THE ROLE OF REGULATION ON BANK COMPETITION AND STABILITY IN ASEAN-5 COUNTRIES

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FACULTY OF BUSINESS AND ACCOUNTANCY
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KUALA LUMPUR

2017

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THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OF BUSINESS AND ACCOUNTANCY
UNIVERSITY OF MALAYA
KUALA LUMPUR

2017

UNIVERSITY OF MALAYA
ORIGINAL LITERARY WORK DECLARATION

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Matric No: CHA130018

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ABSTRACT

Competition in banking industry has favourable outcomes in terms of efficiency, product diversification, financial innovation and financial inclusion. Whether competition is good or bad for bank stability is an issue of ongoing academic and policy debate, especially after the global financial crisis. Several studies have identified that regulatory oversight is one of the most important causes of the global financial crisis. However, to date, there has been no empirical evidence as to whether bank regulation shapes bank stability in competitive environment. The main objective of this study is to identify the moderating role bank regulation on the relationship between bank competition and bank stability in Association of Southeast Asian Nations (ASEAN) over the period of 1990-2014. For the purpose of analysis, the main objective is divided into three parts. Firstly, examining the effect of bank competition on bank stability, secondly, identifying the moderating role of bank regulation on the relationship between bank competition and bank stability, and thirdly, analysing the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank stability. The bank regulations considered in this study include capital regulation, activity restrictions, deposit insurance, and official supervision. Annual data on bank level variables, bank regulations and macroeconomic variables for five ASEAN countries – Indonesia, Malaysia, the Philippines, Singapore and Thailand – are compiled and analyzed. Two-step system Generalised Method of Moments (GMM) has been employed as estimation technique to bank level panel data. The results indicate that competition enhances bank stability by promoting solvency and capitalisation, and by reducing credit risk. Moreover, bank regulation moderates the relationship between bank competition and bank stability. Among bank regulations, this thesis found that activity restrictions are most effective bank regulation in promoting bank stability in competitive environment, while deposit insurance found most effective bank regulation in promoting bank stability in less competitive environment. Furthermore, the moderating roles of bank regulation on the relationship between bank competition and bank stability are found remained unchanged during the financial crisis except deposit insurance. The results have several policy implications for policy makers and regulators. Firstly, the policy makers should avoid anticompetitive policies as competition promotes bank stability. Secondly, activity restrictions work well only in the competitive market, while deposit insurance enhances bank stability only in less competitive markets. Thirdly, deposit insurance found effective to keep banks stable in competitive market during crisis period.

ABSTRAK

Persaingan dalam perbankan memberi manfaat kepada industri dari segi kecekapan, kepelbagaian produk, inovasi kewangan dan rangkuman kewangan. Walau bagaimanapun, apabila dinilai dari segi kestabilan kewangan, isu ini masih diperdebatkan sama ada sama ada persaingan adalah baik atau buruk terutama. Isu ini telah menjadi perbahasan yang berterusan dikalangan penggubal dasar dan para akademik, terutamanya selepas krisis kewangan global. Faktor kawal pemantauan adalah punca utama krisis itu, setakat ini, tiada bukti empirikal tentang bagaimana bank membentuk peraturan untuk kestabilan kewangan melalui saluran persaingan. Objektif utama kajian ini adalah untuk mengenal pasti peranan persaingan bank dan peraturan bank ke arah kestabilan kewangan dalam Persatuan Negara-Negara Asia Tenggara (ASEAN) sepanjang tempoh 1990-2014 telah. Bagi tujuan analisis, objektif utama dibahagikan kepada tiga bahagian. Pertama, memeriksa kesan persaingan terhadap kestabilan kewangan, kedua, mengenal pasti peranan pengawalan seliaan bank dalam menggalakkan kestabilan kewangan kedua-dua bebas persaingan dan melalui saluran persaingan, dan ketiga, menganalisis peranan pengawalan seliaan bank dalam menggalakkan kestabilan kewangan kedua-dua pesaing bebas dan melalui saluran persaingan tertentu semasa krisis kewangan. Peraturan bank yang dipertimbangkan dalam kajian ini termasuk peraturan modal, sekatan aktiviti, insurans deposit, dan pengawasan rasmi. Data tahunan ke atas tahap pembolehubah bank, peraturan bank dan makroekonomi pembolehubah untuk lima negara- Indonesia, Malaysia, Filipina, Singapura dan Thailand- dari ASEAN dikumpul dan dianalisis. Sistem dua langkah umum Kaedah semasa (GMM) telah diambil sebagai teknik anggaran untuk bank panel tahap data. Keputusan menunjukkan bahawa pertandingan meningkatkan kestabilan bank oleh mempromosikan Kesolvenan dan permodalan, dan mengurangkan risiko kredit. Antara peraturan-peraturan bank, tesis ini mendapati bahawa aktiviti sekatan adalah peraturan bank paling berkesan dalam mempromosikan kestabilan

bank dalam persekitaran yang kompetitif, manakala insurans deposit ditemui peraturan-peraturan bank yang paling berkesan dalam mempromosikan kestabilan bank kurang persaingan. Theis ini, peranan menyederhanakan peraturan bank tentang hubungan antara bank pertandingan dan kestabilan bank terdapat tetap tidak berubah sewaktu krisis kewangan kecuali insurans deposit. Keputusan yang mempunyai implikasi dasar beberapa penggubal dasar dan pengawal selia. Pertama, penggubal dasar dapat mengelak daripada polisi anti-persaingan kerana persaingan dapat mempromosi kan kestabilan kewangan. Kedua, aktiviti sekatan bekerja baik sahaja di pasaran yang kompetitif, manakala insurans deposit meningkatkan kestabilan bank hanya di pasaran kurang berdaya saing. Ketiga, insurans deposit yang didapati berkesan untuk memastikan Bank stabil dalam pasaran yang kompetitif dalam tempoh krisis.

ACKNOWLEDGEMENTS

My greatest regards to the Almighty Allah (SWT) for bestowing upon me the courage to face the complexities of life, complete all the KPIs of the Bright Spark Program and this PhD journey successfully.

I am indebted to many people who have helped and supported me throughout my PhD apprenticeship. Above all, I thank my dear wife, Sajeda Pervin, and my mother, Fazilatun Nisa, for their enduring love, patience and prayers. And I thank My daughter, Ruknin Shadid, for her compassion, tolerance and sacrifice. I am also grateful to my sisters for their constant support and prayers and sincerely acknowledge the constant love of my brothers.

I am thankful to my supervisors Professor Dr. Che Ruhana Isa and Dr. Chan Sok Gee for their help and guidance without which this thesis would never have come to fruition. Many thanks for their supervision not only in this thesis but also in guiding me on how to become a good academician as well as building my interest in the field of research. Also, thanks for being good mentors and research partners as I have learned a lot.

My thanks are due to Professor Dr. Yong-Cheol Kim from the University of Wisconsin for his interest in my research. Thank you for your guidance and constructive comments, which helped in the completion of this thesis. I am also grateful to Professor Dr. Dominique Fisher from the World Bank and Dr. Michiel van Leuvensteijn, from the Netherlands' Bureau for Economic Policy Analysis for their constructive comments.

I am also vastly indebted to University of Malaya, Malaysia for supporting my PhD study through the Bright Spark Program, without which it would be impossible for me to support my study and stay in Malaysia the last three years. I am also appreciative to International Islamic University Chittagong, Bangladesh for granting me the study leave that allowed me to engage completely in my research. I dedicate this thesis to the memory of my father, Md. Badiul Alam. I hope he would have been proud.

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LIST OF SYMBOLS AND ABBREVIATIONS

ABIF	:	ASEAN Banking Integration Framework
ADB	:	Asian Development Bank
AFC	:	Asian Financial Crisis
AEC	:	ASEAN Economic community
ASEAN	:	Association of South East Asian Nation
BIBF	:	Bangkok International Banking Facilities
BND	:	Boyd and Nicolo
CAR	:	Capital Adequacy Ratio
CIR	:	Ratio of Cost to Income
CR	:	Concentration Ratio
DFE	:	Dynamic Fixed Effect
DOLS	:	Dynamic Ordinary Least Square
ESH	:	Efficient Structure Hypothesis
Equity ratio	:	Ratio of equity to total assets
EU	:	European Union
FRA	:	Financial Sector Restructuring Authority
FE	:	Fixed Effect
FVH	:	Franchise value Hypothesis
GDP	:	Gross Domestic Product
GFC	:	Global Financial Crisis
GMM	:	Generalised Method of Moments
HHI	:	Herfindhal-Hirschman Index
IBRA	:	Indonesian Bank Restructuring Agency
IDR	:	Indonesian Rupiah

IMF	:	International Monetary Fund
LLRGL	:	Ratio of Loan Loss Reserve to Gross loan
MAS	:	Monetary Authority of Singapore
NEIO	:	New Empirical Industrial Organisation
NLTA	:	Ratio of Net Loan to Total Assets
NPL	:	Nonperforming Loan
NPL ratio	:	Ratio of NPL to gross loan
OECD	:	Organisation for Economic Cooperation and Development
OLS	:	Ordinary Least Square
PHP	:	Philippines Peso
PIBF	:	Provincial International Banking Facilities
RM	:	Malaysian Ringgit
ROA	:	Return on Assets
ROE	:	Return on Equity
SCP	:	Structure Conduct Performance
S$	:	Singaporean Dollar
TB	:	Thai Baht
TPP	:	Trans-Pacific Partnership
USA	:	The United State of America
2SLS	:	Two Stage Least Square

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CHAPTER 1: INTRODUCTION

1.1 Chapter Overview

The objectives of this study are, firstly, to examine the influence of bank competition on the bank stability in the banking sector, secondly, to examine the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector, and finally, to examine the effect of financial crisis on the moderating role of bank regulation on the relationship between bank competition and stability in the banking sector. The background of the study is presented in section 1.2 followed by the bank restructuring and deregulation in ASEAN-5 in section 1.3, where this study presents the pre-Asian Financial Crisis liberalisation and deregulation strategies, bank restructuring strategies during and post-Asian Financial Crisis, and Post-Global Financial Crisis bank deregulation strategies in ASEAN-5 countries. Next, the problem statement, research questions and objectives, and contributions of the study are presented in sections 1.4, 1.5 and 1.6 respectively. Section 1.7 provides the organisation of the thesis.

1.2 Background of the Study

Banks as financial intermediary institutions play a key role in the economic development of a country by creating credit, and increasing demand and supply of goods and services through mobilising financial resources across the economy (Franklin & Carletti, 2008). These institutions deal with 42.23% of total assets as a share of world GDP[1], while it is 86.04% in emerging countries with bank based financial systems (Zhang, Jiang, Qu, & Wang, 2013, World Bank, 2016). Efficient intermediation of the banking system requires bank stability to build public trust in the system and develop well-functioning financial markets. This is because, instability, which results from high

[1] Total assets held by banks as a share of bank and central bank claims on domestic non-financial real sector, where banks consist of commercial and other financial institutions that accept transferable deposit, and assets include domestic real non-financial sector.

risk-taking attitude of the banks, contaminates the financial system by shrinking credit facilities, distorting interbank loan market and payment system (Khan, Ahmed, & Gee, 2016). Instability is also considered as the main cause of bank failure which outbursts financial crisis with its negative contagious effect to the economy[2](World Bank, 2013). Also, the fiscal cost of instability is very high in the economy which is approximately 17.5% of GDP, and it becomes 32.5% if it combines with the currency crisis in emerging economies (Hoggarth, Reis & Saport, 2002).

The smooth functioning of the intermediation process also requires competition in the banking market as competition is seen as a precondition for efficient, innovative and productive banking system (Ye, Xu & Fand, 2012; Barth, Lin, Ma, Seade, & Song, 2013b; Fungáčová, Pessarossi & Weill, 2013; Andrieş & Praru, 2014)[3]. Furthermore, competition is required for lowering loan prices and increasing financial inclusion (World Bank, 2013). As a result, both matured economies (including the United States and European countries) and emerging economies (including Indonesia, Malaysia, Thailand, Philippines) have started liberalising and globalising their banking market since the late 1970s and early 1980s, in order to foster competition and ensure smooth functioning of the intermediation process (Beck, 2008). The increased competition influences large banks from matured countries operating at lower profit margins to extend their presence to the emerging countries with relatively higher profit margins. This drives banking institutions in both groups to accelerate consolidation process to protect their market power, which may create concern of less competition (Kasman & Kasman, 2015). As a

[2] The history of the recent 2008-2009 global financial crisis has shown that the crisis started with failure of Lehman Brothers in the United States resulting from taking high risk, by investing 56 percent of total investment in real estate alone and holding high leverage ratio, measured with total assets to owners' equity ratio, of 31:1 and could not finance its liquidity from other financial institutions to cover losses due to subprime mortgage crisis (Lehman, 2007). The failure of Lehman Brothers spilled over to the entire US banking sector and caused of 25, 140 and 157 bank failures in 2008, 2009 and 2010 respectively (Federal Deposit Insurance Corporation, 2016)

[3] Ye, Xu, and Fang (2012) find a positive association between competition and technical efficiency in china. Similarly, Barth et al., (2013b) find a negative relationship between concentration and technical efficiency in global cross country study of 72 countries. Fungáčová, Pessarossi and Weill (2013) also find competition granger causes to cost efficiency in China. Andries and praru (2014) finds that greater competition enhances both cost and profit efficiency in European economies.

result, determination of competition policy becomes an issue of concern for policy makers and academics. Literature document that competition influences bank stability (such as, Allen & Gale, 2002, 2004; Beck et al., 2006, 2008, 2013), but it is not yet clear whether competition is good or bad for the stability of banking institutions.

The relationship between bank competition and stability is ambiguous in theory (Keeley, 1990; Boyd & Necolo, 2005). The traditional competition-fragility theory as modelled by Keeley (1990) suggests that banks with high market power in a less competitive market enjoy more franchise value to earn monopoly rents. However, the franchise value is eroded with increasing competition which decreases both profit margin and capital buffer of the banks, and encourages them to adopt risk-taking strategies to increase returns and compensate franchise value lost (Ghosh, 2009). The resulting high risk-taking tendency of the bank management due to increased competition leads to banking institutions towards bankruptcy. On the other hand, the alternative competition-stability theory claims that competition is not responsible for bank fragility. Rather, it reduces banks' risk-taking behaviour and increases the stability of the individual bank. The advocate of this proposition, Boyd & Nicolo (2005) claimed that less competition allows banks to enjoy more market power to set higher interest rate for borrowers which increases borrowers' default risk, and that default risk is ultimately shifted to the banks and increases their moral hazard and adverse selection problem, this is because the borrower's risk and bank's risk are perfectly correlated. On the other hand, Martinez-Miera & Repullo (2010) claimed that both the competition-fragility view and competition-stability view may coexist and the relationship between bank competition and stability is non-linear.

The empirical results on the nexus between bank competition and stability are also inconclusive. For example, a group of studies (e.g., Beck Jonghe, & Schepens, 2013; Kasman & Kasman, 2015) found consistency with competition-fragility theory implying that more competition erodes market power and the profit margin of banking institutions, and induces them to take more risk which makes them fragile. Conversely, other studies (e.g., Fiordelisi & Mare, 2014) support competition-stability theory arguing that more competition reduces banks' risk-taking behaviour and increases bank stability in the banking institutions. Others (e.g., Berger, Klapper, & Turk-Ariss, 2009; Tabak, Fazio, & Cajueiro, 2012; Fu et al., 2014) find a non-linear or inverted U-shaped relationship between bank competition and stability implying that competition leads to both bank stability and fragility concurrently in the banking sector.

In examining the nexus between bank competition and stability, Beck et al. (2013) claim that bank stability or fragility of banks do not only depend on competition, but also on the efficiency of the regulatory framework, under which banks operate and make risk-taking decisions. This is because, macroprudential regulations such as capital regulation, activity restrictions and deposit insurance increase competition and influence the risk-taking behaviour of the banks (Barth et al., 2004). Stringent official supervision of the regulators can also enhance monitoring of the banks' operations in a competitive market and prevent banks from engaging in risk-taking behaviour (Barth et al., 2008). As a result, bank regulatory policies may play an important role in the relationship between bank competition and bank stability. Moreover, the financial crisis in both matured and emerging countries has led researchers to examine the role of macroprudential regulation in the relationship between bank competition and stability. Keeley (1990) and Cubillas & Gonzalas (2014) have shown that liberalisation and deregulation have a great influence on the level of competition, and regulatory failure to control banks' risk-taking appetite is considered a contributing factor to the banking crisis in the US during the 1980s and also the 2008-09 credit crunch in the US and UK.

Despite a number of earlier studies that examined the nexus between bank competition and stability, most focused on matured markets (Berger et al., 2009; Schaeck et al., 2009; Jiménez et al., 2013) with little emphasis on emerging markets (Fu et al., 2014). Few studies the control bank regulation on the relationship between bank competition and stability (e.g., Berger et al., 2009, Beck et al., 2013; Fu et al., 2014). However, the literature has shown that no earlier study investigated the extent to which bank regulation, such as activity restrictions, capital regulation, official supervision and deposit insurance, interacts with the level of competition in shaping bank stability of the individual bank, especially in emerging markets. Determination of the interaction effect of bank regulation and competition brings significant policy implications for both bank regulators and policy makers. This is because the effect of bank regulation on bank stability depends on the level of competition. This effect may change with changing levels of competition in the banking sector (Beck et al., 2013).

In examining the role of bank regulation on the relationship between bank competition and stability, attention is placed on a unique banking sector restructuring and regulatory changes which have a far-reaching effect on both bank competition and stability of individual banks. The effect is more prominent among the old member states of the Association of South East Asian Nations (ASEAN) commonly known as ASEAN-5 countries including Indonesia, Malaysia, the Philippines, Singapore and Thailand based on the experience of financial liberalisation and severe banking crisis, and further bank restructuring and re-regulation aftermath of the crisis. The reasons of selecting ASEAN-5 as sample of this thesis are explained below:

Firstly, the banking sector of these countries liberalised in the early 1990s (Teo et al., 2000). The liberalisation resulted in credit boom in the banking market and exacerbated the risk-taking tendency of the banks (Corsetti, Pesenti, & Roubini, 1999). On the other hand, it decreased banks' cost, profit and technical efficiency, and loan quality which together with sub-standard regulation and supervision led to the outbreak of the 1997-1998 Asian Financial Crisis (AFC) in Indonesia, Thailand and neighbouring countries (Karim, 2001; Williams and Intarachote, 2002).

Secondly, to handle this crisis, various emergency drives were introduced in the crisis-affected countries especially Indonesia, Malaysia and Thailand with a view to stabilise the banking system and restore public confidence, the gross cost of which ranged from 12 to 45% of GDP (Teo et al., 2000).[4] The crisis emergency programs included the introduction of blanket guarantee, closing unviable banks, transferring NPL to state-owned banks, government capital injection, which is accompanied by tremendous bank restructuring drivers (Woo, Sachs, & Schwab, 2000; Laeven, 2005; Williams & Nguyen, 2005). Post-crisis restructuring in ASEAN-5 continued until 2002 which included the merger of small banks and non-bank financial institutions with large banks, nationalisation of private banks, widening foreign ownership in join venture banks and increase the access of foreign banks (Williams & Nguyen, 2005; Thoraneenitiyan & Avkiran, 2009). The policy reforms resulted in a high degree of consolidation and decreased the number of commercial banks from 453 in 1997 to 264 in 2001, to 225 in 2014. This increased the number of large banks with a 'too-big-to-fail' problem and changed the market structure and risk-taking behaviour of the banks (Kishi, 2001; Soedarmono et al., 2013; Sufian & Habibullah, 2013, 2014).

Thirdly, initiatives also adopted to upgrade bank regulation and supervision according to international best practices were capital regulation, activity restrictions, deposit insurance and official supervision (Gochoco-Bautista, Oh, & Rhee, 1999; Teo et al., 2000;

[4] National authorities of Indonesia and Malaysia determined that the cost of AFC as a percentage of GDP was 45 percent in Indonesia and 12 percent in Malaysia. In estimating the costs, the national authorities considered states of macroeconomics, efficiency and effectiveness of bank and corporate restructuring.

Kishi & Okuda, 2001). The post-crisis restructuring, deregulation and supervisory drives resulted in strengthening the capital base, risk management capability and bank stability in the region which are observed through Table 1.2.

Fourthly, on the other hand, ASEAN banks recently initiated to implement the ASEAN Banking Integration Framework (ABIF[5]) as a part of the ASEAN Economic Community (AEC[6]) blueprint among ASEAN-5 by 2020 to increase the international competitiveness of banks and their stability (Asian Development Bank, 2013). Despite the framework's benefits to the banking sector of the region by increasing banks' efficiency, reducing cost and helping to attain at economic of scale, it may also bring challenges for the banks (Yamanaka, 2014). Indeed, the framework requires regional banks to meet the competitive challenge of Basel III requirements in capital regulation, risk management and official supervision (ADB, 2013; Chan, Koh, Zainir, & Yong, 2015). It allows qualified banks to expand their presence in other member countries with a home country advantage. This new challenge may stimulate regional banks towards further consolidation to strengthen their market power and better compete with regional banks. The accelerated consolidation process may allow the regional banks to enjoy more monopoly power, which is a concern for bank regulator and policy makers, this is because high monopoly power allows banks to raise interest rates of loan which weaken easy access to credit and financial inclusion, and put bank stability of the region at risk due to the high risk taking behavior of the banks (Boyd & Nicolo, 2005).

Fiftly, despite some investigation focusing on different geographical areas, after two decades of financial liberalisation, reform and integration, there is a scarcity of clear and robust empirical evidence for the ASEAN region regarding bank competition and its

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[5] ABIF aims to create region wide consistent banking environment and eliminate entry barrier for regional banks and remove discrimination for foreign banks in host country.

[6] AEC aims to fully liberalize capital mobilization along with goods and skilled manpower across the ASEAN-5 countries

effect on bank stability except for evidence in some cross-country studies focusing on Asia and Asia Pacific countries. For example, Laeven (2005) found bank competition in Singapore is relatively lower while it is higher in Indonesia. Further, Liu, Molyneux, & Nguyen (2012) for four East Asian countries and Soedarmono et al. (2013) for 13 countries in Asia and emerging Asia found more market power is associated with high insolvency risk of commercial banks. On the other hand, Fu et al. (2014) found that although concentration is not a sufficient measure of competition, more market power in the concentrated market is associated with less insolvency risk for the Asia Pacific region.

In addition, Nguyen, Skully, & Perera (2012a) indicated that the results of prior studies regarding competition and stability focusing developed countries (especially the USA and European countries) may not be relevant for ASEAN countries due to their different institutional set up from developed countries where institutional structure influences banks' risk-taking behaviour (Beck et al., 2013; Chan, Koh, Zainir, & Yong, 2015).

