Development Economic Review
Volume 16 No.1 (January 2022)

Bank Competition and Financial System Stability: A Simultaneous Equations Approach

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Received April 29, 2021
Revised November 29, 2021
Accepted November 30, 2021

Abstract

This paper on reexamines the competition-stability nexus by applying the simultaneous equations technique on a sample of 81 countries including both developed and developing countries during the year 2000 to 2013. The results reveal that the proxies for bank competition from structural and non-structural approach have reverse effects on financial system stability. In addition, these proxies for bank competition do not only affect the financial system stability but also affect bank-specific variables, such as efficiency, revenue diversification and portfolio risk at the same time.

Keywords: Bank Competition, Financial System Stability, Market Concentration, Market Pricing Power, Efficiency

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บทคัดย่อ

การศึกษานี้ศึกษาความเชื่อมโยงระหว่างการแข่งขันและเสถียรภาพของระบบการเงินโดยประยุกต์ใช้ระบบสมการเกี่ยวเนื่องกับกลุ่มตัวอย่างของธนาคารพาณิชย์ใน 81 ประเทศ ซึ่งครอบคลุมทั้งในประเทศที่พัฒนาแล้วและประเทศที่กำลังพัฒนาระหว่างปี พ.ศ. 2543 จนถึง พ.ศ. 2556 ผลการศึกษาพบว่าความสัมพันธ์ของการแข่งขันในกลุ่มตัวอย่างจากวิธีเชิงโครงสร้างและไม่ใช่โครงสร้างมีลักษณะที่ตรงกันข้ามกัน นอกจากนี้ การแข่งขันไม่เพียงแต่ส่งผลกระทบต่อเสถียรภาพของระบบการเงิน แต่ยังส่งผลต่อตัวแปรที่เกี่ยวข้องอื่น ๆ ด้วย เช่น ประสิทธิภาพการกระจายรายได้ และความเสี่ยงของพอร์ตโพลิโอของธนาคารในเวลาเดียวกันอีกด้วย

คำสำคัญ: การแข่งขันของธนาคารพาณิชย์, เสถียรภาพของระบบการเงิน, การกระจุกตัวของตลาด, อำนาจการตั้งราคาในตลาด, ประสิทธิภาพของธนาคารพาณิชย์

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1. Introduction (บทนำ)

It has been known among researchers and practitioners that the relationship between bank competition and financial system stability is very complex, and it has been the center of interest for over the decades. The recent financial crises throughout the globe further exhibit the crucial need to conclude the relationship between them. The complexity is arisen from the inconclusive proxy for bank competition. At present, there are two main streams pertaining to how the competition can be determined. Under the structural approach, the competition can be represented by the market concentration. On the other hand, under the non-structural approach, the competition can be represented by the market pricing power.

To date, there are several empirical studies investigating the relationship between competition and financial system stability. However, there are limited empirical evidences documenting for the effect of bank competition under both structural and non-structural approaches simultaneously. This paper will, therefore, contribute to the existing literature gap of the competition-stability nexus by adopting the simultaneous equations technique on a sample of 81 countries including both developed and developing countries during the year 2000 to 2013. The results reveal that the proxies for bank competition from two main approaches indeed have opposite effects on financial system stability. Specifically, an increase in the market concentration is associated with lower stability, while an increase in the market pricing power is, on the contrary, associated with higher stability. In addition, these competition measures do not only affect the financial system stability but also affect bank-specific factors, such as efficiency, revenue diversification and portfolio risk at the same time.

This paper is structured as follows. Section 2 summarizes the existing literature on competition-stability nexus. Section 3 and 4 illustrate data, variable specifications and methodology. Then, section 5 presents and discusses the empirical results. Finally, section 6 concludes the paper with notes.

2. Literature Review (ทบทวนวรรณกรรม)

Based on the evolution of research on bank competition and financial system stability, we classify prior studies into three main subsections, starting from the very early stage on how to determine the level of bank competition in section 2.1 Then, the studies on the relationship between bank competition and financial system stability are reviewed in section 2.2 Finally, section 2.3 reviews the empirical studies on the competition-stability nexus with other factors.

