, M. (2012). How Does Bank Competition Affect Systemic Stability. *Policy Research Working Paper,* No.5981, The World Bank.

Bain, J. S. (1951). Relation of Profit Rate to Industry Concentration. *Quarterly Journal of Economics*, 65(3), 293-324.

Beck, T., Demirguc-Kunt, A., & Levine, R. (2010). Financial Institutions and Markets Across Countries and Over Time: The Updated Financial Development and Structure Database. *World Bank Economic Review*, 24, 77-92.

Beck, T., De Jonghe, O., & Schepens, G. (2013). Bank Competition and Stability: Cross-Country Heterogeneity. *Journal of Financial Intermediation*, 22, 218-224.

Berger, A. N., Klapper, L., & Turk-Ariss, R. (2009). Bank Competition and Financial Stability. *Journal of Financial Services Research*, 35, 99-118.

Bikker, J. A., & Groenevald, J. M. (2000). Competition and Concentration in the EU Banking Industry. *Kredit und Kapital*, 33, 62-98.

Bikker, J. A., & Haaf, K. (2002). Competition, Concentration and Their Relationship: An Empirical Analysis of the Banking Industry. *Journal of Banking and Finance*, 26(11), 2191-2214.

Bikker, J. A., & Spierdijk, L. (2008). How Banking Competition Changed Over Time. *Working Paper*.

Boyd, J. H., & De Nicolo, G. (2005). The Theory of Bank Risk-Taking and Competition Revisited. *Journal of Finance*, 60, 1329-1343.

Bresnahan, T. F. (1989). Empirical Studies of Industries with Market Power. *Handbook of Industrial Organization*, Elsevier, 2, 1012-1055.

Cihak, M., & Hesse, H. (2010). Islamic Banks and Financial Stability: An Empirical Analysis. *Journal of Financial Services Research*, 38(2-3), 19-35.

De Bandt, O., & Davis, E. P. (2000). Competition, Contestability and Market Structure in European Banking Sectors on the Eve of EMU. *Journal of Banking and Finance*, 24(6), 1045-1066.

Evanoff, D. D., & Fortier, D. L. (1988). Reevaluation of the Structural-Conduct-Performance Paradigm in Banking. *Journal of Financial Services Research*, 1(3), 277-294.

Keeley, M. C. (1990). Deposit Insurance, Risk and Market Power in Banking. *American Economic Review*, 80, 1183-1200.

Laeven, L., & Levine, R. (2009). Bank Governance, Regulation and Risk Taking. *Journal of Financial Economics*, 93(2), 259-275.

Liu, H., Molyneux, P., & Nguyen, L. H. (2012). Competition and Risk in South East Asian Commercial Banking. *Applied Economics*, 44, 3627-3644.

Molyneux, P., Lloyd-Williams, D. M., & Thornton J. (1994). Competitive Conditions in European Banking, *Journal of Banking and Finance*, 18(3), 445-459.

Nathan, A., & Neave, E. H. (1989). Competition and Contestability in Canada's Financial System: Empirical Results. *Canadian Journal of Economics*, 22, 576-594.

Panzar, J. C., & Rosse, J. N. (1987). Testing for Monopoly Equilibrium. *Journal of Industrial Economics*, 35, 443-456.

Schaeck, K., & Cihak, M. (2008). How Does Competition Affect Efficiency and Soundness in Banking? New Empirical Evidence. *Working Paper*, No.932, European Central Bank.

Schaeck, K., Cihak, M., & Wolfe S. (2009). Are Competitive Banking Systems More Stable? *Journal of Money, Credit and Banking*, 41(4), 711-734.

Shaffer, S. (1982). Non-Structural Measures of Competition: Toward a Synthesis of Alternatives. *Economics Letters*, 12(2), 349-353.

Shaffer, S. (1989). Competition in the U.S. Banking Industry. *Economics Letters*, 29(1), 321-323.

Shaffer, S. (1993). A Test of Competition in Canadian Banking. *Journal of Money, Credit and Banking*, 25(1), 49-61.

Smirlock, M. (1985). Evidence on the (Non) Relationship between Concentration and Profitability. *Journal of Money, Credit and Banking*, 17(1), 69-83.

Turk-Ariss, R. (2009). Competitive Behavior in Middle East and North Africa Banking Systems. *The Quarterly Review of Economics and Finance*, 49(2), 693-710.

Uhde, A., & Heimeshoff, U. (2009). Consolidation in Banking and Financial Stability in Europe: Empirical Evidence. *Journal of Banking and Finance,* 33(7), 1299-1311

Yeyati, E. Y., & Micco, A. (2007). Concentration and Foreign Penetration in Latin American Banking Sectors: Impact on Competition and Risk. *Journal of Banking and Finance*, 31(6), 1633-1647.