Thus, this study intends to fill the literature gap for ASEAN by investigating the nexus between bank regulation, competition and bank stability in ASEAN-5 countries. The determination of the subsequent effect of competition and regulation through the channel of competition on banking sector stability is highly important for ASEAN-5 for significant policy formulation and regulation, and for successful implementation of ABIF and to fulfil the goals of the AEC.

1.3 Banking Restructure and Deregulation in ASEAN-5 countries that changed the Landscape of Competition and Risk-taking behaviour of the Banks.

In selecting an appropriate sample for examining the relationship of bank regulation, competition and bank stability, the study is interested in the ASEAN-5 banking sector due to the 1997-98 AFC, the post-AFC crisis bank reform strategies and initiative towards regional banking integration which changed the landscape and level of competition and bank stability.

1.3.1 Pre-Asian financial crisis liberalisation and deregulation

ASEAN-5 especially Indonesia, Philippines and Thailand introduced tremendous liberalisation and deregulation in their banking market in the late 1980s and early 1990s to make the banks more market oriented, increase the availability of credit and foster competition in banks. The Philippines lifted the interest rate ceiling from commercial banks in the late 1980s, liberalised entry barrier for foreign banks in 1994 and granted a license to ten foreign banks in 1995 (Cook, 2008; Hall, 2003; Thoraneenitiyan & Avkiran, 2009). Indonesia also liberalised and deregulated its banking market, firstly in 1983 by fully liberalising both lending and deposit interest rate and removing banks' credit ceiling (Batunanggar, 2008), and secondly in 1988, where Indonesia reduced the minimum reserve requirement to 2% and lifted the barrier for both local private banks and foreign banks to open new branches and subsidiary across the country (Bennett, 1995). This increased the number of banks in Indonesia to 158 in 1993 from just 63 in 1988 (Sato, 2005) and increased the availably of credit in the market due to more competition.

Thailand also liberalised its banking market for foreign banks in 1993 by granting 46 new licenses for Bangkok International Banking Facilities (BIBFs[7]) and Provincial International Banking Facilities (PIBFs[8]) and relaxed corporate taxation rate and prudential regulation for capital requirements and single lending limit in order to enhance competition and make Bangkok a finance hub in the region. These facilitated both foreign banks and local banks to take excessive risk and develop a credit bubble which was

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[7] BIBFs allow banks (both local banks and non-bank financial institutions as well as foreign banks) to raise fund via off shore market and lend it in foreign currencies.
[8] PIBFs allows foreign banks with BIBF status to lend fund in local currency and receive deposit in foreign currency from local depositors who also borrow from BIBFs

extended to local borrowers in foreign currencies that ultimately mobilised the non-productive high yielding real estate market (Pathan, Skully, & Wickramanayake, 2008). Further, Thailand deregulated its exchange rate and made it floating in 1997 which collapsed the exchange rate against the US Dollar (Kishi & Okuda, 2001). The actions led to the Asian Financial Crisis when the devaluation of the Thai Baht busted the credit bubble of Thai banks and brought about a contagion effect to the currencies of neighboring Indonesia, Malaysia and Philippines, Singapore and other East Asian countries like China and Korea. Its negative externality subsequently brought credit crunch in the banking sector (Kishi & Okuda, 2001). The crisis continued until the end of 1998 when 67 banks liquidated in ASEAN-5 due to high liquidity shortage affecting 40 banks in Indonesia, nine banks in Malaysia, ten banks in the Philippines, six banks in Singapore and two banks in Thailand (Bankscope, 2005). The severity of AFC was very high during 1998 when the NPL ratio reached at 48% in Thailand, 36% in Indonesia, 11% in the Philippines, 9% in Malaysia and 7% in Singapore (Kishi & Okuda, 2001). The AFC brought a devastating consequence on the fast-growing economy of ASEAN-5. The economic growth rate become negative from a promising one in all ASEAN-5 as it become -13.10 % in 1998 from 7.80 % in 1996 in Indonesia, -7.40% in 1998 from 10.00 in 1996 in Malaysia, -0.60% in 1998 from 5.80% in 1996 in Philippines, -1.40% in 1998 from 7.80% in 1996 in Singapore, and -10.50% in 1998 from 5.90 % in 1996 in Thailand (Cook, 2008).

The excessive risk-taking behaviour of the banks is identified as the major reason of credit crunch following financial liberalisation in East Asia (Mishkin, 1999; Williams & Nguyen, 2005). Following the financial liberalisation, the excessive risk-taking tendency of the financial institution could be attributed to two reasons. Firstly, bank managers lacked risk management capabilities for managing the risk properly when opportunities for lending were created after liberalisation. Also, banks failed to create the risk management system fast enough including well-trained loan officers, risk assessment and monitoring system simultaneously with the lending boom to monitor and control the new loans. Secondly, the inefficiency of supervisory and/or regulatory systems was also responsible for excessive risk-taking of banks. There was no provision for deposit insurance or formal government safety net in the banking system. There was an implicit government safety net which might give rise to a moral hazard problem for the banks which induces them to take excess risk. Thus led foreign lenders and domestic depositors to have little incentive to monitor the lending behaviours of the banks due to their confidence in a government bailout in case of emergency. Inadequate supervision and/or regulatory system could not reduce banks' moral hazard problem resulting in the implicit government safety net which increased banks' excessive risk-taking. This problem became worsened with a rapidly growing credit bubble which stretched the supervisor's resources as they could not increase their supervisory capabilities (including trained examiner, information system) simultaneously with a rapidly growing additional responsibility to monitor new lending operations.

1.3.2 Bank restructuring during the Asian financial crisis

In response to the crisis, the governments of the crisis-affected countries came up with emergency measures to protect against bank runs, rebuild public trust and bring discipline into the banking system. The emergency measures of the crisis-affected countries include the government's liquidity supports and blanket guarantee accompanied by a comprehensive banking sector restructuring programs.

The central banks of the crisis affected Indonesia, Thailand and Malaysia, and the Philippines supported the weak banks with liquidity to shield banks' funding from rapid withdrawal of deposits and credit from the banks and protect the bank failure and bank runs. The central banks of these countries supported liquidity in the form of emergency lending and lender of last resort in the amount of IDR170 trillion (17% of GDP) in Indonesia, RM35 billion (13% of GDP) in Malaysia, PHP18.6 billion (0.8% of GDP) in the Philippines and TB1037 (22% of GDP) billion in Thailand (Ito and Hashimoto, 2007). Despite the blanket guarantee scheme suffers from the provisional cost and moral hazard problem, failure of liquidity supports to protect agianst bank runs initiated the crisis-affected countries to adopt the blanket guarantee scheme for the banks' depositors and creditors to rebuild their confidence and trust in the banking system as well as to support the banks' funds (Ariff, Skully, & Ahmad, 2007; Hall, 2003; Sastrosuwito & Suzuki, 2012).

In mid-1998 and early 1999, all ASEAN-5 countries including the crisis affected Indonesia and Thailand underwent comprehensive bank restructuring drives to increase efficiency and stability in the banking sector. The restructuring process was led by the newly formed government entity such as Indonesian Bank Restructuring Agency (IBRA) in Indonesia, Financial Sector Restructuring Authority (FRA) in Thailand and Danaharta National Berhad (Danaharta) in Malaysia (Kishi & Okuda, 2001; Ariff et al., 2007). In the case of Philippines, it was managed by the Philippines Deposit Insurance Corporation which was established in 1963 (Batunanggar, 2008). The restructuring drives included establishing assets management companies, liquidating insolvent banks, the merger of weak banks, elimination of shareholders' stake from insolvent banks, state intervention in banks, improving risk management practices and changing the banking regulation and supervision (Corsetti et al., 1999). To increase the capital flow to the banking sector, the private sector was encouraged along with foreign banks by liberalising the rules for foreign participation in the domestic banking market. These restricting drives brought order in bank regulation and supervision and changed the banking sector landscape in these countries (Soedarmono et al., 2013).

Following the implementation of restructuring strategies, the number of commercial banks decreased in all ASEAN-5[9] countries. The number of banks in 1997 was 222 in Indonesia, 82 in Malaysia, 53 in Philippines, 12 in Singapore and 84 in Thailand which decreased to 165, 34, 44, 5 and 16 in Indonesia, Malaysia, the Philippines, Singapore and Thailand respectively in 2001 (Teo et al., 2000; Kishi & Okuda, 2001). The decline in the number of banks was the result of restructuring initiatives in the form of the closing of insolvent banks and consolidation of small banks to form bigger banks with high capitalisation. The restructuring process closed 64 commercial banks in Indonesia, one commercial bank each in Philippines and Thailand besides a few non-bank financial institutions. The tight capital regulation[10] in ASEAN-5 countries encouraged commercial banks to merger with other banks to strengthen their position which resulted in four state commercial banks merging into one state commercial banks in Indonesia, 15 banks merged in Malaysia, four banks mergers in Philippines, eight banks merged in Singapore and three mergers with five commercial banks and 12 non-bank financial institutions in Thailand (Hall, 2003; Ariff et al., 2007; Menkhoff & Suwanaporn, 2007).

The state intervention in Indonesia, Malaysia and Thailand, and liberalisation of entry barriers for the foreign banks changed in order to increase capital flow to the banking sector. The state intervened in 12 banks in Indonesia (Sato, 2005), one merchant bank and three non-bank financial institutions in Malaysia (Ariff et al., 2007), and six commercial banks and 12 non-bank financial institutions in Thailand (Kishi & Okuda, 2001). The region wide entry restrictions for the foreign banks were liberalised and encouraged them to increase their presence in the region. Indonesia allowed to have 99% ownership in joint venture banks (Sato, 2005), Malaysia allowed foreign investors to hold up to 30% in

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[9] Total number of commercial banks for Singapore is unavailable, however, the number of domestic commercial banks declined from 12 in 1997 to 5 in 2001.

[10] Minimum capital requirement increased to IDR3.00 Trillion (Lee and Park, 2009); RM2.00 billion in Malaysia (Batunanggar, 2008); Minimum capital adequacy ratio increased to PHP4.95 billion for universal bank; PHP2.4 billion for commercial in Philippines(Hall, 2003); S$ 1.5billion in Singapore (Chia, 2003); and THB5 billion in Thailand (Menkhoff and Suwanaporn, 2007)

equity of domestic banks (Gopalan & Rajan, 2010), Philippines allowed foreign banks to have full ownership of weak banks (Tetangco & Pilipinas, 2006), Singapore lifted the restrictions for foreign banks to hold 40% share in domestic banks (Hall, 2003) and Thailand extended the foreign banks shareholding limit up to 49% (Menkhoff & Suwanaporn, 2007).

Table 1.1: Snapshot of restructuring drives of 1997-98 Asian Financial Crisis in ASEAN-5

Measures	Indonesia	Malaysia	Philippines	Singapore	Thailand
Emergency Measure					
Liquid support	√	√	√	√	√
Blanket Guarantee	√	√			√
Institutional Measure					
Establishing bank restructuring public entity	√	√			√
Intervention in wean and insolvent Banks in the form of:					
Merger	√	√	√	√	√
Closure	√		√		√
Use of fiscal allocation to purchase Nonperforming loan	√	√			√
Use of Fiscal allocation to recapitalise banks in the form of state intervention	√	√			√
Elimination of shareholders' stake in weak banks	√	√	√		√
Liberalisation of foreign banks entry	√	√	√	√	√
Corporate restructuring	√	√	√	√	√
Prudential Regulation & Supervision					
Supervisory power of central bank	√	√	√	√	√
Capital regulation	√	√	√	√	√
Deposit Insurance			√		
Activity Restrictions					
Securities	Permitted	Permitted	Clarification and response needed	Restricted	Conditional
Insurance	Prohibited	Permitted	Do	Permitted	Partly permitted
Real estates	Prohibited	Restricted	Do	Restricted	Permission needed
Owning of Non-financial firms	Prohibited	Restricted	Permitted	Permitted	Restricted

Sources: Batunanggar, 2008; Cook, 2008; Ito & Hashimoto, 2007; Tetangco & Pilipinas,2006

Structures in the percentage of assets holding changed in the region. For example, in Indonesia, the assets holding of 43 public banks increased to 73% in 1999 from 42% of 34 banks in 1997, share in assets of 40 joint venture banks increased to 10% in 1999 from 8% of 44 banks in 1997, and this gain in the share of assets at the cost of assets share of domestic private commercial banks which lost it's market share from 50% of 160 banks in 1997 to 17% of 82 banks in 1999 (Teo et al., 2000).

To strengthen the regulatory and supervisory power, the autonomy of the regulator enhanced in every country. In Indonesia, a new central bank law was passed and the central bank (Bank Indonesia) decomposed to a newly established on-site supervisor (Sato, 2005). In Thailand, a new act passed to strengthen the autonomy of Bank of Thailand (Teo et al., 2000). In Philippines, the regulatory power of Bangko Sentral Pilipinas was enhanced by shifting from the checklist driven type of examination to a more analytical approach which focused on an assessment of the consolidated risk management practices of each bank and its affiliates (Hall, 2003). Supervision of banks' operations and supervisory reporting were improved. Also, the supervisory power over the banks improved by requiring to keep more provision against the loan, and taking corrective actions when problem identified.

The prudential bank regulation in respect to loan provisioning, classification and the capital requirements has been stringent to comply with the international standard in all countries. The period of nonperforming loan's interest suspension tightened to three months in Indonesia, Philippines and Thailand (Kishi & Okuda, 2001). All countries increased or tightened requirements for both loan loss provision and general provision. The capital is redefined in all countries and strengthened the absolute capital requirements by increasing it to 8% in Indonesia and Malaysia, 10% in Philippines, 12% in Singapore and 8.5% in Thailand. Except for the Philippines, all other countries' capital was risk weighted in line with the Basel Accords (Kishi & Okuda, 2001). Further, all countries required disclosing the information regarding the sources of capital and provision preserved to use the borrowed fund in capital formation except the Philippines and Singapore. In respect to the activity restrictions, the securities business was permitted in

Indonesia and Malaysia while it was permitted for Thai banks through subsidiaries upon permission of the Finance Ministry. However, it was unrestricted in Singapore while clarification was required in the Philippines. In respect to engaging in the insurance business, banks were permitted in Malaysia and Singapore, partly permitted in Thailand, but prohibited in Indonesia while a clarification and response were needed in the Philippines. On the other hand, real estate business was restricted in Malaysia and Singapore, prohibited in Indonesia while permission was needed from Bank of Thailand in Thailand and clarification and responses needed in the Philippines. In the ownership of the non-financial firm, banks were permitted in Philippines and Singapore, restricted in Malaysia and Thailand and prohibited in Indonesia (Kishi & Okuda, 2001). During the 1997-98 Asian Financial Crisis, explicit deposit insurance was absent in all countries except the Philippines. It was introduced in Malaysia, Indonesian and Singapore in 2005, and Thailand in 2011 which replaced the blanket deposit guarantee system in order to remove moral hazard introduced by the blanket guarantee and increase market discipline on banks and minimise the public cost of the deposit insurance system (Hall, 2003; Ariff et al., 2007; Batunanggar, 2008).

The restructuring drives improved regulatory and supervisory quality and strengthened the banking system in the ASEAN-5 as shown in Table 1.2. The commercial banks became better capitalised, with high assets quality, better-earning capacity and higher bank stability in 2003 compared to 1998. Nevertheless, the region kept strengthening the bank stability by increasing risk management capacity and market discipline in the banking system. Basel II accords of Bank for International Settlement were adopted in Indonesian in 2008, in Malaysia in 2004, in the Philippines in 2007, in Singapore in 2008 and Thailand in 2008 to improve the credit risk management capacity, supervisory power and market discipline (Batunanggar, 2008; Thoraneenitiyan & Avkiran, 2009).

Table 1.2: Capitalisation, assets quality, earning capacity and bank stability of ASEAN-5 in 1998, 2003 and 2008

Particulars	Indonesia			Malaysia			Philippines			Singapore			Thailand		
Years	1998	2003	2008	1998	2003	2008	1998	2003	2008	1998	2003	2008	1998	2003	2008
Capitalisation	-3.70	14.98	13.25	9.75	12.81	10.77	18.25	13.17	12.83	24.88	18.72	23.29	5.81	13.67	10.96
Assets quality	36.46	6.95	3.58	11.13	11.38	2.06	11.88	16.52	8.78	7.00	4.07	1.89	48.46	14.96	7.03
Earning capacity	-15.27	1.81	0.130	0.32	0.97	1.30	1.23	1.08	.661	.62	.792	.867	-7.14	.55	.60
Bank stability	13.94	42.27	80.63	17.87	59.56	89.89	70.36	133.0	43.92	35.28	107.7	69.25	1.72	17.56	108.9

Source: Bankscope database of Bureau van Dijk, Capitalisation is measured with the ratio of equity to total assets, assets quality is measured with the ratio of nonperforming loan to gross loan, earning capacity is measured with the ratio of return on average total assets, and bank stability is a measure of Z-score which is a ratio of sum of return on assets and capitalisation to standard deviation of return on assets.

1.3.3 Post-global financial crisis banking deregulation in ASEAN-5

The global financial crisis which started in the United States due to extensive subprime loan default in 2008 led to a financial crisis that rapidly spilt over to the rest of the world along with ASEAN-5 countries. The banking sector around the world especially the US and Europe suffered from high liquidity shortage which substantially eroded banks' capital buffer and resulted in many bank runs across the world. Although the capitalisation and earning-capacity of ASEAN-5 banks reduced, they were sheltered from the direct effects of the crisis due to the benefits of post-AFC crisis bank restructuring drives (Lee & Park, 2009, Fu et. al., 2014). As a result, this region did not face extensively huge pressure for the post-2008-09 global financial crisis bank restructuring and deregulation drives. However, state support in the US and Europe compelled the governments of this region to support a banking system to create a level playing field and ensure bank stability. To preserve bank stability, the main challenge was to safeguard and protect the depositors' confidence and avoid systematic failure. Therefore, the governments supported banking sector in the form of capital support, liquidity support, credit guarantee scheme, regulatory forbearance and deposit guarantee (Pomerleano, 2009). As the effect of the depositors' confidence is more acute in the financial crisis, deposit guarantee and liquidity supports were given priority (See Table 1.3). The stimulating packages successfully secured the depositors' confidence and protected the banks funding to help avoid bank runs in ASEAN-5 (Pomerleano, 2009).

Table 1.3: Government response to banking system to cope with Global financial crisis in ASEAN-5 countries

Particulars	Indonesia	Malaysia	Philippines	Singapore	Thailand
Capital Support	√				
Liquidity Support		√	√	√	
Credit Guarantee Scheme	√	√			
Regulatory forbearance	√	√	√		√
Deposit Guarantee	√	√	√	√	√

Source: Lee & Park (2009)

Although the post-Asian Financial Crisis banking reform strengthened banks' the risk management capabilities, the global financial crisis identified those capabilities as insufficient due to changes in the global banking environment resulting from innovation, globalisation and deregulation. In the changed environment, financial interdependency among the banks increased as banks introduced new products and services, and expanded the scope of banking operations. Further, difficulties of structured credit products which involve high leverage challenged the capabilities of banks and regulators to identify and manage the banking risk. The changed banking environment required the existing regulatory framework to update to cope with the changed environment. In order to strengthen the risk management capacity and market discipline, the Basel III accords adopted in all ASEAN-5 nations between 2013 and 2014 where the capital standard in Singapore is 2% more than Basel III accord of 10.5% (BIS, 2014). To secure depositors' confidence and remove the moral hazard of bank runs, all ASEAN-5 countries made deposit insurance scheme explicit. Further, the scope of banking activities also changed to limit the scope of banks risk-taking tendency. Barth, Caprio, & Levine (2013) identified that Indonesia prohibited commercial banks from involving in securities, insurance, real estate and owning non-financial firms. Conversely, the Philippines permitted commercial banks to involve in all sorts of operations. On the other hand, Malaysia, Singapore and Thailand restricted commercial banks to involve in all earlier mentioned activities except securities. Malaysia permitted, Singapore unrestricted and

Thailand prohibited commercial banks to involve in securities. Also, Barth et al. (2013b) identified that the banking system is supervised by single supervisors with the power to an on-site examination of banking operations of the commercial banks, whereas, supervisors are liable for their actions in only the Philippines and Thailand. Also, the Monetary Authority of Singapore (MAS) approved the Banking Bill 2016 where Singapore is approaching consolidated supervision to allow MAS to supervise all foreign subsidiaries of local banks and the parent supervisor of foreign banks to monitor the foreign banks in Singapore upon approval of MAS (Monetary Authority of Singapore; 2016).

Further, ASEAN initiated the ASEAN financial integration as a part of the ASEAN Economic Community (AEC) in 2007 which will be implemented in 2020 to fully liberalise capital mobilisation along with goods and skilled manpower across the region, and contribute to creating a larger and globally competitive economy (Yamanaka, 2014). Subsequently, the Governors of ASEAN central banks endorsed the ASEAN Banking Integration Framework (ABIF) in December 2011 as a part of AEC. The main purposes of ABIF are to enhance bank stability in the region and liberalise banking market for the regional banks. More particularly, the ABIF allows commercial banks from any of the ASEAN-5 nations to access into other members with the status of local banks and enable them to enjoy home field advantage in the host countries (Yamanaka, 2014). As preconditions of ABIF, ASEAN-5 started to harmonise a regulatory framework such as all member nations introduced deposit insurance and adopted Basel III accords to enhance risk management capacity, market discipline and bank stability. Further, they started to liberalise the entry barrier for the foreign banks in the domestic market. The Philippines eliminated the limit of foreign banks and allowed foreign investors to hold up to 100% share in new subsidiaries, and raised the limit of foreign investors' holding of voting stock from 60% to 100% in the existing local banks in 2014 (Deorukhkar, Gastón, Garcia-Herrero, & Xia, 2014).

1.4 Problem Statement

Bank stability is pivotal for the banking institutions to develop public trust in the banking system and facilitate smooth functioning of the intermediation process to support the economic development by credit creation and payment function (Jokipii & Milne, 2008). It is also warranted in the banking system to avoid a financial crisis, as it has a negative contagious effect on the economic system via shrinking credit facilities, distorting interbank loan market and payment system (Hoggarth et. al., 2002). As an important determinant of bank stability, competition is needed in the banking system to bolster intermediation process and financial inclusion by obliging banks to efficient, innovative and productive (Andrieş & Căpraru, 2014). Nevertheless, there has been no consensus in literature as to whether competition leads to bank stability or fragility.