2.1 Degree of Bank Competition Measurement

As competition cannot be measured directly, academicians need to find an appropriate proxy to represent it. The research on the degree of bank competition has been evolved in two main approaches called the structural and non-structural approaches. The structural approach focuses mainly on the Structure Conduct Performance (SCP) framework and the efficiency hypothesis. The SCP framework explores whether a highly concentrated market will result in a superior industry performance through the collusive behavior among larger banks or not. 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 as general contestability of the market, barrier to entry and exit, competitive environment restrictions and so on.

There are two distinctive traditional models for non-structural approach that have been constructed, which are the model of Bresnahan (1989) and Panzar and Rosse (1987). There are several empirical studies that apply either the Bresnahan's or the Panzar and Rosse's model to investigate the issue of bank competition and financial stability. The study from Shaffer (1989) is one of the early applications of the Bresnahan's model. By using the data in the U.S. banking industry during the period 1965 to 1987, he finds the result that strongly rejects collusive behavior even though it is still consistent with perfect competition. By applying the same methodology to the Canadian banking industry during the year 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, Nathan and Neave (1989) investigate Canadian banking industry and find the consistent result with that of Shaffer (1989), which employs Bresnahan's model.

In addition, the degree of bank competition and concentration are studied by Bikker and Haff (2002). They investigate on the European banking markets and make a comparison with that in the U.S. and other countries and find strong evidence showing that the banking markets in the industrial countries are characterized by monopolistic competition. More recently, Bikker and Spierdijk (2008) study the level of competition using the sample of 101 countries during the period 1986 to 2004. They find that the level of competition is declining for developed countries and increasing for developing countries.

From the above studies, it can be concluded that there are two different angles to measure competition. The first one is from the structural approach, namely market concentration. The second one is from the non-structural approach, namely market pricing power.

2.2 Bank Competition and Stability

The existing economic theories still provide an unclear conclusion on the relationship between bank competition and financial system stability. There are two main hypotheses regarding to the relationship, which are competition-fragility and competition-stability hypotheses. Under the traditional competition-fragility view, more competitive banking systems are more fragile. In other words, in less competitive banking systems, banks usually have more lending opportunities and can increase profits. Therefore, such ample profits will help these banks be able to withstand more economic fluctuation and less likely to take excessive risky project. Hence, the systems will become more sTable.

Contrary to the traditional view, the recent competition-stability view suggests that more competitive banking systems are more sTable. Boyd and De Nicolo (2005) develop the theoretical framework concluding that less competition in the banking industry will eventually lead to financial instability. They begin their analysis by assuming that the 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 to banks will increase. So, the authors conclude that as the risk is eventually transferred from borrowers to banks in this circumstance, it will lead to a higher probability of financial system instability.

Not only the existing theories provide an ambiguous conclusion, but existing empirical studies on the effect of bank competition to financial system stability also show inconclusive results. For example, Boyd, De Nicolo and Jalal (2006) and De Nicolo and Loukoianova (2007) find that the risk of bank failure increases in less competitive markets. However, Jimenez, Lopez and Saurina (2007) finds that risks decrease when market power of incumbent banks increases. By investigating the markets in eight Latin American countries during the period 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 stability using a sample of more than 3,600 banks from 10 European countries and more than 8,900 banks from the U.S. during the year 1995 to 2005. They conclude that competition increases stability by increasing efficiency. More recently, Anginer, Demirguc-Kunt and Zhu (2012) study a sample of 1,872 banks in 63 countries during the year 1997 to 2009 and find a positive relationship between bank competition and stability.