Theoretically, the relationship between bank competition and stability is inconclusive. The traditional competition-fragility theory of Keeley (1990) claims that more competition exacerbates banks' risk taking appetite and makes them fragile institutions. This theory argues that increased competition erodes banks' franchise value and market power of earning monopoly rents which reduce their profit margin from which capital buffer is raised and drives them to take more risk to compensate loss in profit margins. On the other hand, the competition-stability theory of Boyd & Nicolo (2005) claims that excessive competition reduces banks' risk taking appetite which makes them financially stable and less susceptible to financial crisis. This theory claims that banks set higher loan interest rates using high market power in less competitive markets. The resulting increased default risk of the borrowers is shifted to the banks due to the perfect correlation of bank risk and borrower's risk. In reconciling the conflicting theoretical prediction between bank competition and stability, Martinez-Miera & Repullo (2010) claimed that the correlation between a bank's risk and borrower's risk is imperfect. As a result, both margin effect of high profitability and risk-shifting effect of high risk-taking are concurrently applied in the lending process. Therefore, the relationship between bank competition and stability is not straight forward but non-linear or inverted U-shaped. Recent empirical literature (such as Anginer et al., 2014a; Schaeck & Čihák, 2014; Kasman & Kasman, 2015) have not reached a consensus as to whether competition is good or bad for the stability of banking institutions. This becomes an issue of active regulatory and policy debate especially in the aftermath of the 2008-2009 GFC with growing concern among policy makers and academics regarding the extent to which competition is responsible for the crisis when many banks failed, and others lost their profitability and required additional capitalisation[11] (Kasman & Kasman, 2015). This study examines the role of competition on the stability of the banking institutions.

In investigating the root of the 2008-09 GFC, the recent literature evidence that regulatory oversight to discipline banks, rather than competition, is responsible for bank fragility which outbreaks the financial crisis (OECD, 2010, Barth et al., 2013b). This further increased concern among the policy makers and academics regarding contrasting issue of whether regulation exacerbates banks' risk-taking behaviour or its effectiveness depends on the level of competition in the banking market.

The theoretical literature document that bank regulation, especially capital regulation, activity restrictions, deposit insurance, powerful official supervision, is a sword of two edges shaping bank stability. The same regulation may limit and/or exacerbate the risk-taking behaviour of the bank. On capital requirements, while Hellmann et al. (2000)

[11] Such as, U.S. Federal Deposit Insurance Corporation reports that alone in USA 322 banks failed and 13 required additional financial assistance in the form of capital injection during 2008-10 (Detail is available at https://www5.fdic.gov/hsob/hsobRpt.asp)

claimed that high capital requirements provide incentive to the banks to build riskier loan portfolio in order to cover cost of equity and lost market power due to franchise value effect, Repullo (2004) claimed that this regulation leads banks to be more prudent in making investment decisions, and motivates them to increase loan monitoring process due to equity-at-risk effect. Similarly, with respect to activities restrictions, while Keeley (1900) identified activity restrictions limit banks' scope of operations and ability of risk diversification, and erode banks' charter value by increasing competition in traditional loan market which exacerbates their risk-taking behaviour due to franchise value effect, Boyd, Chang, & Smith (1998) identified that broad range of activities reduces competition which intensifies the moral hazard of a bank and provides more incentive to take more risk. In a similar vein, despite Diamond & Dybvig (1983) claimed that deposit insurance promotes bank stability by providing public safety net and building depositors trust on the banking system and protecting bank runs during crisis, it also increases moral hazard of excessive risk-taking by banks due to loss of depositors' incentive to monitor and control banks' risk-taking behaviour in the presence of public safety net (Matutes & Vives, 2000). The effect of powerful official supervision on bank stability is also controversial due to divergent views of the supervisor (Barth et. al. 2013b), where with public interest view supervisors are concerned about market failure, but they are more focused on their self-interest if they are driven by private interest view (Beck et al., 2006).

These contrasting relationships between regulation and bank stability may be due to the fact that the effect of regulation on bank stability may depend on the level of competition in the market, and that relationship may be changed due to the change in the level of competition resulting from the effect of certain regulation. Bank regulation has an effect on bank market power which is reflected in competition. As such, changes in competition may influence the relationship between regulation and bank stability. However, the academic literature has yet to examine empirically how bank regulation, particularly capital regulation, activity restrictions, deposit insurance and official supervision, moderates the relationship between bank competition and bank stability.

Anginer et al. (2014b) claimed that stabilisation and moral hazard effect of bank regulation depend on the economic conditions. That is, while prudent banking regulation may discipline and order the banking system and reduce the likelihood of contagious bank runs during a crisis period, these may also increase moral hazard of the banks and make the banking system vulnerable to the crisis during normal period (Beck et al., 2006; Repullo & Suarez, 2013). That is, the net effect bank regulation on bank stability or risk-taking at a certain level of banking competition may depend on whether the benefits of the regulation can offset their costs. However, no literature investigates the influence of financial crisis on the moderating role of the bank regulation on the relationship between bank competition and bank stability. Therefore, this thesis examines the moderating role of bank regulation on the relationship between bank competition and bank stability. Further, it examines the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank stability.

The findings of this thesis contribute to the puzzle on the nexus between bank competition and bank stability by incorporating the moderating role of bank regulation on the relationship between bank competition and bank stability. The study also guides policy makers who are concerned about deregulation effects on bank stability by identifying the set of bank regulations which work well in enhancing the bank stability in competitive environment.

1.5 Research Questions and Research Objectives

Based on the problem statement, this study seeks to address the following research questions:

I. Does bank competition influence bank stability in the banking sector?

II. Does the bank regulation moderate the relationship between bank competition and bank stability in the banking sector?

III. Does financial crisis influence on the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector?

This study seeks to answer the above research questions with the following research objectives:

First, to examine the influence of bank competition on bank stability in the banking sector. This objective is designed to answer does bank competition influence stability by identifying whether bank competition increases stability or fragility of banks. The influence of bank competition on bank stability is important for both academics and policymakers. This is because the instability of a bank resulting from high risk-taking behaviour may spillover to other banks and the entire economic system through its negative externalities which may lead to financial crisis. It involves high fiscal costs in the form of public safety net subsidies through deposit insurance, lender of last resort and crisis resolution procedure (Allen & Gale, 2000, Cubillas et al., 2014). The effects of bank competition on stability are inconclusive. The traditional competition-fragility view of Keeley (1990) claims that banks enjoy more market power and high franchise value to earn monopoly rents in the less competitive market which deter them from high risk-taking behaviour because the risk is associated with the opportunity cost of bankruptcy. However, competition erodes the market power and franchise value of the banks to earn monopoly rents which stimulate them to take a high risk to compensate return from franchise value lost (Allen & Gale, 2000; Hellmann, 2000; Repullo, 2004).

However, the proponent of modern competition-stability view Boyd & Nicolo (2005) claims that competition-fragility theory of Keeley (1990) ignores borrowers' risk-taking behaviour in the less competitive and highly concentrated market. The borrower's behaviour model of Boyd & Nicolo (2005) shows that in equilibrium state more competition leads to less risk-taking behaviour or more stability in the banking sector. Banks enjoy more market power to increase the interest rate on loan in less competitive and highly concentrated market. This increases borrowers' loan interest rate who respond by undertaking riskier projects and subsequently increases borrowers' probability of default. The probability of borrowers' default undermines the stability of the banks as borrowers' risk, and banks' risk is perfectly correlated as the model assumes. Acharya, Gromb, & Yorulmazer (2012) and Fu et al. (2014) further argued that large banks in a less competitive and highly concentrated market receive subsidies from policy makers through "too-big-to- fail" and/or "too-important-to-fail" schemes, that exacerbate their risk-taking behaviour believing that government will come forward to protect them if they fail. This tendency of large banks in less competitive markets renders the banking sector fragile.

In a competitive market, banks are more reluctant to involve in the risky loan portfolio as it is associated with higher opportunity cost of bankruptcy. As a result, they tend to behave more prudently in order to protect their franchise value which is only be captured if they continue their operations or remain active in the banking market (Berger et al., 2009). As prudent risk management tools, Schaeck & Cihak (2007) argued that banks hold more equity capital than the minimum requirements in a competitive market to maintain and improve its soundness. The theoretical model of Bolt & Tieman (2004) claimed that despite additional capitalisation reduces per period profits, it extends the expected life of the banks by providing a buffer against the risk of insolvency in due course of lending operations. It increases the expected future cash flow stream. Also, the theoretical model of Allen (2005) showed that banks hold more equity in a competitive loan market when they find fewer opportunities for good lending.

In a competitive market, banks may maintain high quality in their loan portfolio by keeping NPL ratio low due to the depositors' behaviour, especially when depositors are well-informed and monitor the risk-taking behaviour of the banks. According to Shy & Stanbecka (1998), the quality of loan portfolio is an important strategic instrument for the banks in the competitive deposit market which motivates banks to offer lower deposit interest rate and invest in a less risky project. In a similar vein, Cordello & Yeyai (1998) claimed that when risk-taking behaviour of the banks is observable to the depositors, banks give focus on improving their loan quality and depositors are happy with lower interest rate. In another theoretical study, Matutes & Vives (2000) showed that depositors behave harshly by depositing less in high risk-taking banks when the quality of loan portfolio is observable. Also, Niinimäki (2004) claimed that depositors avoid the banks offering excessively high deposit rates, considering that high deposit rates are usually offered by risky banks. As a result, the credit rationing equilibrium of Stigliz & Weiss (1981) takes place in the deposit market where rational depositors supply deposits to less risk-taking behaviour banks offering lower deposit rate.

Apart from the above formal competition models of the banks, competition is treated as a strong incentive for the banks to increase efficiency and reduce information asymmetry, which helps them manage banking risks more prudently (Demirgüç-kunt & Pería, 2010; Weill, 2013). Also, competition influences bank conduct which makes banks more innovative to render higher quality financial services as well as adopt prudent risk management strategies, which likely increases bank stability in the banking system

(Apergis, Fafaliou, & Polemis, 2016). Efficiency, right information availability and innovative effects of competition on the banking system enable banks' flexibility and keep them resilient in crisis, which keeps the banking system stable financially. Therefore, this study develops the following hypothesis.

Hypothesis 1: Bank Competition promotes bank stability in the banking sector.

In examining the ambiguous relationship between bank competition and stability, Berger et al. (2009) showed that the competition-fragility and competition-stability views are not necessarily opposite; rather both are concurrently applicable if insolvency risk is hedged with a high capital buffer or other risk mitigation strategies. In addition, Martinez-Miera & Repullo (2010) claimed that more competition may not only induce banks to reduce interest rate due to risk-shifting effect as argued by Boyd & Nicolo (2005), it may also reduce banks' profit margin from non-default loans due to declines in interest revenue, which would lead to fragility due to margin effect as identified by Keeley (1990). They argued that margin effect dominates risk-shifting effect in the concentrated market. This demonstrates that when the concentration is high and competition is less, competition increases slowly in the market, existing high-interest revenue generates enough capital buffer to protect banks from a potential decline in interest rate without seriously threatening their performance and bank stability. In this situation, a decline in interest rate leads borrowers to take less risk, yet decline of interest revenue will not be threatening to banks' stability. However, if competition is intensified and interest rate continues to decline, the negative margin effect for bank stability will start dominating over the positive risk-shifting effect, which leads the banks towards fragility. In sum, Martinez-Miera & Repullo (2010) claimed that bank stability increases with increase in the level of competition, but up to a certain level. After that further increase in competition reduces bank stability. That is, the relationship between bank competition and stability is non-linear or inverted U-shaped. Based on the argument of Martinez-Miera & Repullo (2010), this study may also develop the following hypothesis.

Hypothesis 2: The relationship between bank competition and bank stability is non-linear.

Second, to examine the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector. This objective is designed to answer does the bank regulation moderate the relationship between bank competition and bank stability by identifying the effect of a particular regulation on bank stability in both less and more competitive environment. With respect to the ambiguous relationship between bank competition and stability, recent literature including Beck et al. (2013) and Fu et al. (2014) argue that the macroprudential regulation plays an important role in explaining the relationship between bank competition and stability. In addition, OECD (2010) reports that regulation leads the financial institutions to show resilience to the 2008-09 global financial crisis claiming that the countries with stringent regulatory framework have been less suffered during the crisis. A well-structured bank regulation may reduce the adverse effect of the competition on risk taking the behaviour of the banks which ultimately affect the stability of banks. If competition is high in the deposit market, banks are likely to offer higher deposit rates which reduce bank profit margin by reducing interest spread. To increase profit margin, banks are likely to invest in riskier assets which may increase the probability of the failure. However, if a set of macroprudential regulations are in place, then these regulations may control the market power of the banks and restrain them from taking excessive risk. In other words, the regulatory failure may be considered a contributing factor for increasing the adverse effect of competition on bank stability which may lead to the banking sector failure.

The objective of bank macroprudential regulations is to restrain banks from risk-taking behaviour and ensure a financially sound and stability banking system (Diamond &

Dybvig, 1983). One of such regulation is capital regulation which is considered as the backbone of bank regulation to serve as a buffer against potential loss (Barth et al., 2013a; Repullo & Suarez, 2013). Despite capital regulation erodes the franchise value of banks and exacerbates their risk taking behaviour (Hellmann et al. 2000), the dynamic model of Repullo (2004) which built on the model of Hellmann et al. (2000) shown that 'risk-shifting effect' dominates over the 'franchise value effect' of capital regulation, and argued that tight capital regulation forces banks to behave more prudently to reduce their risk-taking and promote bank stability. This is because, when the capital requirements are imposed on the banks, banks' equity capital moves at risk, as the cost of defaults is adjusted with shareholders' equity. As a result, banks do not have the incentive to engage in risky lending or operations that could potentially push them to bankruptcy. Therefore, banks lend or invest prudently and also increase monitoring and controlling in investment process due to the equity-at-risk effect of capital requirements.

Capital regulation may also influence bank stability in competition environment. Firstly, capital requirements may serve as an entry barrier for the new entrants which allows the existing banks to increase market power to take risk more prudently (Northcott, 2004). Secondly, the capital requirements may serve as a buffer against unexpected loss, and also face liquidity shortfall in competitive market (Barger, et al. 2013). Thirdly, high capital requirements, despite reduce market power by increasing the cost of capital and reducing the gross loan, it may also induce banks to set stricter loan granting criteria which in turn increases operational excellence and prudent risk-taking behaviour (Bolt & Tieman, 2004). Moreover, high capital requirements may induce banks to build a close relationship with the borrowers based on which banks can grant them the lower amount of loan in the highly regulated system.

Another bank regulation is restrictions on banks' non-traditional activities such as insurance, securities, real states and also owning the voting right of non-bank firms. These restrictions reduces banks' scope of operations, risk diversification and market power (Keely, 1990, Barth et al., 2001). Despite the exiting literature such as Barth et al. (2001, 2004, 2008), Claessens and Laeven (2004), Beck et al. (2006, 2013), Berger et al. (2009), Liu, et al. (2012) and Fu et al. (2014) showed a negative effect of activity restrictions on banking market development and bank stability due to 'franchise value effect' of activity restrictions, activity restrictions may promote banks stability in competitive market. This is because, activity restrictions increase competition in the market gradually (Keely, 1990), after a certain level of competition those activity restrictions may limit banks from taking excessive risk due to risk-shifting effect of Boyd & Nicolo (2005), because, borrowers' risk and banks' risk are perfectly correlated and risk is associated with the probability of bankruptcy. Also, if the restrictions are imposed to prevent banks from extending the risky line of business in the competitive market, this may also reduce banks' moral hazard of risk-taking.

Deposit insurance also moderates the relationship between competition and stability. Because, Diamond & Dybvig's (1983) claimed that deposit insurance brings stabilisation effect on banking system by providing a safety net subsidy and preventing bank runs. Deposit insurance also increase competition by increasing the level of intermediation through building public trust on the banking system, and that increased competition may alter the influence of deposit insurance on bank stability if deposit insurance is not properly priced (Demirgüç-Kunt & Huizinga, 2004).

Similarly, powerful official supervision which is tighten up to foster private monitoring and brings discipline and governance in banking market, it may moderate the bank competition-stability relationship. Despite, Barth et al. (2001, 2003, 2004) provided empirical support of risk-taking effect of powerful official supervision, yet Fogel, Morck & Yeung (2008), Agoroki et al. (2011) and Shehzad & Haan (2015) found that official supervision has a positive effect on bank stability due to it's public interest view as proposed by Beck et al. (2006), as financial stability is linked with social and economic objectives and supervisors are very concerned about the market failure, rather than their private or political interest.

In addition, official supervision may also increase competition in the market by improving level of financial intermediation and corporate governance (Levine (2003). It may reduce the risk taking behaviour of the banks in the competitive market due to efficiency gain as Barth et al. (2013b) found evidence of efficiency enhancement effect of powerful supervisor who are independent and free from political biasness..

The above arguments mean that the efficiency of bank regulation to limit bank's risk-taking behaviour or enhancing their bank stability depends on the level of competition, and any wrong selection of bank regulation without considering the level of competition may result in regulatory failure which may render the banking sector unstable and cause financial crisis which is witnessed by both emerging and matured countries in recent decades (Cubillas et al., 2013, Kasman &Kasman, 2015).

The above arguments demonstrate that bank regulation promotes bank stability and also bank competition. Therefore, this study develops the following

Hypothesis 3: Bank regulation moderates the relationship between bank stability and bank competition.

Third, to examine the impact of financial crisis on the moderating effect of bank regulation on the relationship between bank competition and bank stability in the banking sector. This objective answers does financial crisis affect the moderating role of bank regulation on the relationship between bank competition and bank stability by identifying whether the effect of a particular regulation on the bank competition-stability relationship depends on economic conditions. Investigating the role of bank regulation during financial crisis in addition to the overall period would help to determine whether the effectiveness of a particular bank regulation in promoting bank stability changes during financial crisis. Further, it helps identify which regulation works well in restoring bank stability in both less competitive and more competitive environment during financial crisis.

In investigating the cause of the GFC, OECD (2010) and Böheim (2011) identified regulatory oversight or failure of the regulators and supervisors to discipline banks properly and reduce their moral hazard of risk-taking as the main cause of the crisis. In this regard, Anginer et al. (2014b) claimed that stabilisation and destabilisation or moral hazard effect of bank regulation depending on the economic conditions. That is, while prudent regulation restores bank stability or brings order in the banking system and reduces the likelihood of contagious bank runs during crisis period, these may also increase moral hazard of the banks and make the banking system vulnerable to the crisis during normal period (Beck et al., 2006; Repullo & Suarez, 2013).

During financial crisis, banks face maturity mismatch in their investment portfolio, and experience the loss of profit margin, equity capital and franchise value, which induce them to behave imprudently (Brownbridge & Kirkpatrick, 1999). In this connection, business cycle theory suggests that, during financial crisis, banks adopt different conservative approaches to avail competitive advantage such as restrict credit expansion, increase safely net subsidies and give more focus on building capital buffer in order to reduce moral hazard and regain bank stability (Jokipii & Milne, 2008). Similarly, Soedarmono et al. (2013) empirically found that emerging Asian banks showed a high degree of risk aversion during the 1997-98 AFC despite being were affected severely by the crisis. In this regard, Barth et al. (2013b), Beck et al., 2013, and Berger & Bouwman (2013) suggested that stringent bank regulation such as activity restrictions, capital regulation, deposit insurance that are undertaken in response of financial crisis may abolish the moral hazard problem in bank lending and reduce the likelihood of the banking crisis. In addition, Beltratti & Stulz (2009) empirically found that the banks with more tier 1 capital performed well during the 2008-2009 credit crunch in the US, and Demirgüç-kunt, Detragiache, and Merrouche (2013) in a cross-country found that the banks with higher Tier 1, Tier 2 capital and equity ratio enjoyed more stock market return during the global financial crisis. Similarly, Anginer et al. (2014b) found that the countries with more explicit deposit insurance were more resilient during the financial crisis.

It is possible that the positive stabilisation effect can dominate the negative moral hazard effect of the banking regulation during the crisis period. During crisis banks may face limited funding and inadequate investment opportunities which limit its scope of excessive risk-taking. Under such circumstances, deposit insurance can restore the depositors' confidence and prevent bank runs during the crisis, and enhance bank stability (Anginer et al., 2014b). In the same way, stringent capital regulation may play the role of buffer against capital lost, and also to absorb earnings shock which enhance the survival probability of the bank during crisis (Berger & Bouwman, 2013). Similarly, high activity restrictions may promote the lending relationship of banks with the borrowers during financial crisis which promote bank stability (Fernández et al., 2013). In a similar vein, powerful official supervisors who are driven by public interest may also protect banks from failure by increasing monitoring over the lending operations of the banks and compliance of bank regulation, which may reduce their risk-taking behaviour during crisis. Thus, this study develops the following hypothesis:

Hypothesis 4: Financial crisis influences on the moderating role of bank regulation on the relationship between bank regulation and bank competition.

1.6 Contributions of the Study

This thesis contributes to knowledge, methodology and policies.

Firstly, investigating the effect of bank competition on bank stability is important for both academics and policy due to its far-reaching influence on the whole economy, given the highly concentrated market setup that often leads to fragility due to excessive risk-taking behaviour of banks. The academics and policy makers are in a puzzle regarding the subsequent effect of bank competition on bank stability, and this study contributes to this puzzle by investigating the moderating role of macroprudential regulation on the bank competition-stability nexus in ASEAN-5 where the banking sector has undergone tremendous consolidation and regulatory reforms as post-AFC banking sector restructuring strategies. The following Table 1.4 explains uniqueness of this thesis from the works of Liu et al. (2012), Apergis, N. (2015), and Fu et al. (2014) who also focus competition-stability nexus in emerging countries of Asia and pacific including ASEAN-5.

Secondly, this thesis contributes to the literature by investigating the moderating role of bank regulations in a disaggregated manner by identifying the most relevant regulation for banks in competitive market. The study of the moderating role of the disaggregated bank regulations in competitive market provides significant policy implications to the policy makers of bank regulation that works best in achieving their economic objective towards a more stable banking system. The two-step system GMM estimates yield that most important bank regulations are activity restrictions and deposit insurance. Unlike the existing literature such as Barth et al. (2001, 2004, 2008), Claessens and Laeven (2004), Beck et al. (2006, 2013), Berger et al. (2009), Liu, et al. (2012) and Fu et al. (2014) which found an evidence of the franchise value effect of activity restrictions to exacerbate risk-taking behavior of banks, this study for the first time found an evidence of risk-shifting effect of activity restrictions to reduce the risk taking behavior of banks in competitive banking environment. Further, this study found that stabilization effect of deposit insurance is supported in less competitive market to promote bank stability, while moral hazard effect of deposit insurance is supported in more competitive environment to weaken bank stability.

Table 1.4 Uniqueness of the thesis from Liu et al. (2012), Apergis, N. (2015), and Fu et al. (2014)

Liu et al., (2012)	Apergis, N., (2015)	Fu et al., (2014)	This thesis
➢ They examined the effect of competition on banks' risk-taking behaviour in four South East Asian countries (Indonesia, Malaysia, Philippines, and Vietnam) over 1998-2008 period. ➢ They estimated competition using H-statistic and HHI, and risk taking using ratio of loan loss reserve to total loan, loan loss provision to total loan, standard deviation of ROA and Z-score. ➢ Controlling bank activity restrictions, their GMM results shown that both competition and concentration decrease risk taking behaviour of the bank, while restrictions associated with fragility.	➢ They assessed competition across the banking systems in emerging markets including Indonesia, Malaysia, Philippines, Singapore and Thailand. ➢ The analysis employed H-statistic to proxy competition, spanning the period 2000-2012, and emphasized the impact of recent financial crisis on the extent of competition in these banking market. ➢ Their results shown the banks face monopolistic competition in those markets. Further, the results shown that the level of competition declined during the recent financial crisis.	➢ They examined the trade-off between competition and financial stability in 14 Asia Pacific economies from 2003 to 2010 covering the recent financial crisis. They also investigated the influence of bank competition, concentration, regulation and national institutions on individual fragility ➢ They measured fragility with the marton's distance to default model and Z-score, and competition with Lerner index and HHI. ➢ Their GMM results suggested that greater concentration foster fragility, while market power promotes stability controlling a variety of bank and macro-economic variables. ➢ The results further shown that entry restriction is good for stability, but deposit insurance relates with fragility.	➢ This thesis is different from the Apergis (2015), who only focused on determining the state of competition in emerging market during 2000-2012 period including GFC period, while, this thesis examines competition-stability relationship by investigating the moderating role of bank regulation on the relationship in 1990-2014 period. ➢ Further, this thesis is also different from Liu et al. (2012) and Fu et al. (2014). While, the mentioned literature considered only two bank regulations (restrictions and deposit insurance) as control variable in the investigation process showing only direct effect, this thesis examines the moderating role (both direct and indirect effect) of bank regulations particularly capital regulation, activity restrictions, official supervision and deposit insurance on the competition-stability relationship in order to show how bank regulations influence on bank stability in both less and more competitive environment. ➢ In addition, this thesis also examines the influence of financial crisis on the moderating role of the bank regulation on the relationship between bank competition and stability.

Thirdly, it contributes to the puzzle by determining inflection point of competition to show the threshold level of competition beyond which franchise value effect of competition starts dominating over the its risk shifting effect. It has important implication for policy makers and academics to understand the extent of competition which is associated to bank fragility and stability; and how the threshold level of competition changes with implementing a particular bank regulation. By determining the marginal effect competition on bank stability proxied by *ln*Z-score, this thesis found the threshold level of competition proxied by H statistic is 0.7631, against the regional average of 0.55. This thesis, further, contributes to the literature by showing the role of bank regulation to move forward the threshold level of competition to get benefits of competition to promote bank stability in ASEAN-5 countries. By determining the marginal effect of bank regulation on the relationship between bank competition and stability, this thesis shown that the threshold level of competition may be shifted to the right to reduce the fragility effect of the competition and increase the stability effect of competition in the banking market.

Fourthly, this thesis extends the literature by examining the impact of financial crisis on moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector. This is an important addition to the banking literature, as earlier literature such as Hellmann, Murdock, & Stiglitz (2000), Hakenes & Schnabel (2011), and Anginer, Demirgüç-kunt, & Zhu (2014b) suggest that bank regulation brings both benefits and costs to the bank stability on the basis of the economic conditions of the country. For example, bank regulations such as deposit insurance, capital regulation, activity restrictions and official supervision may increase the moral hazard of the banks and make them vulnerable to crisis during normal periods. Simultaneously, these may bring a stabilisation effect on the banking sector and reduce the possibility of contagious banks failure during the crisis period. Using a dummy variable, capturing both the 1997-98 AFC and the 2008-09 GFC to construct the crisis dummy, the study contributes to the bank literature by identifying that fragility effect of deposit insurance in competitive environment in financial crisis changes and promotes financial stability alike other regulation variable such as, capital regulation, activity restriction and official supervision disaggregated manner.

Fifthly, with respect to the methodology, this thesis provides a new evidence in examining the relationship between bank competition and stability in emerging market context using alternative measures of bank stability. This study uses Z-score, NPL ratio and equity ratio as alternative measures of bank stability based on both factor analysis and theoretical judgments. The use of alternative proxy of bank stability, Z-score, NPL ratio and equity ratio, contributes to the literature by identifying that the level of bank stability is enhanced due to rise in equity ratio and/or decrease in credit risk. This has significant policy implications for the policy makers to strengthen equity capital base and improve risk management capacity in order to promote the stability in the banks.

Sixthly, this thesis uses a long panel data covering 25 years ranging from 1990 to 2014 which captures the period of financial liberalisation, both 1997-98 AFC and 2008-09 GFC, and banking sector restructuring and regulatory reform. The relevant literature that examine the nexus between bank competition and stability are based on pre-global financial crisis except Fu et al. (2014) and Kouki & Al-Nasser (2017), but these are limited to the 2008-09 GFC. Thus, the study of long period allows for the development of an extensive database to capture bank competition and stability and provides a better understanding of the relationship between bank competition and stability in the emerging market context, and how that relationship is changed by the presence of a particular regulatory framework during financial crisis period and overall period.

Finally, the findings of this thesis would enable the policy makers and regulators of ASEAN-5 countries to ascertain whether the implementation of Basel III accord, imposition of restrictions on banking activities, and the introduction of deposit insurance focusing on ASEAN banking integration framework are effective in enhancing banks market power and stability of the banking sector in the region. The selection of appropriate bank regulation is required for implementing the regional banking integration framework successfully, because the framework allows regional banks to expand their presence to other member countries with the status of local bank which will increase competition in the host country. Under such a situation, failure of the regulatory framework may induce the banks to take high risk and make them vulnerable to the crisis. The selection of right bank regulation is equally important for some ASEAN-5 countries such as Malaysia and Singapore which joined the Trans-Pacific Partnership (TPP) on February 2016 to enhance trade cooperation among 12 Pacific rim countries. The findings of this study suggest that deposit insurance are useful regulatory tools to promote bank stability in less competitive markets. However, in more competitive markets, activity restrictions work well in promoting bank stability. Further, these regulation also bring a stabilisation effect in the bank in both high and less competitive market during financial crisis.

1.7 Organisation of the Study

To address the research questions and achieve the objectives mentioned in Section 1.5, the study is organised into five chapters which are summarised in Table 1.5.

Chapter-1 is the introduction chapter. It introduces the overall research. It begins with the background of the study. This is followed by banking restructure and deregulation in ASEAN-5 countries. This chapter also presents problem statement, research questions, objectives and research contribution. Further in the line of the research objectives this chapter develop four testable hypotheses following the research questions. This chapter ends by providing the structure of the study where the main contents for each chapter are explained.

Table 1.5: Thesis structure

Chapter	Coverage
1. Introduction	
	Background Objectives Hypothesis development Structure
2. Literature Review	
	Evaluation of theories Empirical evidences Development of research framework
3. Methodology	
	Research design Methods, variables and data
4. Results and Discussion	
	Results Findings Discussion
5. Conclusion	
	Implications Limitations Future research direction

Chatper-2 presents a review of theoretical and empirical literature on bank competition, regulation and stability and identifies the research gap based on which the research framework is developed. This chapter reviews the theories pertaining to the bank competition and stability which is followed by the empirical literature focusing both single country and cross-country studies. Next, it links bank regulation with bank competition and stability which is followed by the link to bank regulation with the financial crisis. Subsequently, based on the research gap, the research framework is developed for this thesis.

Chapter-3 is concerned with the research design. It defines the research methodology used in this study. It details the research processes providing an understanding of how the study goes about answering the research questions to achieve the research objectives. The formulation of the research variables based on literature, as presented in Chapter-2, are shown together with the hypotheses developed in this study. The statistics used in analysing the data and the method are also explained. Further, this chapter also deals with the construction data panel including their sources.

Chapter-4 presents and discusses the descriptive statistics concerning bank competition, regulation and stability in ASEAN-5. It then presents and discusses the effect of competition on bank stability followed by the moderating role of bank regulation on the relationship between bank competition and stability both during the overall period and crisis period separately.

Finally, chapter-5 presents the main findings of the study followed by its implications, limitations and suggestions.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The chapter reviews literature on the relationship between bank regulation, competition and bank stability, and different measures used to capture bank regulation, competition and bank stability in the banking literature. The framework of the literature review is presented in Figure 2.1. This chapter first pays attention to the theoretical literature followed by empirical evidence focusing on both cross country and single country in examining the relationship between bank competition and stability in section. 2.2. Next, it reviews literature that examines bank regulation and its relationship with competition and bank stability in section 2.3. Section 2.4 summarises the literature review and reveals the research gap in the existing empirical literature.

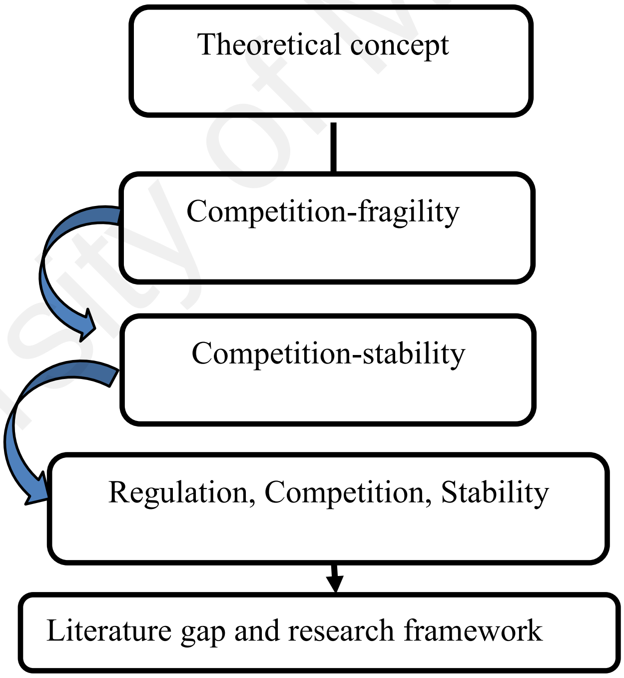

Figure 2.1 Framework of the literature review

2.2 Bank Competition and Bank Stability

Competition in banking is a strong incentive to boost efficiency, financial innovation, technological advancement, productivity and financial inclusion (Demirgüç-kunt & Pería, 2010; Weill, 2013; Apergis et al., 2016). As a result, more competition is supposed to bring greater stability in the banking sector which may bring a widespread effect on the economic development of a country through ensuring continuous credit supply and sound intermediation process. Conversely, competition is considered a driving force in banking to exacerbate excessive risk-taking in setting product prices and selecting loan borrowers to compensate the foregone profits by offering a competitive price in a competitive market (Beck, 2008). Thus, the imprudent risk management capacity of the bank managers might raise financial fragility in the banking sector which is likely to contaminate the entire economy by sinking credit facility and distorting the interbank loan market and payment system. In fact, the relationship between bank competition and stability is conflicting in both theoretical and empirical studies. The following subsection presents conflicting theoretical predictions, followed by the empirical results of the studies focusing on the relationship between bank competition and stability.

2.2.1 Theoretical literature on bank competition and bank stability

Theoretical literature makes a contrasting prediction on the relationship between bank competition and stability. The views developed in the last three decades on competition-bank stability relationship are grouped into two conflicting views, competition-fragility view and competition-stability view. This subsection summarises the theoretical literature supporting the competition-fragility view in subsection 2.2.1.1 and competition-stability view in subsection 2.2.1.2.

2.2.1.1 Competition-fragility view

The traditional competition-fragility view of Keeley (1990) is well established in the banking literature. This view explains that more competition among the banks in the banking market impedes solvency of an individual bank and deteriorates the bank stability of the whole industry though contagious effect. This paradigm considers that any rise in competition in the loan market erodes franchise value as well as the profit margin of the banks, and induces them to adopt excessive risk-taking strategies to compensate profit margin erosion for the shareholders. However, adoption of risky strategies increase credit risk exposure of the bank and increases their probability of bankruptcy in the competitive market. As banks are tightly connected in the financial market due to interdependency for liquidity supply, failure of a bank rapidly spills over to others in the competitive market which make the entire banking market fragile. All banks are a price taker in a competitive market and no one wants to support liquidity to the distressed banks which cause to increase instability in the whole industry. On the other hand, less competition allows banks to gain franchise value to earn monopoly rents and high-profit margin which are used as a capital buffer and stimulate them to take less risk in the loan market. This enhances stability in the banking sector. This view is supported in banking literature both theoretically and empirically.

The competition-fragility view demonstrates the relationship between bank competition and risk-taking behaviour through franchise value channel, also known as charter value. It is the net present value or expected value of the future cash inflows derived from banking operations (Ghosh, 2009). Franchise value is also used to indicate intangible assets of the banks which are beyond tangible properties (Ren & Schmit, 2009). In the banking industry, intangible assets may encompass a bank's reputation, market power, growth opportunity, business prospect, risk management capability and agreement with borrowers. Franchise value raises bankruptcy cost or financial distress cost of a bank, because the equity holders of the bank may lose their franchise value in case of financial distress or bankruptcy. From this point of view, franchise value gives a risk aversion incentive to the banks to defend their franchise value. This concept is firstly conceptualised in the work of Marcus (1984), where the author developed a single period option pricing model which shows that franchise value motivates banks to adopt risk constraining approach which is known as 'franchise value theory'. This theory further demonstrates that deregulation efforts in the banking sector may downsize the charter value of the banks which incentivise them to take risk-taking strategy to protect the charter value.

Later, Chan, Greenbaum, & Thakor (1986) linked franchise value with competition and explained that more competition curtails the profit margin of the bank resulting from information reusability. They assumed that banks' motivation to appraise loan proposal and resulting portfolio credit quality depend on the surplus of identifying high-quality borrowers in the loan market using reusable information. However, competition in the banking market erodes the surplus of identifying high-quality borrowers. Consequently, any deterioration in the surplus discourages banks to screen their borrowers which increases the credit risk of the borrowers and decreases portfolio credit quality of the banks.

Indeed, Keeley (1990) started the lively debate on the nexus between bank competition and stability using a state preference model with current and a future period where he suggested that anticompetitive actions capable banks earn market power and charter value to earn a high profit and hold more capital relative to the assets. Deregulation and liberalisation of branching restrictions during the 1980s in the US increased competition in the market which erodes the market power and chartered value and encourages banks to take high risk and reduce capital holding which increases the chance of bank failure.

In a similar vein, applying a dynamic model Suarez (1994) showed that banks' risk-taking behaviour changes with the change of the market power. He claimed that deregulation and low market power and higher risk-free rate transform a bank from safe to fragile bank.

Advocates of this view consider that large banks dominate in less competitive markets which are better able to reap benefits from economies of scale and scope and better able to diversify their portfolios compared to smaller banks (Diamond & Dybvig, 1983). Likewise, a small number of large banks is easy to monitor and supervise in a less competitive market (Allen & Gale, 2000). Allen & Gale (2000, 2004) further claimed that banks earn fewer information rents from the relation with borrowers in competitive markets which provide them less incentive to monitor them prudently and may give rise to moral hazard and adverse selection problem. In this connection, Boot & Thakor (2000) claimed that large banks in less competitive market enjoy comparative advantages in compare to small banks in a competitive market on credit provisioning and credit rating. A few high-quality investments increase the return on investment of larger banks and a capital buffer which make them financially sound in a concentrated market.

In the context of information asymmetry, Smith (1984) showed a link between information availability with competition and bank stability. He claimed that positive information of depositors' liquidity requirement is more likely available in the less competitive market which plays an important role in building sustainable banking relationship. This relationship is highly needed for bank stability. In a similar vein, using a simple competition model Marquez (2002) showed that new entrants in the market raise competition which disperses borrowers' information from the market. This decreases the banks' ability to screen borrowers while increases the funding cost and inefficiency due to more access of low-quality borrowers to the credit market.

Competition may also affect bank stability through contagion or spillover effect. Considering spillover or contagion effect in financial markets, Allen & Gale (2000) claimed that all banks are price takers in the competitive market, and none has the incentive to supply liquidity support to the distressed bank. Consequently, the failure of a distressed bank contaminates the entire banking sector with negative spillover effect. Allen & Gale (2000) further claimed that contagion effect or spillover effect of a distressed bank is less infectious in concentrated markets, because it is very easy for the regulators and supervisory agencies to monitor and control a small number of large banks in the concentrated and less competitive market, and high supervision makes large banks more resilient to financial distress. In this connection, Sáez & Shi (2004) revisited Allen & Gale (2000) to demonstrate financial contagion in the banking market. Sáez & Shi (2004) demonstrated that absence of asymmetric information makes possible for banks to share risk and protect contagion effect across the sector by providing a liquidity pool. They argued that asymmetric information is absent in imperfect market where a large bank can provide liquidity support and cooperate with the distressed bank to handle temporary liquidity distress. Further, Allen & Gale (2004) argued that financial distress is likely to take place in highly competitive and less concentrated market due to lack of large, powerful banks which can earn high profit offering highly profitable financial products that can be used as a capital buffer against possible financial distress or deterioration of assets quality. In a similar vein, Boyd, Nicoló, & Smith (2004) claimed that large bank with high franchise value to earn monopoly rents can make more profit from less competitive markets, where high profit can be used as a capital buffer against liquidity shock or any other macroeconomic shock. In such a way, less competition fosters financial soundness of large banks.

2.2.1.2 Competition-stability view

The competition-stability view is the opposite of competition-fragility which claims that more competition in less concentrated markets leads to financial fragility in the banking market by eroding the franchise value of earning a high profit margin of banks and increasing the risk-taking intuition to compensate for profit margin loss. The alternative competition-stability view suggests more competition leads to stability in the banking market by reducing the risk-taking behaviour of the banks. This theory assumes that less competition incentivises banks to increase loan interest rate which increases moral hazard as well as default risk of borrowers. This ultimately shifts to the banks and make them fragile due to risk-shifting effect.

Boyd & Nicolo (2005), popularly known as BDN, proposed an alternative to franchise value paradigm or competition-fragility view extending theoretical model of Allen & Gale (2000) assuming a perfect correlation of borrowers' probability of default with the probability of the default of the banks, given that borrowers estimate riskiness of their project, and banks estimates interest rate of the loan. They showed that high concentration or less competition in loan markets provide the banks with the market power which incentivises them to charge a higher interest rate of the loan to earn more rents from their loan portfolio. This high-interest rate on bank loan increases borrowing cost for the borrowers and increases their probability of default. This strategy further increases borrowers' moral hazard as identified by Stiglitz & Weiss (1981) to borrow at higher interest rates and choose to invest in the riskier projects which, in turn, increases the borrowers' nonperforming loan. The model further shows that the resulting default risk of the borrowers shifted to the banks due to the assumption of perfect correlation of banks risk with borrower risk, and erodes solvency of the banks by increases their chance to be bankrupted through risk-shifting effect. Thus, the competition-stability paradigm of Boyd & Nicolo (2005) shows a negative relationship between bank competition and bank risk-taking behaviour, suggesting that any decrease in competition increases the risk-taking behaviour of the bank, which renders the banking system fragile.

The advocate of competition-stability view, Caminal & Matutes (2002) argued that high concentration and less competition lead lower portfolio diversification and larger loan, which ultimately increases the probability of failure. Also, Beck et al. (2006) claimed that firm size increases the complexity in the organisation as large banks are difficult to monitor. Similarly, the expansion of existing line of business or in different geographical areas may give rise to transparency problems, and the use of different financial instruments to support financing and investing adds to organisational complexity. These complexities may undermine managerial efficiency and increase the operational risk of the bank. Similarly, large banks in the concentrated market is also difficult to monitor and supervise due to their high complexity and high political connections (Johnson & Kwak, 2011). Also, Barth, Prabha, & Swagel (2012) argued that a concentrated market is where only a few large banks operate and policy makers are always concerned with the failure of a large bank with a too-big-to-fail problem. In a similar vein, Acharya, Gromb, & Yorulmazer (2012) argued that large banks in concentrated markets receive subsidies from policy makers through 'too-big-to-fail' or 'too-important-to-fail' principle which alter their risk-taking motives and induce them to take extra risk thereby intensifying their fragility. Furthermore, large banks in a concentrated market influence others through the contagion effect (Anginer et al., 2014a; Fu et al., 2014). Therefore, failure of large banks in a concentrated market renders the entire system fragile.

To reconcile the distinctive relationship between competition-fragility view and competition-stability view, Berger et al. (2009) suggest that competition-fragility view and competition-stability view do not predict oppositely, rather both are concurrently applicable if high risk-taking can be hedged with a high capital buffer, using credit derivative and lowering interest rate risk. This theory claims that even though high market power exacerbates banks' risk-taking, that risk can be neutralised with using appropriate risk management tools. Later, Martinez-Miera & Repullo (2010), popularly known as MMR, extended the model proposed by Boyd & Nicolo (2005) assuming that a bank's risk is imperfectly correlated borrowers' loan defaults. This assumption generates the conflicting risk-shifting effect and margin effect of competition in the loan market. This is because, as Boyd & Nicolo (2005) assumed both bank's risk and borrowers' risk are perfectly correlated, any attempt to raise borrowers' loan interest rate in the less competitive market increases the default risk of both borrowers and the bank due to risk-shifting effect. On the other hand, margin effect shows that less competition induces banks to charge a high interest rate which not only increases bank's risk and the probability of default, but also increases its profit margin due to margin effect. The MMR model shows that there is a U-shaped relationship between bank competition (number of entries) and risk of failure of the bank due to the net effect of risk-shifting effect and margin effect. This means that the risk-shifting effect rules over the margin effect in highly concentrated market where more entry of the banks reduces banks' probability of failure. On the other hand, margin effect rules over the risk-shifting effect in highly competitive markets where more entry increases the banks' probability of failure. Here, banks reach the lowest level of risk exposure and the probability of default at moderate competition level.

2.2.2 Empirical literature on bank competition and bank stability

Evidence allows us to draw the relationship between bank competition and stability a summary of which is provided in Table 2.1. The empirical literature is grouped based on their findings supporting the competition-fragility view, competition-stability view and neutral view. Here it is worth mentioning that the extent of empirical literature uses different proxies of competition and bank stability in the investigation process using different data sets of different geographical areas focusing on both single and cross country.