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

2.3 Bank Competition, Stability, and Other Factors

The study in competition-stability nexus is not limited only between these two variables. For example, Claessens and Laeven (2004) construct a major study of competition and concentration that includes the banking systems of 50 developed and developing countries. They find the markets with greater foreign bank entry and fewer entry and activity restrictions to be more competitive. They also find no empirical evidence that the competitiveness measure relates negatively to the banking system concentration.

By using Lerner index to investigate the implication of market power on bank efficiency, Maudos and De Guevara (2007) find a positive relationship between market power and cost efficiency during the period 1993 to 2002. Delis and Tsionas (2009) investigate an empirical framework for the joint estimation of efficiency and market power for a sample of European and U.S. banks during the year 1996 to 2006. They report a negative relationship between market power and efficiency. More recently, Turk-Ariss (2010) employs a sample of 60 banks in developing countries during the year 1999 to 2005 and investigates on bank efficiency as a possible conduit through which competition influences financial stability and find a significant relationship among them. The results show that an increase in the market power leads to greater bank stability and enhanced profit efficiency.

Besides competition, concentration and efficiency, the impact of revenue diversification on bank stability is also under investigation even though the findings are not yet under one consensus. On one side, Stiroh (2004) and Hirtle and Stiroh (2007) find no benefits from revenue diversification. On the other side, Landskroner, Rutenberg and Zaken (2005) conclude that diversification indeed can decrease bank insolvency risk. Also, Sanya and Wolfe (2011)

similarly conclude that revenue diversification across and within both interest and non-interest income decreases bank insolvency risk. More recently, Amidu and Wolfe (2013) investigate the role of revenue diversification in the competition-stability nexus. They explore how the level of competition affects revenue diversification and financial stability by using the data of 978 banks in 55 developing countries during the year 2000 to 2007. After simulating the above panel data set using three-stage least square technique, they find that competition increases stability as revenue diversification increases. Their result is quite robust to other several alternatives, such as variable specification, regulatory environment and so on.

According to the above empirical studies, it can be confirmed that there are some other variables, such as efficiency and revenue diversification, which actually have significant effects on the relationship between competition and stability.

3. Data (ข้อมูลที่ใช้)

This paper uses both micro bank-level and macro country-level data during the period 2000 to 2013. The bank-level data is taken from Bankscope database. The sample is limited to the commercial banks, and the countries that have banks less than ten banks in the industry are also excluded. Also, to align the analysis at country level, bank-level data are aggregated into country-level. For other country-level data, they are obtained from the latest update of the World Development Indicators Database (WDID) and Global Financial Development Database (GFDD) from the World Bank.

The variables used in this paper can be categorized into five main groups. The first one is the competition measurement under the structural approach, while that under non-structural approach is described in the second group. The third group illustrates the stability measures. The fourth group contains bank-specific control variables, and the last group is the instrument variables used for the simultaneous equation.

3.1 Structural Competition Measure

The component of the structural competition measure is based mainly on the number of banks and the distribution of banks in a certain market. The general form of the Concentration Index (CI) can be illustrated as following.

$$CI_t = \sum_{i}^{n} s_{it} w_{it} \qquad (1)$$

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 following.

$$CI_{kt} = \sum_{i=1}^{k} s_{it} \tag{2}$$

The index is in a range between zero and one, and it can be interpreted as following. If it is equal to one, it means that the banks included in the computation make up the entire industry. As a result, the competition is at the lowest in this case. On the other hand, if it approaches zero, it means that there exists the 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. As a result, the competition is at the highest in this case. Even though there is no rule determining the optimal value of k, in order to align with other existing literature, k=3 and k=5 are arbitrarily applied in this research (CI3 and CI5).

3.2 Non-Structural Competition Measures

There are two main measures under this group. The first one is called Lerner Index (LI). This proxy provides a direct measure of the degree of market power as it represents the mark-up of price over marginal cost. It 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. The interpretation of this index is that when there is no mark-up, it means the market is very competitive. When LI is higher, it means higher market power. As a result, the competition is lower. LI can be computed as following.

$$LI_{t} = \frac{P_{it} - MC_{it}}{P_{it}} \tag{3}$$

where: P_{it} is the price of each bank i at time t

MC_{it} is the marginal cost of each bank i at time t

The second measure under this category is called H-statistic Index (HI). This proxy can classify the market structure into perfect competition, monopolistic competition and monopoly.

For the empirical analysis, the following reduced-form revenue equation is estimated by running on a panel data set in order to obtain the index as following.

$$\ln(P_{it}) = \alpha + \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) \quad (4)$$

where: P_{it} is the price of each bank i at time t

$W_{1,it}$ is the price of deposit of each bank i at time t

$W_{2,it}$ is the price of labor of each bank i at time t

$W_{3,it}$ is the price of fixed asset of each bank i at time t

$Y_{1,it}$ is a control variable for the ratio of total equity to total asset

$Y_{2,it}$ is a control variable for the ratio of total loan to total asset

$Y_{3,it}$ is the log of total asset to capture size effect

After estimating the above equation, HI can be calculated as following.

$$HI_t = \beta_1 + \beta_2 + \beta_3 \quad (5)$$

3.3 Stability Measure

The measure for stability is called Z-score Index (ZI). This index actually combines the indicators of profitability, leverage and return volatility into a single factor. Mathematically, it measures the number of standard deviation that a bank's profit must fall to drive it into insolvency. So, the higher ZI, the lower probability of insolvency risk. It is computed as following.

$$ZI_{it} = \frac{ROA_{it} + ETA_{it}}{SD(ROA)_{it}} \quad (6)$$

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

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

3.4 Bank-Specific Control Variables

There are three variables under this group. The first one is the proxy for the efficiency, which is Cost to Income Ratio (CIR). CIR 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 variable under this category is the Revenue Diversification Index (RDI). It is calculated by using Hirschman Herfindahl approach for each bank. It accounts for the diversification between interest and non-interest income. The higher RDI means higher revenue concentration and hence lower revenue diversification.

$$RDI_{it} = \left(\frac{NII_{it}}{TR_{it}}\right)^2 + \left(\frac{FI_{it}}{TR_{it}}\right)^2 + \left(\frac{TI_{it}}{TR_{it}}\right)^2 \quad (7)$$

where: TR_{it} is the total revenue (or the sum of NII, FI and TI) 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 variable is Non-Performing Loan ratio (NPL). It 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.

3.5 Instrument Variables

Five instrument variables are selected and assigned in the same approach as Berger et al. (2009), Amidu and Wolfe (2013) and Beck et al. (2013). The included variables are as followings: (1) Foreign Entry Restriction (denoted as FER hereafter) is the proxy for the barrier to entry. There are three restrictions for the foreign banks to enter to the market, which are acquiring domestic banks, opening their subsidiaries, and opening their branches. Dummy value equal to one is assigned per each restriction if a particular country imposes the restriction, zero otherwise. Then, the three dummies are averaged. (2) Non-Bank Activity Restriction (denoted as NBAR hereafter) is the qualitative variable proxy for the restrictions on three non-bank activities, which are security business, insurance business and real estate business. The score is ranging between one and four for each restriction where one means the lowest restriction, and four means the highest restriction. Then, the score will be averaged. (3) Risk Monitoring (denoted as RM hereafter) is the control variable evaluating three main risks whether they are assigned to capital requirements or not. These risks cover credit, market, and operational aspects. Dummy value equal to one is assigned to each risk perspective, and zero otherwise. Then, three dummies are averaged. (4) Percentage of Government-Owned (denoted as PGO hereafter) is the dummy variable reflecting the fraction of banking system's assets in banks that is 50% or more government-owned., and (5) Percentage of Foreign-Owned (denoted as PFO hereafter) is the dummy variable reflecting the fraction of banking system's assets in

banks that is 50% or more foreign-controlled. All of the data for instrument variables are from the World Bank Regulation and Supervision Survey conducted in the year 2011.