2.2.2.1 Empirical literature supporting competition-fragility View

In a seminal paper, Keeley (1990) investigated the relationship between financial liberalisation, market power and risk-taking of the US banking market using state-preference model over the 1970 to 1986 period. He measured market power using Tobin's q defined as a proportion of market value of equity over book value of it, and risk-taking using solvency ratio defined as a ratio of bank's market value of capital to its market value of assets, and default risk captured by cost of funding via interest rate of uninsured certificate of deposit. Here, the author showed an effect of financial liberalisation on market power and then linked bank risk with market power. His results showed that liberalisation on branching reduces the bank's market power captured with Tobin's q controlling both bank-specific and macroeconomic variables. He then showed that market power relates with solvency positively and market power relates to default risk negatively. The overall findings demonstrated that banks are exposed to low default risk and high solvency when they enjoy more market power in a less competitive market. However, liberalisation increases competition in the market and erodes the market power of the bank which weakens the bank's solvency and increases the probability of bankruptcy. This study is consistent with the competition-fragility view.

Table 2.1 Summary of empirical literature on the nexus between bank competition and stability

Author	Sample	Period	Bank stability	Competition	Method	Regulation
Competition-fragility View						
Keeley (1990)	US	1970-1986	ETA, CD rate	Tobin's q	OLS, 2SLS	Liberalisation on branching
Salas & Saurina (2003)	Spain	1968 -1998	ETA, LLR	Tobin's q	OLS	Liberalisation on interest & entry
Bofondi & Gobbi (2004)	Italy	1986-1996	NPL	HHI	OLS	Liberalisation on branching
Beck et al. (2006)	69 countries	1980-1997	Crisis	CR3	LPM	ED, AR, CR
Jiménez et al. (2007)	Spain	1988-2003	NPL	Lerner, HHI, CR5	GMM	N/U
Beck et al. (2013)	79 Countries	1994-2009	Z-score, SDROA	Lerner, HHI, H	FE	CR, DI, MS, AR
Cubillas & González (2014)	83 countries	1991-2007	Z-score	Lerner	GMM	CR, OS
Anginer et al. (2014a)	63 countries	1997-2009	Z-score, Marton's Distance to Default, ΔCoV	Lerner, H, HHI	FE	CR, AR, SP, DI
Craig & Dinger (2013)	US	1997-2006	SDROA, NPL, SDSP.	MMDR	GMM	N/U
Kasman & Kasman (2015)	Turkey	2002-2012	Z-score, NPL ratio	Boone and Lerner, CR5, HHI	Sy. GMM	N/U
Leroy & Lucotte, (2017).	EU	2004-2013	Z-score, Marton's Distance to Default, and SRISK	Lerner	RE, FE and 2SLS	N/U
Kabir & Worthington	16 Developing	2000-2012	Z-score, Distance to Default, NPL ratio	Lerner	VAR, Quantile regression	N/U
Competition-stability View						
Boyd et al. (2006)	US and 134 non-OECD	1993-2004	Z-score, LTA	HHI	OLS, GMM	N/U
Schaeck & Cihak (2008)	European Union-10	1995-2005	Z-score	Boone	LPM, DM	N/U
Liu et al. (2012)	East Asia-4	1998-2008	LLR, LLP, SDROA, Z-score	H	Pool, FE, GMM	AR, DI
Soedarmono et al. (2013)	Asia-11	1994-2009	Z-score, ETA, Z-score(roe), DROA, SDROE	Lerner	FE, 2SLS	N/U
Schaeck & Čihák (2014)	European Union-10	1995-2005	Z-score, NPL, ROA	Boone, H	2SLS, FE	N/U
Fiordelisi & Mare (2014)	European Union-5	1998-2009	Z-score	Lerner	Pool OLS, FE	N/U
Goetz(2017)	US	1976-2006	Z-score, NPL ratio, ROA	Removal of entry barrier	FE	N/U
Mixed view/Non-linear relationship						
Berger et al. (2009)	Developed 30	1999-2005	Z- score, NPL, ETA	Lerner, HHI	GMM	N/U
Tabak et al. (2012)	Latin America-10	2003-2008	Z-score, Stability inefficiency	Boone	FE, GMM	N/U
Jeon & Lim (2013)	S. Korea	1999-2011	Z-score	Boone	OLS, FE	N/U
Liu & Wilson (2013)	Japan	2000-2009	Z-score	Lerner	Sy. GMM	N/U
Jiménez et al. (2013)	Spain	1988-2003	NPL	Lerner, HHI, CR5, No. of banks	Sy. GMM	N/U
Fu et al. (2014)	Asia pacific-14	2003-2010	Z-score, Merton's Distance to Default	Lerner, CR3	Sy. GMM	DI, CR, ER

Table 2.1 presents a summary of the empirical literatures showing the nexus between bank competition and stability. The literatures are grouped into three panels (competition-fragility, competition-stability and mixed view) based on the characteristics of the competition-stability nexus. Here, the bank stability measures, CD rate stands for interest rate of certificate of deposit, NPL stands for ratio of Nonperforming loan to gross loan, LLP stands for ratio of loan loss provision to total loan, NCOTL stand for ratio of net charge off to total loan, equity ratio stands for ratio of equity to total assets, SDROA stand for standard deviation of return on assets, SDROE stands for standard deviation of return on equity, ΔCoV stands for change of coefficient of variation, ETA stands for ratio of equity capital to total assets, Z-score(AE) is the Z-score which is based on return on equity, CAR stands for capital adequacy ratio, SDSP stands for standard deviation of stock price, LTA stands for loan to total assets. The market competition measures, MMDR stands for money market deposit rate, Lerner stands for Lerner index, EA Lerner stands for efficiency adjusted Lerner index, Boone stands for Boone indicator, H stands for Panzar-Rosse-H-statistic, HHI stands for Herfindhal-Hirschman Index, CR3 and CR5 stands for concentration ratio of large three and large five banks respectively. The bank regulation, DI stands for deposit insurance, CR stands for capital ratio, ER stands for entry restrictions, AR stands for activity restrictions, ED stands for entry denied, OS stands for official supervision, MS stands for multiple supervisors. The regression method, 2SLS stands for two stage least square, OLS stands for ordinary least square, FE stands for fixed effect and GMM stands for Generalised method for moments, LPM stands for Logit Probability model, and DM stands for duration model. On the other hand, N/U stands for regulation variable not used.

In another study, Salas and Saurina (2003) investigated the effect of deregulation on bank market power and risk-taking of 21 Spanish commercial banks using 31 years' data from 1968 to 1998. They followed the methodology of Keeley (1990) using more regulatory variables and the ratio of loan loss to total loan as a proxy of credit risk for the first time to justify the trade-off between bank competition and risk-taking is specific to a particular country and particular period. The study also considers Tobin's q as a proxy of competition and market power, and the ratio of market value of equity to total assets and the ratio of loan loss to total loan as a measure of risk-taking. The study finds that liberalisation increases competition in Spanish banking market which erodes market power and economic profit of the bank. At the second stage, the study finds that economic profit measures have a robust significant positive effect on high equity capital ratio and low loan loss ratio. This indicates that liberalisation increases competition and erodes bank charter value to earn high economic profit which declines banks solvency and increases credit risk exposure of Spanish banks.

Similarly, Bofondi & Gobbi (2004) investigated the relationship between new entrants in the local credit market and the default rate of the entrants using 7275 observations of 729 banks' lending from 1986-1996 in Italy. The economic theory explains the new entrants may expose to high default rate than incumbents due to asymmetric information problem and winner's curse effect. The empirical results using fixed effect model evident that the new entrants increase competition captured by HHI in the local credit market and they experience higher default rate due to both information disadvantage and winner's curse effect. The study also supports the competition-fragility view.

In another study, Beck et al. (2006) examined the validity of franchise value hypothesis and risk-shifting hypothesis in the light of 47 banking crisis incidents of a sample of 69 countries over the 1980-1997 period. The paper investigated the effect of banking system concentration on the probability of banking crisis controlling for bank regulation (such as fraction of entry denied, activity restrictions, required reserve and capital regulation), national institutional variable (such as banking freedom, economic freedom and KKZ-composite) and macroeconomic variables (such as real GDP growth, real interest rate, inflation and M2/reserve). The findings reveal that more concentration does not relate to the probability of systematic banking crisis. Rather, it accelerates banking stability supporting the competition-fragility hypothesis. They also found evidence that a more concentrated banking system increases the chance of risk diversification when they investigate the channel through which concentration influence stability positively. However, they did not find any evidence that more concentration provides more market power to increase stability. Therefore, they are uncertain as to of the appropriateness of concentration as an indicator of bank competition.

Jiménez, España, & Lopez (2007) investigate linearity of the relationship between competition and bank solvency using a unique sample of Spanish commercial banks for the 1988-2003 period. The study considered nonperforming loan ratio as a proxy of risk-taking and both Lerner index and concentration ratio such as HHI and number of large five banks' concentration ratio as competition measure. By controlling bank specific variables (such as return on assets, loan ratio and bank size) and the business cycle, the GMM estimates show an evidence of the existence of franchise value hypothesis on the Spanish banking market if competition is measured with the Lerner index. However, they do not find any significant relationship between concentration ratios and risk-taking.

Further, Craig & Dinger (2013) examined deposit market competition, the cost of wholesale funding and default risk of 581 US banks over the period from 1997 to 2006. The study considered ROA volatility, Stock price volatility and NPL loan ratio as the measures of default risk and retail deposit rate and wholesale rate as competition measures of banks operating in multi-market. The empirical evidence founds a significant positive relationship between bank competition in deposit market and bank risk-taking controlling bank characteristics such as bank size and capitalisation and market characteristics such as HHI, market size, the average income of population and income growth. The investigation found a risk-increasing effect of US deposit market and interprets that the banks with less market power in the deposit market prefer risk-taking strategies which support franchise value hypothesis.

Beck et al. (2013) related country-specific factors such as bank regulation, market structure and institutional features in explaining the relationship between bank competition and stability by using a sample of 17055 banks from 79 countries over the 1994-2009 period. The study measures market power using Lerner index and banking sounding using Z-score. It considers the depth of information sharing and stock market turnover as institutional development indicator; capital stringency, multiple supervisor, deposit insurance coverage and external governance index as regulatory variables; and systematic stability, activity restrictions and heterogeneous bank revenue as herding and market structure. The investigation found a heterogeneity in the relationship between bank competition and banking sector soundness. The competition-fragility view dominates the competition-stability view on the average country. It reveals that regulatory and institutions factors influence the variation and conclude that more competition renders the banking system more fragile in the countries with strict activity restrictions, lower systematic fragility, better-developed stock exchange, more generous deposit insurance and effective system of credit information sharing.

Moreover, Cubillas & González (2014) investigated the potential channels through which financial liberalisation influences the risk-taking incentives of the 4333 banks of 83 developed and developing countries over the 1991 to 2007 period. The investigation found that liberalisation decreases bank stability through increasing competition in the developed country. However, it brings negative effect on bank stability in developing countries not for more competition but risk-taking opportunity. The results also demonstrated that capital requirements reduce the negative effect of liberalisation on the bank stability of both developed and developing countries, but financial transparency and official supervision are effective only in developing countries in minimising the adverse effect of competition on risk-taking. The results suggested that financial liberalisation renders the banking system fragile in both developed and developing countries but through different channels based on economic and institutional development. The results further suggested that financial liberalisation is more disadvantageous in developing countries where increased risk offsets competition gains due to lack of institutional development.

In a recent study, Kasman & Kasman (2015) investigated the influence of concentration and competition on the risk-taking for the Turkish commercial banking sector over the 2002 to 2012 period. The study captured concentration with the HHI Index and concentration ratio of large five banks in the loan market, competition with Lerner index and Boone indicator; and risk-taking with Z-score and NPL ratio. Using two-step system GMM, the study found that competition increases credit risk and decreases solvency controlling a number of bank specific (including bank size, loan ratio and bank ownership) and macroeconomic (including crisis and GDP growth) control variables. The study further found that concentration also increases default risk and undermines bank stability. To check non-linearity between bank competition and risk-taking, the study used quadratic terms of competition measures, but, does not find any evidence of non-linearity between bank competition and risk-taking, as, the sign of the coefficient of competition on risk-taking is not changed for quadratic terms of competition. Therefore, the study supports the competition-fragility view for Turkish commercial banking sector.

Recently, Kabir & Worthington (2017) for the first time investigated competition-stability nexus focus both conventional banks and Islamic banks from 16 developing countries during 2000-2012. They considered Z-score, Marton's Distance to Default and NPL ratio as proxy of bank stability, and Lerner index as proxy of bank competition. They used panel vacto auto-regression and two-stage quantile regression in the investigation process. Their results reviled that market power promotes stability in both conventional and Islamic banks supporting competition-fragility view. They further found that the magnitude of market power on stability is greater in conventional banks.

In another study Leroy & Lucotte (2017) examined competition-stability nexus of listed European banks during 2004-2013 period. They considered both individual bank risk using Z-score and Marton's Distance to Default approach, and also systematic risk using SRISK of Acharya et al. (2012). They captured competition using Lerner index, and investigated the relationship using fixed effect and 2SLS model. Their results shown that competition incentivizes the individual banks to take more risk supporting competition fragility, but competition promotes financial stability by reducing systematic risk in the banking system. They argued that weak competition increases correlated risk taking behavior of the banks.

2.2.2.2 Empirical literature supporting the competition-stability view

Boyd, Nicoló, & Jalal (2006) used both the franchise value model and risk shifting model to investigate the effect of concentration on systematic bank distress by using two data sets of 2500 US banks and 2700 banks from 134 non-OECD countries for the period from 1993-2004. The study measured insolvency risk using bank level measure Z-score; assets allocation using the ratio of loan to total asset and competition using HHI. It determined the relationship between concentration and probability of bank failure, and then determined the relationship between concentration and assets allocation. Both sample sets revealed that the probability of bank failure negatively relates to competition which is consistent with the competition-stability hypothesis or risk shifting model and inconsistent with franchise value model. This means that more concentration renders the banking market fragile. Inversely, more competition does not necessarily predict reducing the scale of profitability of the bank. However, both models find a negative and significant relationship between concentration and asset allocation, and the authors are not sure about the concentration as a true measure of competition.

Schaeck & Cihak (2008) investigated the link between bank competition, efficiency and banks soundness to determine the effect of competition on the stability of banks using two sample sets comprising 3600 banks from ten EU countries and 8900 banks from the US during the 1995-2005 period. The result revealed that competition measured by Boone indicator increases the soundness of the bank measured by Z-score through profit efficiency channel. The result found robust using alternative proxies for competition, efficiency and bank stability. The findings suggest that competition is favourable for both efficiency and soundness of the bank. In another study, Schaeck & Čihák (2014) investigated the link between bank competition, efficiency and stability on the condition that profit is reallocated from an inefficient bank to an efficient one in a competitive market using a unique data set from 3325 banks of ten EU countries during the 1995-2005 period. The finding shows that competition measured by Boone index robustly and positively influences banking stability measured by Z index through efficiency channel. The result further indicates that bank capital and profitability play important roles in influencing competition on bank soundness through efficiency. The study also identified that more efficient banks benefit more on competition than less efficient ones. The study suggested that regulation should focus on improving efficiency and healthy coexistence of the banks in the competitive market.

In another study, Liu et al. (2012) investigated competition and risk-taking behaviour of four South-East Asian countries using various risk measures including loan loss provision, loan loss reserve, ROA volatility and a log of Z index from 1998 to 2008. The study found that the Panzer-Rosse H-statistic (a measure of competition) is negatively related to all risk measures except Z index controlling for bank characteristics and macroeconomic variables. The results suggest that more competition is not threatening for the banks in the region. The study also finds that concentration is negatively and bank regulation including activity restrictions, entry requirement and diversification opportunity positively related to the risk-taking incentive of the bank.

In addition, Soedarmono et al. (2013) examined the influence of market power on risk-taking and insolvency of banks during the crisis period using a sample of 636 commercial banks from 11 emerging Asian countries during the 1994-2009 period. The researchers considered capital adequacy ratio (CAR), equity ratio, the standard deviation of ROA and ROE; and Z-score as risk-taking and insolvency measures. On the other hand, Lerner index is used to measure the market power of individual banks. Moreover, they considered bank specific (including deposit ratio, loan ratio, loan loss provision ratio, operating expenses ratio and bank size) and country-specific (including the growth rate of foreign exchange reserve, GDP growth rate, inflation rate) control variables. The results demonstrated that market power stimulates Asian banks to expose high default risk and income risk while reducing capital buffer. The study further revealed that market power has a stabilisation effect on the crisis period particularly during the Asian Financial Crisis in countries with a small number of large banks.

Moreover, Anginer et al. (2014a) explored the effect of concentration and competition on banks' systematic fragility using a sample of 1872 listed banks of 63 countries from 1997 to 2009. The study measures credit risk, and its contribution to systematic risk using

Merton's (1974) contingent claim pricing framework, and competition using Lerner index. By controlling bank characteristics (such as bank size, leverage, market to book value and ratio of the provision for NPL to total loan) and macroeconomic variables (such as GDP per capita, stock market capitalisation), the paper found a competition-stability paradigm indicating that more competition encourages banks to diversify more risk making banks less fragile to systematic crisis. The study also considered regulatory variables (such as entry barrier, application denied, Government ownership, activity restrictions, capital regulation, supervisory power, diversification index and deposit insurance coverage) and institutional variables (such as investor protection index, credit information sharing and private information bureau) and their effect on the stability competition relationship. The study evidenced that the banks are less stable and more fragile in those countries where there is less supervision and private monitoring, higher government ownership and more restrictive policy for competition.

Fiordelisi & Mare (2014) explored the relationship between bank competition and stability of 2529 cooperative banks from five EU banks over the 1998-2009 period. The study also determined the effect of herding behaviour, concentration, crisis and bank level fundamentals on the competition-stability relationship. The study used Z-score as the measure of banks soundness and Lerner index as the measure of bank market power. The result found that competition has a stabilise effect on cooperative banks of the EU countries in both the short and long run, and crisis does not influence the relationship which supports the competition-stability paradigm. It also found that the stability of the banks is higher in the homogenous market due to herding behaviour.

Recently Goetz (2017) also invested the relationship between bank competition and stability in US banks during 1976-2006 period. They considered Z-score, NPL ratio and return on assets as a proxy of bank stability and removal of inter-state entry barrier as a measure of competition. Using fixed effect model, their results shown that more competition decreases banks' non-performing loan and probability of default, rather it promotes profitability supporting competition-stability paradigm.

2.2.2.3 Empirical literature supporting non-linear relationship

Berger et al. (2009) investigated how several measures of bank level risk are affected by competition using a sample of 8235 banks of 23 developed countries over the period from 1999 to 2005. They considered Z index, non-performing loan ratio and capitalisation ratio as a bank level risk measure. They measured market power using Lerner index, and HHI on both loan and deposit for checking the robustness of the results. They controlled bank size, asset composition, foreign bank, in addition to legal right index and GDP per capital log value for controlling business environment and economic development. The finding revealed that market power condenses the overall risk exposure captured by Z-score of the banks in both loan and deposit markets, supporting the competition-fragility theory. They further revealed that market power exacerbates portfolio risk as captured by NPL ratio of the banks also supporting the competition-stability theory. The paper proposed that the bank with high market power may defend their charted value from high portfolio risk holding significantly more equity capital as a prudent risk management tool.

In another study, Tabak et al. (2012) explored the relationship between bank competition and risk-taking of ten Latin American banks over the 2003 to 2008 period. The study measured competition using Boone indicator and risk-taking using stability inefficiency. The results demonstrated that there is a non-linear relationship between bank competition and risk-taking of Latin banks because average competition intensifies risk-taking attitude of the banks, while more and less competition condense their risk-taking attitude. Further, the findings demonstrated that both bank size and capitalisation ratio play a significant role in explaining the competition-stability relationship. The study further found that large banks benefit much from the more competitive market, and the banks with high capitalisation bolster the stability of large banks in more and average competition scenarios.

In another study, Liu & Wilson (2013) explored the relationship between bank competition and bank risk-taking depending on national and regionally focused Japanese banks with 4806 observations over the 2000-2009 period. The study considered the Lerner index for measuring competition and Z index for measuring risk-taking of the banks. It found that the effect of competition on risk is high on national banks than a regional focused bank, and the effect of competition on risk depends on the initial level of risk. The study further identified that competition negatively affects risk-taking of national banks with a high level of initial risk which supports the franchise value view, while competition affects positively on risk-taking of regional focus banks with low initial risk which supports the risk shifting view.

Jeon & Lim (2013) investigated the competition-stability nexus of Korean Commercial Banks (CB) and Mutual Savings Bank (MSB) for the period starting from 1999 to 2011. The study measured competition using the Boone index along with concentration ratio and HHI index as supplementary measures, and measured insolvency using Z-score. The investigation process initially estimated competitiveness of both types of banks and then determined the influence of competition on bank stability using pool and panel regression, and OLS fixed and random effect models. For commercial banks, the results suggest that the relationship between bank competition and stability is negative, and turned out to be a non-linear reflecting a balance of risk shifting and margin effect controlling bank characteristics and market-related indicators such as bank size, profit ratio, loan to deposit ratio, commercial bank to home loan ratio and CD volatility ratio. On the other hand, for mutual saving banks, the results suggest that competition influences positively on bank stability supporting the competition-stability view.

In another study, Jiménez et al. (2013) examined whether the risk shifting paradigm or franchise value paradigm or both are applicable in the Spanish banking system during the 1988 to 2003 period. They captured the main variable of interest, market power, with HHI, CR5, the number of banks operating in a particular Spanish province, and Lerner index, while risk-taking is measured by the non-performing loan ratio. Applying the system GMM estimates controlling macroeconomic condition and bank characteristics, they found strong evidence of a non-linear relationship between market power and risk-taking behaviour of the bank in both loan and deposit markets. They found that the relationship between concentration and risk-taking in the loan market is convex, while it is concave in the deposit market. They also found evidence of franchise value effect, but only in the loan market. On the other hand, they did not find evidence that the number of banks as a measure of market power or competition influences the risk-taking behaviour of Spanish banks.

In a recent study, Fu et al. (2014) investigated the effect of bank concentration and competition on banking stability of 14 Asia Pacific economies over the 2003-2010 period. The study measured risk-taking tendency of banks using Merton's (1974) probability of default approach and Z-score, and competition using tradition concentration ratio of large three banks and a non-structural measure of Lerner index. The results demonstrated mixed evidence of competition effect on banking stability in the Asia Pacific region controlling for a number variables capturing bank characteristics and regulatory environment. The results suggested that market power diminishes the probability of default of individual banks, supporting the competition-stability theory, while concentration exacerbates risk-taking attitude of the banks and increase their probability of default, supporting the competition-fragility theory. That is, both competition-stability and competition-fragility theory are concurrently applicable in the banking industry of the Asia Pacific region. The paper further suggested that small-sized bank and tight entry restrictions weaken fragility and improve bank stability. While deposit insurance weakens the stability of the banks. It also reported concentration as an insufficient measure of competition.

2.3 Literature Review of Bank Regulation, Competition and Stability

This section reviews the literature relating bank regulation with competition and bank stability relationship. The literature that regulatory framework interacts with competition for shaping banking stability started with the works of Keeley (1990) who theoretically and empirically found that deregulation in the US banking market increased competitive pressure on the banks in the loan market and erodes their capital buffer during the 1970s and 1980s which increase the risk-taking tendency of the banks making them fragile institutes. Moreover, the importance of the interaction of bank regulatory variable with competition is evident from the conclusion of Beck et al. (2006) who claimed regulatory failure for unfettered competition resulted in bank fragility. In this connection, Deniz, Asli, & Min (2012) categorised the regulatory variables into three groups where they considered the first group for state policies which include entry barrier, application denied and government ownership; second group for bank regulation and supervision which include activity restrictions, capital stringency, supervisory power, and deposit insurance; and third group for private monitoring and information sharing which include investor protection, department of information sharing and the existence of a private information bureau.

Here the attention is given to the literature related to bank regulation and supervision which are activity restrictions, capital stringency, supervisory power and deposit insurance as the main concern of regulators and supervisors. It is important to note that the literature covering regulatory policies that interact with competition are mostly theoretical in nature with limited empirical evidence.

2.3.1 Capital stringency requirements

Capital stringency requirements refer to minimum capital requirements that a bank needs to maintain against it risk-weighted assets. Since the inception of the BASEL II accord of the Bank for International Settlement (BIS), regulators and international institutions like the World Bank and International Monetary Fund (IMF) consider capital requirements as a regulatory tool for improving bank stability (Cubillas & González, 2014). In this connection, Barth, Lin, Ma, Seade, & Song (2013b) considered that capital requirements can offset the potential capital losses which may arise from risk exposures, albeit banks require holding more capital-at-risk. However, Hellmann et al. (2000) and Repullo (2004) argued that the equity-at-risk effect of high capital requirements may induce banks to function more prudently which reduces risk-taking intention of the banks, thus promoting bank stability. This is because, when capital requirements are imposed on the banks, the banks' equity put at risk, as the cost of defaults are adjusted with shareholders' equity. As a result, banks do not have the incentive to engage in a high level of risk that could potentially push them into bankruptcy. Therefore, due to the equity-at-risk effect of capital requirements, banks do not take high level of risk which may increase the probability of bankruptcy, rather banks invest prudently and increase monitoring and controlling in the investment process.

However, according to Hellmann et al. (2000), the view on risk-taking effect of capital requirements is ambiguous. This is because, apart from the equity-at-risk effect, there is also a negative "franchise value" effect, which makes capital requirements exacerbate risk-taking behaviour of the banks. According to this view, if injecting additional capital is costly for the bank, an increase in capital requirements will generate lower profits for the bank in each period, which, in turn, decreases the bank's franchise value. As a result of the decrease in the franchise value, the bank would be interested to invest in riskier assets. Also, keeping a higher percentage of equity capital, the profitability from bank lending is decreased which erodes the franchise value of the bank, since lower profits have a negative impact on a bank's equity. Repullo (2004) rejected the claim that higher capital requirements may have a negative franchise value effect, stating that higher capital requirements have a 'equity-at-risk effect', thereby discouraging higher risk taking and ensuring a prudent equilibrium. According to Repullo (2004), when the cost of capital exceeds the return on prudent assets, to maintain the profit margins, banks will offer lower deposit interest rates, meaning that the franchise value will be preserved.

The focus of the aforementioned theoretical studies on the competition for deposits is to some extent justified by Niinimäki (2004) who claimed that competition in the deposit market might lead to excessive risk taking. However, when competition is high in the loan market, there is risk taking, but excessive risk-taking is avoided. According to this study, when competition increases only in the loan market, even though investment in extremely risky assets promises higher returns, the probability that the project will turn out successful is lower, making the expected profit from lower risk investments to be higher, and suggesting that banks will not favor excessive risk taking. Excessive risk taking in the asset side according to Niinimäki (2004) may occur if competition takes place in the deposit market because competition for deposits would drive deposits rates upwards, thus reducing banks' interest margins and profits. To compensate for the declining profits, banks would be persuaded to invest in riskier assets which, if successful, would provide higher rates of return. Based on the previous argument of Niinimäki (2004) that banks tend to hesitate to invest in high-risk assets when their probability of default is high, competition for deposits should not necessarily imply excessive risk taking by banks on the asset side of the balance sheet.

On the other hand, Northcott (2004) found that capital stringency requirements may influence on bank competition and stability differently. He considered the higher capital requirements as a regulatory tool to deter new entrants. If the level of regulatory capital is increased, the new entrants require more equity capital which is not possible for many cases to accumulate initially, and consider this regulatory requirement as a restriction for them. This restriction controls the number of banks in the market and limits the level of competition among the existing banks and helps existing banks to build-up market power and to behave prudently which may enhance bank stability.

Also, Bolt & Tieman (2004) showed in a dynamic model that regulator imposed capital requirements allow the bank for setting loan approving criteria for the borrowers eventually resulted in prudent risk-taking behaviour. In a similar vein, Behr, Schmidt, & Xie (2010) showed both theoretically and empirically covering 61 countries that capital requirements have different effects on risk-taking incentive due to the level of concentration. It can effectively reduce risk-taking incentive for the banks in the low concentrated market. They argued that banks have low franchise value in the low concentrated market and banks adopt a risky strategy to raise their franchise value. Similarly, Cubillas & González (2014) found in a cross-country study on 83 developed and developing countries that stringent capital removes negative effect of liberalisation in both developed and developing countries and enhances stability by reducing the negative effect of market power.

2.3.2 Activity restrictions

Activity restrictions are the key determinant of the scope of banks' operations, and they influence on the level of competition in the banking industry. The activity restrictions include the restrictions of activities that the banks may be involved in such as branching, securities, insurance, and real estate; the activities through which banks can own voting right in a non-financial firm or the form of merger. The theoretical model of Keeley (1990) suggested that activity restrictions negatively related with the level of competition. His theoretical model shows that relaxation on restrictions increases risk-taking initiatives of the banks due to 'franchise value effect, because, few restriction increases competition which erodes the market power of the bank to earn franchise value which induces the bank to take high risk to compensate for lost franchise value and results in banking fragility. Similarly, the theory of Matutes & Vives (2000) suggests that activity restrictions are required in the banking market to reduce banks' intention to take high risk especially when competition is higher.

Barth, Caprio, & Levine (2004) identified five theoretical reasons to restrict the commercial banks from certain the activities in order to reduce conflict of interest, excessive risk exposure, difficult to monitor, difficult to discipline, protect competition and efficiency. Firstly, activities restrictions may give rise to the conflict of interest if banks underwrite securities and insurance and engage in the investment in real estate. If banks allow for these activities, banks may go for dumping securities to ill-informed investors by assisting issuing firms with the loan. Secondly, if banks are allowed to engage in a broader range of activities, they will take the level of risk that induces moral hazard. However, restrictions on certain assets class may reduce moral hazard problem in a situation where gambling opportunity results in a moral hazard (Hellmann et al., 2000). Thirdly, allowing banks to engage in a broad range of activities makes them complex and difficult to monitor. Fourth, these banks become very powerful both politically and economically which make them too-big-to-discipline. Finally, allowing to engage in a broad range of activities opens the door to financial conglomerates, which allows a bank to merge with a firm from a different industry, may bring adverse consequences on competition and efficiency of the banks. In addition to the reasons for restricting banks from certain activities, Barth et al. (2004) identified two alternative reasons to allow banks to engage in a broad range of activities. Firstly, less regulatory restriction allows banks to attain economy of scope and scale in information gathering, providing better services to the customers. Secondly, fewer restrictions may increase the charter value of the banks and induces banks to take less risk due to franchise value effect. Finally, less restriction allows banks to bring diversification in the scope of operations allowing to continue income flow which may increase the soundness of the banks.

The empirical evidence on the effect of activity restrictions on bank stability is mixed. Jayaratne & Strahan (1998) found that liberalisation of inter-state branching makes the US banks more competitive and reduces the probability of failure by decreasing loan loss which is opposite to the franchise value hypothesis. They argued that liberalisation of activity restrictions has a stability effect due to better banks' opportunity to grow at the cost of less efficient rivals.

Barth et al. (2001) showed that tighter activity restrictions increase the probability of financial crisis. Barth et al. (2004) showed a negative effect of activity restrictions on banking market development and bank stability in a global context; and Barth et al. (2008) showed that imposition of greater activity restrictions renders the banking system fragile. Similarly, Claessens & Laeven (2004) showed less restriction reduces competition due to an increase of financial conglomerates and high restriction increases competition in the banking market. The more competition resulting from high restrictions affects the profitability and banks' franchise value negatively, which incentivises banks to take more risk. Similarly, Beck et al. (2006) found that tight activity restriction reduces banks profitability and increases the risk of failure in a cross-country study of 69 countries. They found that restrictions prevent banks' diversification opportunity and erode their ability to reduce the portfolio risk. Also, Beck (2008) reported that many industrialised countries imposed restrictions on branching and other activities to banks after the financing crisis of the 1930s to check competition and improve stability. This is supported by Beck et al. (2013) in their study based on 79 countries between 1994 and 2009. Also, Liu, Molyneux, & Nguyen (2012) found a positive relationship between activity restrictions and bank risk-taking in South East Asian countries. They argued that strict activity restriction induces banks to take high risk.

Fernández & González (2005) showed that more activity restrictions are effective in restricting banks from excessive risk-taking. They argued that activity restrictions are effective in reducing risk only if the auditing requirements and information disclosures are developed and reported poorly. They showed that more regulatory restrictions on banks' activities increases the risk incentives of the banks due to their loss of franchise value.

2.3.3 Deposit insurance

Deposit insurance is another regulatory measure that constructively builds a financial safety net for the depositors and promotes financial intermediation and bank stability by promising the depositors that their deposits are safe and protected. The deposit insurance system is implemented in a banking system to prevent bank runs, prevent banking crisis or promote bank stability, and reduce the social cost of the banking crisis (Diamond & Dybvig, 1983; Demirgüç-kunt & Detragiache, 2002; Gropp, Hakenes, & Schnabel, 2011). The theoretical evidence of Merton (1977), Keeley (1990), Matutes & Vives (2000), and Salas & Saurina (2003) showed that, like other insurance systems, deposit insurance could also result in moral hazard problem in the form of excessive risk taken by the banks. Therefore, exacerbation of moral hazard effect may offset the benefits of deposit insurance. That is, the role of banks as financial intermediaries and change of incentive in the contracts between banks as agent and depositors as the principal transforms risks of the contract, which leads to the moral hazard problem. Empirical evidence suggests that a credibly designed deposit insurance could minimise the moral hazard effect (Barth et al., 2004; Demirgüç-Kunt & Huizinga, 2004; Matutes & Vives, 2000), and increases financial intermediation (Chernykh & Cole, 2011; Demirgüç-Kunt & Detragiache, 2002).

Deposit insurance prevents bank runs and systematic effect of bank runs that could spill over to other banks in the system or whole economy as identified by Diamond & Dybvig (1983) which is considered the most important benefits that deposit insurance brings to the banking institutions as liquidity providers and asset transformation agents. Banks' maturity transformation role enable them to accumulate demand deposit like savings deposit, fixed deposit and current account and raise short-term funds in the capital market (Lowe, 2015).

Banks utilise the demand deposit and short-term funds to create bank loans and long-term investments creating a maturity mismatch in the banks' asset transformation process. This maturity mismatch allows banks to offer higher return opportunities for the rational depositors who are likely to share the risk with the banks. Apart from sharing the risk with the depositors, banks are exposed to the risk of early withdrawal of fund by depositors at any time due to panic or otherwise. In that instance, deposit insurance prevents the panic run by depositors by building the depositors' confidence on the banking system.

Thus, theoretically, the government-backed deposit insurance provides bank stability by eliminating the risk of a bank runs. Even during the crisis, deposit insurance system works as a risk minimiser by protecting deposits of major depositors as they anticipate their deposits are under an insurance system which is backed by government safety net. As a result, depositors without an immediate consumption needs do not rush to the bank to withdraw funds which protects a contagious bank run and minimises the social cost of the bank crisis. Thus, deposit insurance not only prevents a bank run, contagious run and reduces the social cost to bank crisis, it also restores depositors' confidence in the banking system which encourages individuals to deposit their saving to the banks and supports banks to increase their level of intermediation and bank stability.

Despite deposit insurance bringing may advantages for the banking system, unfortunately, it can generate moral hazard of the banks and encourage banks to take excessive risk in the absence of a stringent regulatory framework. Merton (1977) is the first who identified the moral hazard problem of the deposit insurance. He recognised the value of deposit insurance as the equivalent of the US federal deposit insurance. At that time, a flat-rate deposit insurance was charged irrespective of bank risk level. The flat rate premium provides the incentive for the banks to alter their risk-taking behaviour because they incur only a part of the losses if the loan becomes nonperforming. Therefore, moral hazard may occur even in normal times if the risk-taking incentives are attractive. Keeley (1990) and Salas & Saurina (2003) also illustrated how deposit insurance changes banks risk-taking behaviour and creates moral hazard.

Moral hazard arises from the agency relationship between principal and agent, and due to the information asymmetry between them. In agency theory, a moral hazard is known as a hidden action which is an action of one party in a transaction (agent) that is unobservable by the second party (principal) who authorised the transaction (Kreps, 1990). With respect to the deposit insurance, the agency theory revolves around the agent's (Banks) risk-taking behaviour associated with the principal (depositors). The information asymmetry is the main concern in the framework. In the banking sector, this asymmetric information problem could arise when there exists a deposit insurance system to prevent bank runs. Moral hazard in banking could stem from the relationship between banks and the insured claim holder(depositors) in the presence of deposit insurance due to information asymmetry (Jensen & Meckling, 1976). Banks usually have more information about their actions or intentions than the depositors as the depositors usually cannot completely scrutinise the banks or banks' actions. In the presence of deposit insurance, depositors are protected against the bank's losses or failure under the public safety net. Hence they do not find motivation to monitor or control the risk-taking incentive of the banks and bring market discipline. Under this circumstance, if the depositors' relaxed attitude to monitor the bank's activities known to the banks in the presence of deposit insurance, the riskiness of the contract also altered as the bank may disclose in riskier activities than it would in the presence of close monitoring. As a result, moral hazard of the bank is created to take extra risk or gamble to reap the higher return by investing in the risky borrowers or risky projects. Jensen & Meckling (1976) found that if the gambling is successful the bank is rewarded, but if the bank fails the cost of the gamble is transferred to deposit insurance fund.

Despite deposit insurance gives rise to moral hazard problem of the banks, it is still needed for the sound banking system and bringing bank stability. Diamond & Dybvig (1983) showed that a run could cause a healthy bank to fail and render the entire banking system fragile due to its contagious effect. Also, the liquidity transformation function of the banks makes them vulnerable to runs as banks finance long term assets with short term deposit. In this regard, deposit insurance builds the depositors' confidence in preventing a bank run and promotes a level of intermediation and bank stability (Demirgüç-Kunt & Detragiache, 2002; Matutes & Vives, 2000). Moreover, Barth et al. (2004) argued that the moral hazard effect of the deposit insurance can be overcome through designing the deposit insurance that involves proper coverage scope, coverage limit, funding, co-insurance, premium structure, membership requirement and management, and other regulatory initiatives including risk-based premium pricing, reserve requirement and capital requirements aimed at curbing excess risk-taking. The accepted view agrees that in mitigating moral hazard, the deposit insurance design features should have the incentives to prevent banks from taking excessive risk. The literature also empirically finds that moral hazard minimises effect of deposit insurance.

Gropp & Vesala (2004) found that limited government commitment in designing explicit deposit insurance in European banks serves as a commitment device which mitigates moral hazard problem of banks through reducing safety net and allowing the subordinate debt holders to monitor banks. Similarly, Maysami & Sakellariou (2008) found that countries with liberalised financial sectors would have a more stable banking sector as deposit insurance system lowers the cost of moral hazard by reducing vulnerabilities. Likewise, Angkinand (2009) considering 47 banking crisis episodes in 35 industrial and emerging markets found that deposit insurance does not have implications for moral hazard. Rather, they argued that a higher coverage of deposit insurance mitigate the moral hazard problem.

Further, Martinez-Miera & Repullo (2010) showed that deposit insurance enhances profitability and stability of the banking sector, as in the absence of deposit insurance banks need to offer high deposit rate to the depositors who would increase loan interest rate and also the probability of failure. Additionally, the empirical evidence of Chernykh & Cole (2011) discovered that in a stable banking system, financial intermediation is greater for banks that have long been under the explicit deposit insurance system. Furthermore, estimating the probability of a banking failure during the 2008-09 Global Financial Crisis, Anginer, Demirgüç-kunt, & Zhu (2014b) provided evidence that the countries that implemented explicit deposit insurance found to have low bank risk and were systematically stable.

2.3.4 Official supervisory power

Powerful official supervision of bank regulator is a regulatory measure is related to the Pillar III of Basel accords which is exercised to restrict banks from taking excessive risk-taking and increase stability (Basel Committee on Bank Supervision, 2011). Barth et al. (2004) demonstrated three theoretical benefits of increasing powers of official supervisors in promoting bank stability. Firstly, powerful official supervision increases monitoring of the banks operations, which requires increasing performance, and protecting market failure, which otherwise is difficult for the banks due to high cost and difficulties involved. Secondly, supervisors play an official role in protecting the banking system from contagious run resulting from information asymmetry. Thirdly, powerful supervision may reduce moral hazard and restrict banks from taking excessive risk, which arise from the existence of deposit insurance and lack of depositors' incentive to monitor banks. Barth et al. (2004) also highlighted the negative consequences of powerful supervision due to involvement in corruptions which render them to take sub-standard actions in some cases which impede the development of the bank operations. In another study, Laeven & Levine (2009) suggested the official supervision improved the banking governance and increased competitiveness.

In this connection, Beck et al. (2006) proposed the 'Public Interest View' and 'Private Interest View'. The 'Public Interest View' suggested that powerful supervisors have expertise and incentive to protect the banks from market failure resulting from information asymmetry, transaction costs and enforcement impediment (Coase, 1960). The market failure indicates that private agencies cannot ensure effective monitoring the banking system, so the market cannot gain required intermediation and be financially stable (Atkinson & Stiglitz, 1980). Therefore, the government can come forward to monitor the banks directly. According to the public interest view, the government through a powerful supervisory body monitors, regulates and supervises the banking system to bring discipline and increase intermediation, and stability in the banking system. As a result, a powerful supervisor that directly monitors the risk-taking operations of the banks and brings discipline in the banks can promote corporate governance and increase stability in the banking system. From this viewpoint, powerful supervision is negatively related to risk-taking behaviour and positively related to bank stability.

Conversely, the 'Private Interest View' suggests that powerful supervisors are not interested to protect banks from market failure rather they are interested in increasing their private interest. As pointed out by Beck et al. (2006), if the powerful supervisor has the power to discipline the non-compliant banks, the supervisor may misuse that power to force or induce those banks to allocate credit to serve private interest or political interest. This is because politicians may have a connection with the powerful supervisor and they may use the supervisor to force banks to lend to the particular borrower on the easier terms. Politicians are not necessarily interested in ameliorating information, transaction cost and enforcement, rather they may create an obstacle in lending forcing banks to be corrupted to exploit their political intention due to their grabbing hand view (Andrei & Vishny, 1998). From this viewpoint, powerful government-backed supervision may be associated with high risk-taking and negatively influence on bank stability if the supervisor is politically connected. Thus, the 'public interest view' focuses on market failure, while, the 'private interest view' focuses on political failure.

In a similar vein, Barth et al. (2013b) pointed out that the effectiveness of official supervision depends on the supervision authority's access to the bank's information and adoption of appropriate actions to change the behaviour of the banks. Sometimes the authority needs to take remedial to correct unauthorised activities of the bank. For example, banks may involve in riskier operations by increasing the level of competition in the market to increase their franchise value. In such a case, strong supervisory power may restrict the bank from involving in that type of risk-taking behaviour. However, there may have some exceptions especially in developing countries where sometimes banks can convince the regulator not to serve the interest of the society rather serve the interest of the bank. In that case, banks may maintain and improve their market power. If powerful and politically connected banks show riskier behaviour, the politically biased regulatory authority not able to implement any corrective action.

The empirical evidence on the effect of powerful supervision on risk-taking is mixed. Barth et al. (2001) found that powerful official supervision brings negative influence on bank performance and increases nonperforming loans in the banking system. Barth, Caprio, & Levine (2003) found that powerful government-linked official supervisor is especially detrimental in developing countries. However, Fernández & González (2005) found that supervision with more disciplinary power reduces risk-taking of the banks controlling the auditing and accounting requirements. In the similar view, Barth, Lin et al. (2013) found where supervisors are independent and free from the political connection is supportive for enhancing efficiency measured with DEA which is positively related with the level of competition. In supporting this Anginer, Demirgüç-kunt, & Zhu (2014a) and Lee & Hsieh (2014) found that weak supervision and private monitoring make the banking system more fragile. On the other hand, strong supervision effectively reduces risk-taking tendency of banks in the developing countries which otherwise worsens due to more competition (Cubillas & González, 2014).

2.3.5 Summary on bank regulation, competition and stability

Bank regulation is designed to mitigate the risk-taking behaviour of the banks and to promote a sound and stable financial system, because instability in the banking sector contaminates the entire financial system by shrinking credit facilities and distorting both interbank loan market and payment system (Khan, et al.,, 2016). Indeed, bank regulation shapes stability through the channel of bank competition. One such regulation is activity restrictions, where less restrictions erode a bank's market power and increase bank competition, and exacerbate the bank's risk-taking behaviour due to the 'franchise value effect'. On the other hand, more restrictions also increase competition by reducing scope of operations and risk diversification and may also motivate the bank to limit risk-taking behaviour at certain levels of competition due to the 'risk-shifting effect'.