4. Methodology (ระเบียบวิธีวิจัย)

The following baseline equation is used to investigate the relationship between bank competition and financial system stability. In essence, financial system stability is a function of bank competition and a series of bank-specific control variables.

$$Stability = f\left(BankCompetition, BankControls\right) \tag{8}$$

As there are two main measures of bank competition, specifically market concentration and market power, the baseline equation can be extended as following.

$$Stability = f\left(Concentration, MarketPower, BankControls\right) \tag{9}$$

From the baseline equation, the simple panel regression model can be constructed as following.

$$Z_{it} = \beta_0 + \beta_1 CON_{it} + \beta_2 MP_{it} + \beta_3 CIR_{it} + \beta_4 RDI_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \tag{10}$$

Furthermore, in order to study the endogenous relationship between bank competition measure and bank-specific control variables, the simultaneous equations can be constructed as following.

$$Z_{it} = \beta_0 + \beta_1 CON_{it} + \beta_2 MP_{it} + \beta_3 CIR_{it} + \beta_4 RDI_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \tag{11}$$

$$CIR_{it} = \beta_6 + \beta_7 CON_{it} + \beta_8 MP_{it} + \varepsilon_{it} \tag{12}$$

$$RDI_{it} = \beta_9 + \beta_{10} CON_{it} + \beta_{11} MP_{it} + \varepsilon_{it} \tag{13}$$

$$NPL_{it} = \beta_{12} + \beta_{13} CON_{it} + \beta_{14} MP_{it} + \varepsilon_{it} \tag{14}$$

where: Z_{it} is a measure for financial system stability of each country i at time t

CON_{it} is a measure for bank concentration of each country i at time t

MP_{it} is a measure for market pricing power of each country i at time t

CIR_{it} is a measure for bank efficiency of each country i at time t

RDI_{it} is a measure for bank revenue diversification of each country i at time t

NPL_{it} is a measure for bank portfolio risk of each country i at time t

5. Empirical Results (ผลลัพธ์เชิงประจักษ์)

5.1 Results from Traditional Models

Table 1 presents the summary of simple fixed effect panel regression results from various traditional models. The main models are T11 to T14. In all models, the logarithmic form of ZI is used as a proxy for financial system stability. For model T11, CI3 is used as a proxy for structural competition (concentration), while LI is used as a proxy for non-structural competition (market power). For model T12, CI5 is used as a proxy for structural competition (concentration), while LI is used as a proxy for non-structural competition (market power). For model T13, CI3 is used as a proxy for structural competition (concentration), while HI is used as a proxy for non-structural competition (market power). For model T14, CI5 is used as a proxy for structural competition (concentration), while HI is used as a proxy for non-structural competition (market power).

The most striking finding from this Table is the adverse effects of structural and non-structural competition measures, which are on the opposite direction. For instance, in model T11, the coefficient of CI3 is negative and statistically different from zero. This means that when the market becomes more concentrated (less competitive), the stability is lower. Surprisingly, in the same model T11, the coefficient of LI is positive and statistically different from zero. This means that when the market has more pricing power (less competitive), the stability is higher. Therefore, based on these results, it can be confirmed that there are two opposing forces from the structural and non-structural competition measures, and the results are quite consistent and robust even when the key variables are changed from CI3 to CI5 or LI to HI.

One possible explanation from the above findings is that the competition proxies from structural and non-structural approaches measure competition in two different angles. On one side, the structural approach or market concentration, considers solely the concentration of the market. On the other side, the non-structural approach or market pricing power, considers the pricing power of banks in the market. Therefore, it is possible that when the market becomes more concentrated, the pricing power does not necessarily increase. Therefore, it is possible that the effect from increasing market pricing power and increasing market concentration can be in the opposite direction. Significant estimated coefficients together with the high R-squared and significant F-statistic confirm the above hypothesis.