Deposit insurance is another regulatory measure that constructively builds financial safety nets for the depositors and promotes financial intermediation by promising the depositors that their deposits are safe and protected. Thus, it prevent bank runs that could spill over to other banks, prevents banking crisis, and promotes bank stability due to its 'stabilization effect'. As deposit insurance increases the level of intermediation by building public trust in the banking system, it may also increase competition, and that increased competition may alter the influence of deposit insurance on bank stability due to its moral hazard effect. Because, in the presence of deposit insurance, depositors are protected against the banks' losses or failure under the public safety net. Hence they do not find motivation to monitor or control the risk-taking incentive of the banks and bring the market in the discipline. Under this circumstance, if the depositors' relaxed attitude to monitoring the bank's activities is known to the banks, the riskiness of the contract is altered as the bank may disclose riskier activities than it would in the presence of close monitoring. As a result, the moral hazard of the bank is created by taking extra risk or gambling to reap higher returns by investing in riskier borrowers or riskier projects.

In a similar vein, the effect of the capital requirements on bank stability may also channeled through the level of competition. Despite, capital requirements oblige banks to hold more equity which increases cost of equity, and increases risk taking behavior of the banks due to loss of the bank's market power to crease more loan (Hellmann et al., 2000), it may also influence competition by preventing new entrants and protecting the market power of existing banks (Northcott, 2004), which may shape bank stability. This is because, capital requirements reduce banks' initiative to invest in risky asset, and stimuate banks to invest more carefully to avoid probability of bankruptcy due to equity-at-risk effect. This means that the efficiency of bank regulation to limit a bank's risk-taking behaviour or to enhance its stability channelled through the level of competition. Therefore, the selection of bank regulation without considering the level of competition may result in regulatory failure which may destabilise the banking sector and cause financial crisis as witnessed by both emerging and matured countries in recent decades.

In addition, as Beck et al. (2006) argued, powerful official supervisors may not be politically biased; rather they may concern about the market failure due to their 'public interest view'. This is because, protection of the market failure is related to the economic and social objective of the government. As a result, powerful supervisor may directly monitor and correct banks' risk-taking operations and bring them in discipline which may promote corporate governance and competition in banks, and increase stability in the banking system.

2.4 Literature Gap and Research Framework

Section 2.2 reviewed empirical studies of the nexus between bank competition and stability focusing on both single country and cross country. The results are summarised in Table 2.1, which confirms that neither single country nor cross country provides clear empirical evidence as to whether competition is supportive for promoting stability or fragility of individual banks in the banking market. As such, the issue remains inconclusive. The literature review further demonstrated that liberalisation, deregulation and unfettered competition are the contributing factors of the banking crisis in the US during the 1980s, and in the recent credit crunch in the US and UK (Keeley, 1990; Fu et al., 2014; Cubillas & Gonzalas, 2014). On the other hand, some literature such as Beck et al. (2006) evidenced that regulatory failure rather than competition is responsible for the financial crisis. Keeley (1990), Salas & Saurina (2003) and Bofondi & Gobbi (2004) identified financial liberalisation is the cause of increasing competition in the banking sector, and Beck et al. (2013), Anginer et al. (2014) Fu et al. (2014), and Cubillas & Gonzalas (2014) identified that bank regulation mediates the relationship between bank competition and stability. However, the empirical literature has thus far shown that no earlier study examined whether bank regulation affects bank stability through the channel of competition.

Table 2.1 further indicates that most of the existing studies are focused on matured countries especially the US or Europe with little attention in emerging Asia. The limited literature on Asian countries provides inconclusive results on the nexus between bank competition and stability, such as Liu et al. (2012) for four East Asian countries and Soedarmono et al. (2013) for 13 emerging Asian countries which found that high market power or less competition relates to high insolvency risk. On the other hand, Fu et al. (2014) for 14 Asia Pacific countries suggested that low market power and greater concentration induce banks to take high risk.

Although Berger et al. (2009) and Kasman & Kasman (2015) considered both competition and concentration could coexist and determine both stability and fragility, Beck et al. (2006), and Fu et al. (2014) found that concentration is not the true measure of competition, rather concentration influences banking stability other than competition channel. Investigations of the link between bank competition and stability and the link between concentration and stability does not provide the same evidence. In addition to the bank regulation, the literature evidenced that bank-specific factor such as bank size, operational efficiency, loan composition, loan quality, foreign ownership influence the relationship between bank competition and stability.

With respect to the bank regulation, competition and stability reviewed in section 2.3, most theoretical literature and limited empirical studies evidenced that regulation influenced stability in different channels. The same regulation may affect bankstability independent of competition, and also through the channel of competition. For example, activity restrictions reduce banks' scope of operations which not only influences the market power of reducing the scope of risk diversification in different business lines but also exacerbates moral hazard for risk-taking to increase profit margin. Similarly, capital regulation requires banks to hold a minimum amount of equity capital which not only induces them to behave more prudently by increasing monitoring and controlling lending operations to borrowers due to 'equity-at-risk-effect', but also protects banks' franchise value and reduces moral hazard by considering high capitalisation as a risk management strategy and leaving a scope of offsetting potential capital losses. Likewise, deposit insurance promotes stability by increasing depositors' confidence over the banking system and promoting financial intermediation. It may also increase the 'moral hazard problem' of banks by reducing depositors' incentive to monitor banks behaviours. In a similar vein, powerful supervision promotes governance of the banks and increases monitoring of banks operations which not only restricts them from high-risk exposures but also increases the market power of banks.

Bank regulation (such as capital regulation, activity restrictions, deposit insurance and official supervision) influences stability and the level of competition. They influence the relationship between bank competition and stability. However, no earlier studies examined empirically how does bank regulation affect the stability through the channel of competition especially at disaggregated levels on emerging countries. Beck et al. (2006), Repullo & Suarez (2013), and Anginer et al. (2014b) argued that the stabilisation or fragility effect of the bank regulation on financial system may depend on the level of economic condition, but how does the regulation influence the relationship between bank competition and stability during financial crisis has not been examined empirically.

To fil these gaps and contribute to the body of knowledge both theoretically and empirically, this study examines the relationship between bank competition and stability, the role of bank regulation on the relationship between bank competition and stability, and the effect of bank regulation on the relationship between bank competition and stability during financial crisis in ASEAN-5. In examining the relationship of bank regulation, competition and stability, the study uses the research framework reported in Figure 2.2.

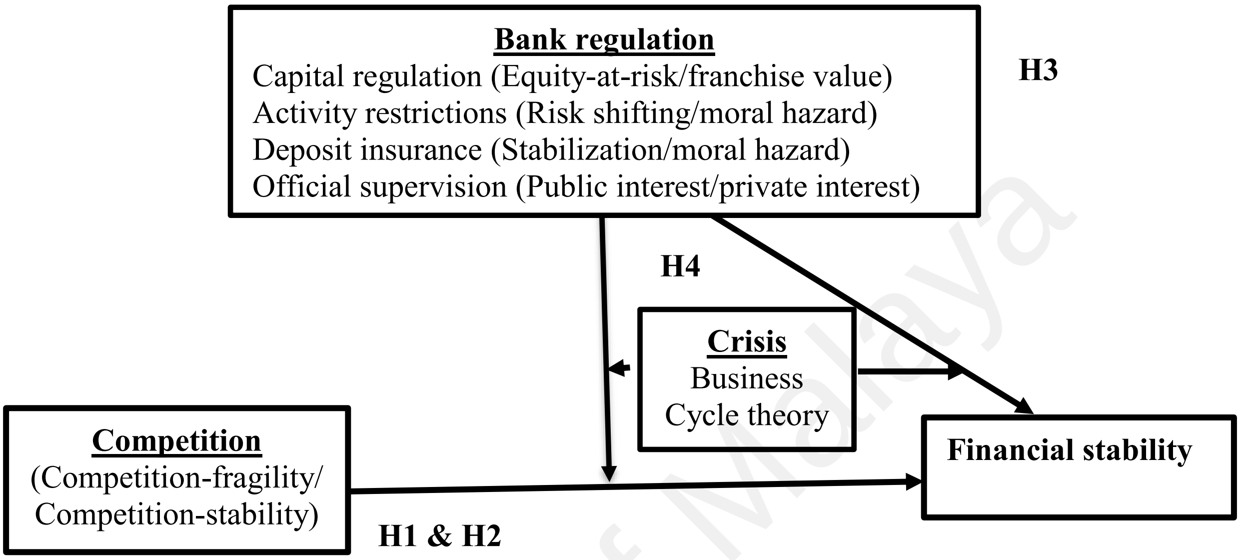

Figure 2.2 Research Framework

Figure 2.2 presents the research framework of this thesis. This framework exhibits that this thesis examines the effect of competition on the stability of the banking sector for ASEAN-5 countries. It tests the competition-fragility theory of Keeley (1990) and competition-stability theory of Boyd & Necolo (2005). It then examines the role of bank regulation (such as capital regulation, activity restrictions, deposit insurance and official supervision) on the relationship between bank competition and stability in the banking sector of the region. It tests the franchise value effect of Hellmann et al. (2000) and equity-at-risk effect of Repullo et al. (2000) for capital regulation; franchise value effect of Keeley (1990) and risk-shifting effect of Boyd & Nicolo (2005) for activity restrictions; stabilisation effect of Diamond & Dybvig (1983) and moral hazard effect of Jensen & Meckling (1976) for deposit insurance; and public interest view and private interest view of Beck et al. (2006) for official supervision. Finally, this thesis examines the role of bank regulation on the relationship between bank competition and stability during the financial crisis. It tests the business cycle theory in the ASEAN banking sector and examines whether the role of bank regulation remains the same on the relationship between bank competition and stability during the financial crisis.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter discusses the methodology used to study the relationship between bank regulation, competition and stability. The flow of this chapter is presented in Figure 3.1. With respect to the objectives of the study, section 3.2 discusses the methodology specifying the models to test the hypothesis and defining the key variables for the model. The estimation technique to estimate the research models is discussed in section 3.3. Section 3.4 discusses data and sample selection of the study. Finally, a summary of this chapter is presented in section 3.5.

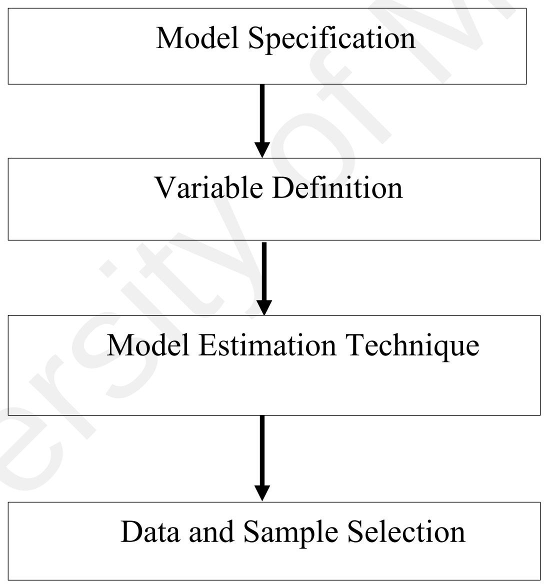

Figure 3.1: Framework of Methodology

3.2 Methodology

Based on the objectives of this study, this developed four testable hypotheses section 1.5. To test these hypotheses, this section designs econometric models. All the dependent and independent variables used in the models are also discussed.

3.2.1 First Objective: Examine the influence of bank competition on bank stability in banking sector

The influence of bank competition on the stability of the banking sector is important for both academics and policymakers. This is because the instability of a bank resulting from high risk-taking behaviour may spillover to other banks and the entire economic system through its negative externalities which may lead to financial crisis. In order to satisfy the first objective, this thesis developed two hypotheses in section 1.5 which are reproduced below:

Hypothesis 1: Bank competition promotes bank stability in banking sector.

Hypothesis 2: The relationship between bank competition and stability is non-linear.

3.2.1.1 Methodology: Econometric model specification for testing hypotheses 1 & 2

To test hypotheses 1 and 2, the relationship between bank competition and stability in the banking sector, the most important econometric concerns in the model specification are dynamic nature of banks in rents-seeking and possible endogeneity of some exogenous variables in the panel regression (Barger et al., 2009; Delis, 2012). In respect to the persistence in earning bank level rants, Barger et al. (2000) showed that even in the developed banking industry, US banks operate under certain constraints such as impediment to competition and information opacity which provide an incentive for the banks to be persistent in enjoying bank level rents. Due to information constraint and an impediment to competition, banks opt for networking and building a bondage in the network which likely to be persistent in enhancing bank stability. In a similar vein, Hossain (2012) showed persistency in rents-seeking prevails in an emerging country due to some inefficiencies which are attributed to more competition, high administrative expenses, the high default rate of the borrowers and macroeconomic conditions. With respect to the endogeneity problem between bank competition and stability, Berger et al. (2009) claimed that endogeneity may araise when causality is coming from the opposite direction, such as, if two banks merged then the market power of the bank is increased with increasing its capitalisation. Similarly, if a bank wants to take on high loan risk or overall risk with anticipating higher expected returns, it may lead the bank to increase its market power.

Supporting dynamic econometric model formation, Laeven & Majnoni (2003) argued that dynamic model can better capture the effect of stock variables on the flow variable such as nonperforming loan ratio. Allen & Gale (2004) argued that risk-taking behaviour of the banks require studying in a dynamic setting. It is attributed to many factors, such as higher expected profitability, the risk of future bankruptcy and presence of economic of scale. Also, the dynamic panel regression allows considering both time variation and cross-sectional variation in the model (Delis, 2012). It also allows avoiding biases in cross country regressions. Moreover, it permits the use of instrumental variables[12] which minimise the bias accrued from the endogeneity problem. Finally, it is more useful for the data with the fewest number of years and large cross section per year (Baltagi, 2005). To test the effect of bank competition on stability, this study uses the following basic dynamic panel regression model:

[12] Instrumental variable is used to correct the biasness of least square estimation due to the presence of endogeneity problem in the model. Endogeneity problem is raised when a variable is correlated with error term in the model. As instrumental variable is used to correct the problem raised from endogeneity problem, instrumental variable must have the following properties as mentioned by Hill, Griffiths, and Lim (2008) such as, it is correlated with endogenous variable and uncorrelated with error term in the model (Exogenous), and it does not have a direct effect on the dependent variable.

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.1)$$

In the equation (3.1), *i= 1-----N, j= 1------J* and *t=1-------T, N* refers to the number of individual banks; J refers to the number of countries; *T* refers to time; and α, β, θ and γ are estimated parameters. The study measures bank stability *(STAB)* for bank *'i'*, country *'j'* and time *'t'* with Z-score, NPL ratio and equity ratio. *COM* is the vector of competition with is captured with two alternative measures of competition, such as Panzar-Rosse H-statistic and HHI. Where, the value of H-statistic is proportional to competition, while the value of HHI are negatively proportional to competition. The vector *'BANK'* represents a set of bank level control variables such as bank size, operational efficiency, loan composition and loan quality and foreign ownership in order to control the variation of the bank characteristics in investigating the relationship between bank competition and stability; *'MACRO'* is a vector of macroeconomic control variables such as real GDP growth rate and inflation based consumer price index to control the variation in the macroeconomic environment in examining the nexus. α_1 measures the persistence of bank stability. A positive and significant value of α_1 implies that financial soundness of one year is to be carried forward to the following year, implying banks' persistent risk-taking behaviour. Thus, it is important to consider the persistence of financial soundness by using a dynamic panel model (Lee, Hsieh, & Yang, 2014). A year dummy is included to capture the year effect due to changes in the business cycle and technological progression. λ_i represents unobserved individual effects, and ε_{ijt} is the error term. The details of dependent variables, explanatory variables, and instrumental variables is presented in Appendix B.

The study assumes the following expected relations between bank competition and stability.

1) If α_2>0 and significant for dependent variable either Z-score or equity ratio, or, $\alpha_2 < 0$ and significant for NPL ratio; it indicates that the hypothesis 1 of the study is supported, meaning that more competition stimulates the individual banks to take less insolvency risk and hold more equity capital which may increase stability of the banking sector, and also support competition-stability theory of Boyd & Nicolo (2005).

2) If α_2<0 and significant for dependent variable either Z-score or equity ratio, or, $\alpha_2 > 0$ and significant for NPL ratio; it indicates that hypothesis 1 is not supported, meaning that more competition motivates banks to take on excess insolvency risk and hold less equity capital that increase the probability of default and make the banking sector instable supporting the competition-fragility theory of Keeley (1990).

As, Martinez-Miera & Repullo (2010) claimed, competition maintains a non-linear relationship with bank stability due to the presence of both risk shifting effect (competition-stability theory) and margin effect (competition-fragility theory). This study further investigates the non-linearity between bank competition and stability, following the work of Fu et al. (2014) and Kasman & Kasman (2015). In this connection, the study adds a quadratic term of competition vector and modifies the basic model of equation (3.1) to the following form:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.2)$$

In equation (3.2) this study uses the same dependent and independent variables as used for equation (3.1) except the quadratic term of the competition vector capturing the non-linear relationship between bank competition and stability.

The study assumes the following expected relations between bank competition and stability.

1) If dependent variable is either Z-score or equity ratio, and $\alpha_2 > 0$ and $\alpha_3 <0$ and significant, indicating that risk shifting effect is dominant initially but margin effect starts dominating after certain level, and the relationship between bank competition and stability is non-linear or inverted U-shaped as suggested by Martinez-Miera & Repullo (2010). An opposite sign is expected for NPL ratio as dependent variable.
2) If dependent variable is either Z-score or equity ratio; and $\alpha_2 <0$ and significant; and $\alpha_3 >0$ and significant indicating that margin effect dominants initially but risk shifting effect starts dominating after certain level of competition and the relationship between bank competition and stability is non-linear or U-shaped as suggested by Martinez-Miera & Repullo (2010). An opposite sign is expected for NPL ratio as dependent variable.

Lind & Mehlum (2010) showed that a significant coefficient of the variable of interest and its quadratic term having reverse signs, and an estimated extreme value based on this computed coefficient lying inside the range of the data, are only the necessary condition, but not the sufficient condition to proof the presence of non-linear relationship (either U-shaped or inverted U-shaped). They further argued that the above-mentioned criteria as weak, even erroneous claiming that the criteria may indicate the relationship as monotonic even though the true relationship is convex. To test the non-linear or inverted U-shaped relationship, Lind & Hehlum (2010) suggested testing whether the relationship is increasing at the right side of the interval and decreasing at the left side of the interval (opposite for U-shaped relationship). Sasabuchi (1980) provides such a type of framework which is commonly used in the literature to test non-linear relationship (Lind & Mehlum, 2010, Schnabel & Wagner, 2012, Haans, Pieters & He, 2015). Therefore, this study uses the framework of Sasabuchi (1980) to test the non-linear relationship, particularly inverted U-shaped relationship between bank competition and stability. The

Sasabuchi-test uses t-statistic to test the null hypothesis that relationship is inverted U-shaped, where, an alternative hypothesis is assumed as the relationship is monotonic.

(a) *Definition of variables*

This study considers alternative dependent variables and several explanatory variables to investigate the relationship between bank competition and stability of banks. Where, bank stability is considered as dependent variable which is measured with Z-score, NPL ratio and equity ratio on the basis of the outcome of the factor analysis, along with the theoretical justification. The main explanatory variable is competition which is measured with both traditional industrial organisational approach, such as HHI and new empirical organisational approach, such as Panzar-Rosse H-statistic. This study also controls a number of bank-specific and macroeconomic variable to control their effect on the relationship between bank competition and stability.

i ***Dependent variable***

As mentioned earlier, this study considers bank stability as the dependent variable to investigate the effect of competition on bank stability in ASEAN-5. bank stability is frequently measured in the literature in a negative term such as systematic and/or individual bank distress (Beck, 2008). Here, the study also considers bank stability to indicate individual bank distress because it threatens financial safety net of an entire banking system (Beck, Demirgüç-kunt, & Maksimovic, 2004). Also, several systematic banking distresses start with an individual bank distress (Beck, 2008) such as the failure of a large bank due to liquidity shortage spill-overs to the entire banking sector as the global banking system observed in the recent 2008-09 GFC.

In selecting appropriate measures of bank stability, this study reviews the recent literature measuring bank stability and comes up with a list of ten measures of bank stability[13] as provided in Table 2.1. Then, using factor analysis,[14] besides considering the economic relations of the measures, this study selects the right number of proxies for bank stability. The analysis produces three factors having the eigenvalue[15] of more than one which accounts for 60.23% of total variation in the bank stability. Anderson & Tatham (1986) suggested that about 60% variation is satisfactory in social science research. Factor 1 with an eigenvalue of 2.9495 explains 29.59% of the total variable, factor 2 with an eigenvalue of 1.7262 explains 17.26% of total variation and factor 3 with an eigenvalue of 1.33 explains 13.37% of total variation. To assist in the easy interpretation of the factors, the factors are rotated using varimax criteria for orthogonal rotation. Where, the orthogonal rotation enhances easy interpretation of the factor by reducing the number of variables with high loading on the factor (Malhotra, 2008). The Table 3.1 presents the factor matrix showing the factor loading of each variable under the three factors.

Table 3.1: Factor loading of the variables under consideration which indicate bank stability

Variable	Factor-1	Factor-2	Factor-3
Z-score based on return on average assets (ROAA)		**0.8792**	
Ratio of equity to total assets			**0.8734**
Ratio of Nonperforming loan to total assets	**0.8721**		
Ratio of loan loss reserve to gross loan	0.8537		
Z-score based on return on average equity (ROAE)		0.5204	
ROAA			0.8732
ROAE			
Standard deviation of ROAA			
Standard deviation of ROAE			
Risk-adjusted performance measure(ROA/SD)		0.8669	

Note: Bank represents the absolute value of factor loading is less than 0.50

13 Besides Z-score based on return on assets, ratio of equity to total assets, ratio of Non-performing loan to gross loan, other proxies of financial stability in the recent literature reported in table-2.1 include Z-score based on return on average equity, standard deviation of return on total assets, ratio of loan loss reserve to grass loan, standard deviation of return on total equity, capital adequacy ratio, risk adjusted return based on return on total equity and total assets.

14 Factor Analysis is a multivariate statistical technique which primarily used for data reduction and summarization by examining interdependent relationships among the variables (Malhotra, 2008).

15 Eigenvalue is the variance attributed to a particular factor which is considered as a criteria to extract the number of factors (Malhotra, 2008). The factor with eigenvalue of more than 1 is extracted as the variable with variance of less than one is no better than a single-variable. Because, each variable has a variance of one due to standardization.