In addition, when focusing on the coefficient of bank-specific control variables, the results can be highlighted as following. In all models, the coefficient of CIR, RDI and NPL are negative and statistically different from zero. It means that (1) when banks become more efficient, the stability increases, (2) when banks diversify more sources of revenue, the stability is enhanced and (3) when banks have higher portfolio risk, the stability decreases. These findings are quite intuitive and self-explained.

Table 1: Regression Results from Traditional Models

Stability = C + Concentration + Market Power + Bank-Specific Variables				
Model	**T11**	**T12**	**T13**	**T14**
Stability	**LNZI**	**LNZI**	**LNZI**	**LNZI**
Market Power	**LI**	**LI**	**HI**	**HI**
Concentration	**CI3**	**CI5**	**CI3**	**CI5**
	Co-efficient		**Co-efficient**	
C	2.8661*** (0.1501)	3.1804*** (0.1723)	3.1950*** (0.1419)	3.4975*** (0.1665)
CI3	-0.3234*** (0.0858)		-0.3222*** (0.0867)	
CI5		-0.5947*** (0.1140)		-0.5778*** (0.1153)
LI	0.5651*** (0.1009)	0.5731*** (0.1002)		
HI			-0.2176*** (0.0674)	-0.2124*** (0.0670)
CIR	-0.4333*** (0.1051)	-0.4502*** (0.1044)	-0.6030*** (0.1015)	-0.6220*** (0.1009)
RDI	-0.3749*** (0.1355)	-0.4019*** (0.1345)	-0.5439*** (0.1334)	-0.5731*** (0.1326)
NPL	-0.9628*** (0.1879)	-0.9271*** (0.1869)	-1.1001*** (0.1881)	-1.0685*** (0.1872)
R-squared	0.91	0.92	0.91	0.91
Adj. R-squared	0.90	0.91	0.90	0.90
F-stat	96.11	97.57	93.79	95.04
F-stat (prob.)	0.00	0.00	0.00	0.00
AIC	0.05	0.03	0.07	0.06
SIC	0.54	0.53	0.56	0.55

Standard errors are in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels.

5.2 Results from Simultaneous Equations Models

Table 2 presents the summary of the regression results from three-stage least square models as per equations 11 to 14. Model S11 uses CI3 as a proxy for concentration and uses LI as a proxy for market pricing power. Model S12 changes the proxy for concentration from CI3 to CI5 but still employs LI as the proxy for market pricing power. Model S13 uses CI3 as the proxy for concentration and changes the proxy for market pricing power from LI to HI. Model S14 eventually uses CI5 as the proxy for concentration and uses HI as the proxy for market pricing power.

For model S11 and S12, the empirical results show that when the bank-specific control variables, specifically CIR, ROA and NPL, are regressed simultaneously with both proxies for bank competition, the coefficients of both concentration and market pricing power are still the same as that from model T11 and T12 as presented in Table 1. Specifically, the coefficient of concentration proxy is negative, while that of market pricing power proxy is positive. Therefore, these results confirm the robustness of the findings from Table 1 even when the variables are endogenously regressed. Similarly, for model S13 and S14, the empirical results show that when the bank-specific control variables, specifically CIR, ROA and NPL, are regressed simultaneously with both proxies for bank competition, the coefficients of both concentration and market pricing power are still the same as that from model T13 and T14 as presented in Table 1.

The most striking finding from this Table is that these competition proxies do not only affect the financial system stability but also affect bank-specific control variables, such as efficiency, revenue diversification and portfolio risk at the same time. For example, in model S11, the coefficient of C(9)_CIR_MP is negative and statistically different from zero. This means that when the market pricing power is higher (less competitive), it is associated with higher efficiency (lower cost to income ratio). In other words, an increase in market pricing power can increase financial system stability through the efficiency enhancement. Also, in the same model, the coefficient of C(14)_NPL_CON is positive and statistically different from zero. This means that when the market becomes more concentrated (less competitive), it is associated with higher NPL. In other words, an increase in concentration can decrease financial system stability through the higher portfolio risk. These findings are also consistent when the variables are changed as per model S12 to S14.

Table 2: Regression Results from Simultaneous Equations Models

EQ1: Stability = C(1) + C(2)*Concentration + C(3)*Market Power + C(4)*CIR + C(5)*RDI + C(6)*NPL

EQ2: CIR = C(7) + C(8)*Concentration + C(9)*Market Power

EQ3: RDI = C(10) + C(11)*Concentration + C(12)*Market Power

EQ4: NPL = C(13) + C(14)*Concentration + C(15)*Market Power

Model	**S11**	**S12**	**S13**	**S14**
Stability	**LNZI**	**LNZI**	**LNZI**	**LNZI**
Market Power	**LI**	**LI**	**HI**	**HI**
Concentration	**CI3**	**CI5**	**CI3**	**CI5**
	Co-efficient		**Co-efficient**	
C(1)	0.3662 (1.0507)	-0.4570 (1.2952)	1.5980 (1.2725)	1.7159 (1.3582)
C(2)_CON	-2.3906*** (0.7740)	-1.2093* (0.8573)	-5.1380*** (1.4218)	-3.4164*** (1.3169)
C(3)_MP	3.4697*** (1.2137)	3.1377*** (1.1370)	-10.5341*** (2.3243)	-7.6584*** (1.8696)
C(4)_CIR	-5.1741*** (1.6190)	-5.5756*** (1.6703)	-12.5294*** (2.3077)	-9.7763*** (2.0620)
C(5)_RDI	1.8982* (1.0432)	1.6246 (1.0401)	1.1118 (1.2282)	0.9494 (1.1509)
C(6)_NPL	-31.4538*** (2.8621)	-27.1206*** (2.7684)	-40.4105*** (4.1080)	-32.7848*** (3.5108)
C(7)	0.7282*** (0.0448)	0.8038*** (0.0616)	0.4282*** (0.1143)	0.4735*** (0.1383)
C(8)_CIR_CON	-0.0277 (0.0639)	-0.1201 (0.0735)	0.0642 (0.1327)	0.0047 (0.1436)
C(9)_CIR_MP	-0.5834*** (0.0990)	-0.5641*** (0.0977)	0.5721*** (0.2085)	0.5430*** (0.1941)
C(10)	0.5720*** (0.0458)	0.5726*** (0.0594)	0.3047*** (0.0934)	0.2972*** (0.1079)
C(11)_RDI_CON	0.2098*** (0.0652)	0.1619** (0.0707)	0.2912*** (0.1086)	0.2624** (0.1124)
C(12)_RDI_MP	-0.5212*** (0.1014)	-0.4799*** (0.0946)	0.5106*** (0.1717)	0.4576*** (0.1530)
C(13)	0.1531*** (0.0170)	0.2080*** (0.0233)	0.1992*** (0.0291)	0.2609*** (0.0364)
C(14)_NPL_CON	0.1514*** (0.0244)	0.1874*** (0.0278)	0.1928*** (0.0338)	0.2347*** (0.0378)
C(15)_NPL_MP	-0.0156 (0.0377)	-0.0335 (0.0370)	-0.1216** (0.0531)	-0.1232** (0.0511)

Standard errors are in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels.

Therefore, based on these results, it can be confirmed that there are two opposing forces from the structural and non-structural competition measures even when the bank-specific control variables are endogenously regressed. Also, the proxies for competition do not only affect the financial system stability but also affect bank-specific control variables at the same time. In other words, this paper proposes a few channels that can transmit the impact of competition to stability.

6. Conclusion (บทสรุป)

This paper contributes to the existing literature on the linkage between bank competition and financial system stability. We utilize both micro bank-level and macro country-level data from a selected sample of 81 countries including both developed and developing countries during the year 2000 to 2013. The data at bank-level is firstly aggregated to be at country-level. The simultaneous regression technique is applied to analyze cross-country information. The stylized facts obtaining from the study can be summarized as followings.

First, the proxies for bank competition under structural (concentration) and non-structural (market pricing power) approaches indeed have the opposite effect on financial system stability. The empirical results in section 5.1 reveal that the competition measure under structural approach, namely concentration, has a negative relationship with financial system stability. That is when the market becomes more concentrated, the system becomes more fragile. On the other hand, the measure under non-structural approach, namely market pricing power, has a positive relationship with financial system stability. That is when banks have higher pricing power, the system becomes more sTable as banks have enough profits to withstand economic fluctuation.

Second, these two measures of competition together with three bank-specific variables, specifically bank efficiency, revenue diversification and portfolio risk, can well explain the variation of financial system stability in the sampling countries and periods. The empirical results in section 5.1 show that bank efficiency and revenue diversification have a positive relationship with financial system stability. On the other hand, portfolio risk has a negative one, intuitively.

Lastly, it can be confirmed from section 5.2 that there are two opposing forces from the structural and non-structural competition measures even when the bank-specific control variables are endogenously regressed. Also, the proxies for competition do not only affect the financial system stability but also affect bank-specific control variables at the same time. For example, an increase in market pricing power does not only increase financial system stability but also increase efficiency. On the other hand, an increase in concentration does not only decrease financial system stability but also increase portfolio risk.

From the above findings, it can be concluded that there are two angles of competition: the concentration and the market pricing power. As the impacts of these two angles of competition are on the opposite side, they truly have important policy implications. To enhance the stability of the financial system, the policy makers need to consider the policy that (1) makes the market to be less monopolized by a few key players and (2) ensures that all players have enough margins to withstand economic fluctuation. Yet, these policy implications are drawn from the cross-country investigations in selected sampling countries. The implications to individual countries are left for future research.

References (บรรณานุกรม)

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.

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.

Boyd, J. H., De Nicolo, G., & Jalal, A. M. (2006). Bank Risk Taking and Competition Revisited: New Theory and Evidence. *IMF Working Paper* WP/06/297.

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

Claessens, S., & Laeven L. (2004). What drives Bank Competition? Some International Evidence. *Journal of Money, Credit and Banking, 36*(3), 563-584.

De Nicolo, G., & Loukoianova, E. (2007). Bank Ownership, Market Structure and Risk. *IMF Working Paper* 07/215, 1-44.

Delis, M. D., & Tsionas, E. G. (2009). The Joint Estimation of Bank-Level Market Power and Efficiency. *Journal of Banking and Finance, 33*(10), 1842-1850.

Hirtle, B. J., & Stiroh, K. J. (2007). The Return to Retail and the Performance of US Banks. *Journal of Banking and Finance, 31*(4), 1101-1113.

Jimenez., G., Lopez, J., & Saurina, J. (2007). How Does Competition impact Bank Risk-Taking?. *Federal Reserve Bank of San Francisco Working Paper Series* 2007-23.

Landskroner, Y., Ruthenberg, D., & Zaken, D. (2005). Diversification and Performance in Banking: The Islaeli Case. *Journal of Financial Services Research, 27*(1), 27-49.

Maudos, J., & De Guevara, J. F. (2007). The Cost of Market Power in Banking: Social Welfare Loss vs. Cost Inefficiency. *Journal of Banking and Finance, 31*(7), 2103-2125.

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.

Sanya, S. & Wolfe, S. (2011). Can Banks in Emerging Economies Benefit from Revenue Diversification. *Journal of Financial Services Research, 40*(1), 79-101.

Schaeck, K., Cihak, M., & Wolfe S. (2008). Are Competitive Banking Systems More STable?, *Journal of Money, Credit and Banking, 41*(4), 711-734.

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

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

Stiroh, K. J. (2004). Diversification in Banking: Is Noninterest Income the Answer?. *Journal of Money, Credit and Banking, 36*(5), 853-882.

Turk-Ariss, R. (2010). On the Implications of Market Power in Banking: Evidence from Developing Countries. *Journal of Banking and Finance, 34*(4), 765-775.

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.