Factor-1 is highly correlated with NPL ratio with factor loading 0.8721 and the ratio of loan loss reserve to a gross loan with factor loading 0.8537.[16] Factor-1 more strongly correlates with NPL ratio which induces to select only that ratio from factor-1 and discard the ratio of loan loss reserve to total assets. Factor-2 is highly correlated with Z-score based on ROAA with a factor loading of 0.8792, Z-score based on ROAE with a factor loading of 0.5204 and risk-adjusted performance measure with a factor loading of 0.8669. Since Factor-2 is more strongly correlates with Z-score based on ROAA, the study selects only that variable and removes the remaining two variables from the Factor-2. In respect to Factor-3, repeating the same criteria, the study selects Equity ratio with a highest factor loading of 0.8734 and eliminates ROAA with a factor loading of 0.8732. Thus, factor analysis reduces the bank stability variables to Z-score based on ROAA, NPL ratio and equity ratio which are mostly accounting-based measures.

i Z-score

It is considered as a universal measure of bank stability in the bank literature (Laeven & Levine, 2009; Beck et al., 2013; Soedarmono et al., 2013). The theoretical underpinning of Z-score is based on Roy (1952) which measures the distance of a bank from insolvency. Where, insolvency is a condition in which losses exceed equity such as $(-\pi>E)$, where π stands for profit and E stands for Equity. The probability of insolvency can be represented as Probability $(E/A < -ROA)$ where E/A stands for the ratio of equity to total asset, and ROA stands for return on total assets. The inverse of the probability of insolvency is $(ROA+E/A) / \delta(ROA)$ where $\delta(ROA)$ stands for the standard deviation of ROA. It combines the three important elements of financial performance indicators such as *ROA* which is widely used as a profitability proxy; volatility in *ROA* which is used as

[16] Factor loading indicates the level of magnitude of the relationship or correlation between a particular variable and the underling factor. Correlation value of 0.50 is important for showing the strong correlation between a variable and the underlying factor(Tai, 2005). Therefore, the study considers minimum factor loading as 0.50 in order to easy interpretation of the variables and underlying factor.

a risk measure and equity to assets ratio which is used as a reciprocal of equity multiplier or leverage. Thus, Z-score is defined as the inverse of the probability of insolvency, and it indicates the soundness of an individual bank. Z-score is calculated in the following way:

$$Z_{ijt} = \frac{ROA_{ijt} + E_{ijt}/TA_{ijt}}{\delta ROA_{ijt}} \qquad (3.3)$$

Where Z_{ijt} is a measure of the stability of i bank in j country at time t. ROA_{ijt} stands for return on assets of i bank in j country at t time; E_{ijt}/TA_{ijt} is a ratio of equity to total assets of i bank in j country at t time and δROA_{ijt} is a standard deviation of ROA_{ijt}. Following Beck et al. (2013) and Soedarmono et al. (2013), the study calculates δROA_{ijt} on the basis of the observation of δROA_{ijt} from time t to $t-2$ (a 3 year rolling window period instead of the full sample period) to calculate the standard deviation of ROA in order to allow the time variation in the risk estimate of Z-score. It makes possible to avoid the variation in Z-score within the banks over the passage of time resulting from the variation in the level of profitability and capital. Additionally, it avoids different window lengths for different banks in the calculation of the denominator of the Z-score due to the unbalanced nature of the data set. As Z-score is highly skewed (Laeven & Levine, 2009), this study considers the natural logarithm of the Z-score to make it normally distributed.

Z-score is interpreted as the number of standard deviations by which the return of a bank needs to fall below its mean to deplete its equity and make it insolvent. That is, the value of the Z-score indicates the distance of a bank from insolvency. The higher the value of the Z-score indicates a low probability of financial distress that a bank may suffer and higher the stability or financial soundness of the bank. The value of Z increases by increasing the level of profitability and capitalisation and falls with the increase in the earning volatility.

The study also uses two alternative measures of financial distress and risk taking, namely the NPL ratio and the equity ratio. These alternative risk measures are used to understand whether the change in financial soundness occurs due to a change in high risk-taking, or capitalisation. The franchise value theory of Keeley (1990) claims that capitalisation and risk-taking are oppositely related, arguing that the bank with high market power enjoy high opportunity to build-up capital buffer which stimulates banks to take less risk-taking. As risk has a cost of insolvency.

ii NPL ratio

It is a ratio of the nonperforming loan (NPL) to total assets computing a bank's credit risk or loan portfolio risk position. The previous studies that use NPL ratio to proxy credit risk or loan portfolio risk include Jiménez, Lopez, & Saurina Salas (2010), and Amidu & Wolfe (2013). This is because credit risk is the primary banking risk, and it' increases results in nonperforming loans in the bank's loan portfolio. A higher ratio indicates a bank's higher tendency to keep riskier loan portfolio, which undermines the banks' financial soundness. The NPL ratio is used here to observe the bank's risk-taking behaviour in the loan portfolio.

iii Equity ratio

It is a ratio of equity capital to total assets measuring capitalisation of a bank. It can also be used as an indicator of solvency of a bank as proposed by Schaeck & Cihak (2007) who argued that banks hold more equity capital than the minimum requirements in a competitive market to improve its solvency. Also, Berger et al. (2009) proposed using the ratio of equity to total assets as an indicator of risk taking behaviour, arguing that high capitalisation may offset the negative consequence of high loan portfolio risk of financial institutions. Further, the competition-fragility of Keeley (1990) claims that high market power induces banks to earn monopoly rents, which may be used as a capital buffer to increase capitalisation. Subsequently, a number of studies used equity ratio as a risk-taking indicator, such as in the work of Laeven & Levine (2009), Soedarmono et al. (2013) and Fang, Hasan, & Marton (2014). The higher capitalisation ratio may enhance bank stability by offsetting banks' risk-taking behaviour.

(b) *Explanatory variables*

The study considers competition as a main explanatory variable to investigate the relationship between bank competition and stability.

i ***Competition measures***

The competition level cannot be directly observed in a firm because of the involvement of some non-observable factors such as specific cost of firm's products, and firm's reaction in response to its competitor' actions (Tabak et al., 2012). Many methods are developed to estimate the level of competition which can be broadly categorised into the traditional industrial organisational or structural approach and new empirical industrial organisational (NEIO) or non-structural approach.

i ***Structural approach***

Traditional industrial organisational approaches or structural approaches are based on oligopoly theory or the Structure-Conduct-Performance (SCP) paradigm of Bain (1951). The structural approaches traditionally measure competition examining the market structure based on concentration ratio. Here, the concentration relates negatively to competition and indicates that banks face less competition in the concentrated market. In this connection, Bikker & Haaf (2002) showed that high level of concentration weakens competitiveness in the banking market, and a small number of large banks can limit competition. Further, Northcott (2004) found that high degree of concentration relates with high loan rate and low deposit rate, and gives the banks opportunity to earn monopoly rents without undermining credit supply as suggested by the market power hypothesis. Some studies argue that concentration provides ambiguous and misleading results, such as concentration exists in competitive market (Dell'Ariccia, 2000), both bank concentration and competition enhance stability and reduce the probability of banking crisis (Beck et al., 2006), and concentration is an inappropriate measure of competition (Beck, 2008; Berger et al., 2009; Liu et al., 2012). This is because, the concentration ratio, which is based on Structure-Conduct-Performance (SCP) paradigm, suffers from both conceptual and practical limitations(Beck et al., 2006). Under SCP paradigm, a rise in concentration is considered as rising collusive opportunities between banks which lead them to enjoy high market power and profitability. However, contestability theory of Baumol, Panzar, Willig, Bailey, Fischer, & Fischer,(1988) claims that a concentrated market can behave competitively if the barriers of entry and exist are lower. In this connection, Shaffer (2004) suggests that anti-competitive behavior of the bank is not the result of structure rather due to conduct or efficiency. Bernheim and Whinston (1990) also find that banks may also enjoy collusive opportunity in the presence of many firms. The weak applicability of the SCP paradigm in banking sector may be attributed to the different bank characteristics such as switching cost of retail borrowings, information asymmetries in corporate borrowings, and network externalities in the payment system Apergis, Fafaliou, & Polemis(2016).

Jiménez et al. (2013), Xu, Rixtel, & Leuvensteijn (2013), Anginer et al. (2014a), and Kasman & Kasman (2015) used concentration measures as a proxy of competition. Under the structural approach, the most frequently and popularly used concentration measures are Herfindahl-Hirschman Index (HHI) and large 'n' bank's concentration ratio (CRn) (Bikker & Haaf, 2002, Leon, 2014). As concentration measure, this study uses HHI following the work of Berger et al. (2009), this is because, it is calculated covering all banks in a particular market against CRn, where CRn considers only ‘n’ large banks are operating in a particular market.

Herfindahl-Hirschman Index (HHI)

HHI is calculated as a sum of the squares of the market share of each bank in a particular market. Though it can be calculated for a loan, deposit and total assets, this study calculates HHI for loan market, as credit creating institution banks faces more competition in the loan market. It is also known as the full information index because it considers the entire distribution of the bank size (Bikker & Haaf, 2002). HHI takes the following form:

$$HHI = \sum_{i=1}^{n} S_i^{\,2} \tag{3.4}$$

Where, S_i is the market share (S) of *i* banks in loan market. The HHI takes account of each bank in a market. It gives importance to the large banks by assigning more weight in compare to small banks, it considers each banks separately so that arbitrary cut-offs, and insensitivity to the distribution can be removed (Bikker & Haaf, 2002). The value of HHI ranges from 1/n to 1 indicating perfect competition to monopoly. That is, the value of HHI is the reciprocal of the number of the bank if the size of all banks is equal in the market, and unit if the market is in monopoly. In order to support the hypothesis 1, HHI is expected to effect negatively on Z-score and equity ratio; and positively on NPL ratio, because the HHI measures concentration which is reciprocal of competition.

ii ***Non-structural approach***

Unlike the structural measure of HHI which measures competition based on indirect proxies such as banks’ conduct or market structure, the non-structural measures estimate competition based on the direct proxies using the bank-specific data and assumption about the competitive behaviour of the bank. The commonly accepted and most efficient tool for measuring the level of competition under NEIO approach is Panzar-Rosse model (Bikker et al., 2012; Tabak et al., 2012; Moch, 2013; Sufian & Habibullah, 2013). The main benefits of using the Panzar-Rosse model are that it is based on a reduced form of revenue function, and the data availability of which are easier from banks' income statement (Moch, 2013). Also, it is easy to calculate the model without requiring any supplementary calculation rather than simply running only one reduced form revenue equation using a few bank-level variables and allowing for bank-specific differences used in the production process (Apergis et al., 2016). Also, Shaffer (2004) claimed that the Panzar-Rosse model is robust to the level as it does not necessitate a market to be recognised as a priori. The proponents of this model such as Bikker et. al. (2012) and Apergis et al. (2016) claimed that the validity of this model depends on the existence of long-run equilibrium condition in the market.

Panzar-Rosse H-statistic

Panzar and Rosse (1987) developed a general model for market structure popularly known as H-statistic. The H-statistic is based on the firm level reduced from revenue equation which satisfies the profit maximising condition of the firm. In theory, banks are considered as normal profit maximising firms and therefore follow the profit maximising rule where profit is maximised when marginal revenue and marginal costs are equal. Using a non-parametric notation, the relationship can be presented in the following way:

$$R_i'(y_i,\ q_i) = C_i'(y_i, w_i, t_i) \qquad (3.5)$$

R' and C' are the first-order differentiation of the bank i's revenue R_i and cost C_i functions. Where, y_i is the level of outputs, but could also include output prices, advertising costs, etc. which are decision variables that affect the bank's revenue and cost. w_i is the vector of input factor prices that are attributed to a given bank. q_i and t_i are exogenous shift variables in the revenue and cost functions, and may or may not contain the same variables.

In the case of competitive outcomes under either perfect competition or Chamberlinian equilibrium of monopolistic competition, the market sustains zero economic profit in equilibrium:

$$R_i^*(y_i^*, q_i) - C_i^*(y_i^*, w_i, t_i) = 0 \quad (3.6)$$

Where, the symbol (*) indicates the equilibrium level of each variable. The subscript of equation (3.6) are same as in equation (3.5) except the endogenous variable y_i^*, a reduced form revenue equation could be derived in terms of input factor prices and other exogenous variables only, that is, $R_i^*(w_i, q_i, t_i)$. The Panzer-Rosse H statistic is defined in a *'j'* input factors case, as the sum of the input factor price-elasticities of the reduced form revenue equation.

$$H = \sum_{j=1}^{J} \frac{\partial R_i^* w_{ij}}{\partial w_{ij} R_i^*} \quad (3.7)$$

The H-statistic measures the extent to which total revenue response to a change in input factor prices. According to the theorem and two propositions of Panzar-Rosse (1987), the H-statistic for a monopolist must be non-positive, implying that an increase in input factor prices will reduce bank's total revenue. The monopoly case is a very generalised result and requires nothing more than the profit maximising hypothesis. In systematic Chamberlinian equilibrium, the H-statistic is less than or equal to unity, indicating a reduction in revenue is less than proportion with the increases in input prices. The H-statistic equals to unity when the banking market is in long-run competitive equilibrium, implying bank's total revenue will increase the same amount as costs. Panzar-Rosse (1987) also attempted a model for oligopoly and shown that the H-statistic is negative. However, there is no evidence of generality, and in general, the relationship is indeterminate.

The Panzar-Rosse (1987) H-statistic is not only used to reject certain market types. It proves that, under the assumption of certain price elasticity of demand with a certain return to scale Cobb-Douglas production technology, the H-statistic for a monopoly is a negative function of the price elasticity of demand, *e*, and equal to *1- e*. Vesala (1995) proves that H-statistic is an increasing function of e in the case of monopolistic competition. As the number of bank increases, the demand elasticity increases till the perfect elastic bank facing demand curve of perfect competition reached. Therefore, the magnitude of H-statistic is also of great interest and could be used a measurement of competition. Table 3.2 summarises the corresponding market structure of each possible H-statistic.

Table 3.2: Interpretation of Panzar-Rosse H-statistic

Estimated H-statistic	Competition Condition
$H \leq 0$	Monopoly competition
$0<H<1$	Monopolistic competition
H=1	Perfect competition

i ***Estimation of empirical model of Panzar-Rosse H-statistic***

The Panzer-Rosse model is empirically examined by estimating a log-linear form reduced revenue function in terms of inputs factor prices and other exogenous variables. The study follows the methodology of Moch (2013) in modelling H-statistic, using the following reduced form revenue regression model:

$$lnP_{it} = \alpha + \beta_1 lnW1_{it} + \beta_2 lnW2_{it} + \beta_3 lnW3_{it} + \gamma_1 lnX1_{it} + \gamma_2 lnX2_{it} + \gamma_3 lnX3_{it} + \varepsilon_{it} \quad (3.8)$$

The subscript ln indicates the natural logarithm, i indicates bank, t indicates time, P_{it} is the measure of output price of the loan, which is calculated by dividing interest income to total assets following an intermediation approach, and ε_{it} is the error term. $W1_{it}$ is the ratio of interest expenses to total assets as a ratio of the price of borrowed funds, $W2_{it}$ is the ratio of personnel expenses to total assets as a measure of the price of labour, and $W3_{it}$ is the ratio of administrative and other operating expense to total assets as a measure of the price of fixed capital. Three bank specific control variables, $Y1_{it}$, $Y2_{it}$, and $Y3_{it}$, were added as the ratio of customer loan to total assets, the ratio of equity to total assets, and total assets in millions of USD, respectively, as these are expected to influence the bank's revenue function.

H-statistic are calculated as a sum of the elasticities of bank's total revenue, with respect to the above input prices, calculated as $H = \beta_1 + \beta_2 + \beta_3$. The H-statistic may take a value from -∞ to +1. A larger H-value indicates the change in input prices' greater influence on total revenue and more market competition. The value of H-statistic in perfect competition is equal to one, or that the proportion of the increase in input prices and total revenue is the same. This is because, the firm exits the market if it does not cover input prices. H-statistic under a monopoly take either a zero or negative value, which means that an increase in input prices reduces the bank's total revenue. Under monopolistic competition, it takes a value between zero and one. To support the hypothesis 1, H-statistic is expected to relate positively with both Z-score and equity ratio and negatively with NPL ratio. Because H-statistic measures competition directly and proportionately demonstrating that greater value of H-statistic indicates more competition in the market.

ii Equilibrium test for Panzar-Rosse H-statistic

The validity of Panzar-Rosse model and its H-statistic depend heavily on the market equilibrium assumption. The predicting power of H-statistic is only valid, especially for monopolistic and perfect competition type of market, when the market is in long-run equilibrium. This assumption can be tested empirically by estimating reduced profit equation. The idea of this test is that the rate of return (risk adjusted) on assets across banks should be equalised under the competitive pressure and no bank can make a supernormal return in equilibrium. Therefore, the rate of return should not be affected by changes in input prices, if the market is in long-run equilibrium. This test is usually based on an equation that replaces the dependent variable in equation (3.8) with risk-adjusted rate of return *(1+ROA)* following Bikker, and Haaf (2012) and Moch (2013) as follows:

$$ln(1 + ROA_{it}) = \alpha + \beta_1 lnW1_{it} + \beta_2 lnW2_{it} + \beta_3 lnW3_{it} + \gamma_1 lnX1_{it} + \gamma_2 lnX2_{it} + \gamma_3 lnX3_{it} + \varepsilon_{it} \quad (3.9)$$

where ROA_{it} is the bank's return on assets. However, the study considers risk-adjusted *ROA or 1+ROA*, instead of *ROA*. It is due to the fact that, if a bank makes losses, its *ROA* would be negative which creates a problem in transforming it to natural logarithm. In a long run equilibrium condition, $\beta_1 + \beta_2 + \beta_3 = 0$, indicating that input prices do not affect the bank's return on assets. However, $\beta_1 + \beta_2 + \beta_3 < 0$ indicates the market disequilibrium in which increases in input prices would lead to decreases in the bank's return on assets.

(c) *Control variables*

In investigating the relationship between bank competition and stability, the study finds that five bank specific variables and two macroeconomic variables influence the stability of banks and need to be taken into account. This bank specific and macroeconomic variables are controlled in this study through equation (3.1)

i ***Bank level control variables***

Bank level control variables include bank size, operational efficiency, loan composition, loan quality, and foreign ownership.

i ***Bank size***

Bank size is calculated in the bank literature as a natural logarithm of total assets. This study controls bank size, as it is expected to influence on the bank stability of banking institutions (Cubillas & González, 2014; Fang et al., 2014). In this connection, Tabak et al. (2012) suggested that large banks are more benefited from the competition, this may be due to the fact that large bank enjoys more market power in the competitive market and they also enjoy more opportunity to diversify their assets' portfolio risk than small banks. Alternatively, the larger a banking firm, the lower the information asymmetry that could lead to adverse decision making in their business and investment activities. Larger banks have more information that they could obtain either in-house or from external financial analysts. Thus, large banks can ensure their stable earning and do not have any incentive for taking an excess risk which makes them financially stable. Further, Schaeck & Čihák (2014) suggested that bank size enhances bank stability through efficiency channel arguing that large banks enjoy a low cost of production due to their high market power. Liu et al. (2012) suggested that the larger the banking firm, the greater the chances to increase risk-taking. This may be due to the fact that large banks may suffer from 'too-big-to-fail' or 'too-important-to-fail' problem in the concentrated market due to their inefficiencies in the present of government safety net subsidy or deposit insurance. In addition, large banks are systematically important banks in a concentrated market and their potential failure may spillover to the entire financial sector, and even whole economy in general, the government and policy makers are often bailout the large banks that are in difficulties. Thus, large banks may suffer from a moral hazard behaviour, because they might take excessive risk with knowledge that the authorities might came forward to bail out them in the case of difficulties. Thus, large banks may make the banking system fragile in the concentrated market. If 'too-big-to-fail' guarantees are present in the banking system of ASEAN-5, this study would expect that large banks to take more risks than smaller banks. On the other hand, if large banks enjoy more efficiency and diversification benefits, and less information asymmetry in a competitive market, this study expects large banks take less risk than small banks in ASEAN-5.

ii ***Operational efficiency***

The study also controls operational efficiency in investigating the nexus between bank competition and stability, as Schaeck & Čihák (2014) suggested that efficiency is the channel through which competition influences bank stability. Bank efficiency may influence on both competition and risk-taking behaviour of a bank. The 'quite life' hypothesis of Hicks (1935) suggests that lack of competition let managers enjoy more market power to earn monopoly rents instead of motivating them to work harder and give more effect to increase efficiency, as the incentive to increase efficiency is unavailable. As a result, managers prefer enjoying a life in a monopoly market instead of giving effect to reduce cost which increases inefficiency in the less competitive market. On the other hand, the 'efficient structure' hypothesis of Demsetz (1973) proposes that competition makes the firm efficient. Banking literature such as Schaeck and Čihák (2010) finds competition promotes both profit and cost efficiency, and Turk-Ariss (2010) also find competition promotes cost efficiency. In parallel, banks may adopt specialisation, bring adjustment in lending technology and emphasis on a particular group of borrowers in a competitive market which may lower their cost and time for loan screening, processing, monitoring and controlling (Zarutskie, 2013). As a result, a more efficient bank in the competitive market may adopt better screening, processing, monitoring and controlling procedure and consequently, the efficient banks may reduce their nonperforming loan and credit risk (Berger & Young, 1997). The empirical investigation evidences that less efficient banks expose to take high risk in their operations to improve performance and generate a high return (Boyd et al., 2006; Fiordelisi, Marques-Ibanez, & Molyneux, 2011).

To capture efficiency, this study follows Haan & Poghosyan (2012), Liu & Wilson (2013), Cubillas & González (2014) and Lee & Hsieh (2014) and considers the cost to income ratio as a proxy of operational efficiency, which is calculated as a percentage of non-interest operating cost to total revenue. A positive and higher value of cost to income ratio implies that the operating costs of a bank are increasing at faster rate than that of income or decreasing the income at a faster rate than that of operating cost, suggesting that the bank is operating inefficiently. Therefore, a positive and higher value of the ratio indicates inefficiency in operations and vice versa. Based on the above argument, this study expects a negative effect of cost to income ratio to bank stability, implying that high efficiency promotes bank stability in the competitive market.

iii ***Loan composition***

Loan composition is also known as a loan ratio which is calculated as a ratio of net loan to total assets. Loan composition indicates the size of intermediation, that is, what fraction of the total asset is used for creating a loan. The ratio is expected to affect bank stability negatively or defaults risk positively due to an increase of the probability of being default with increasing it is lending exposure (Liu & Wilson, 2013). The possible explanation would be the fact that a loan is considered as the main income generating asset of the banks and the ratio is expected to be higher to increase the profit level. Thus, loan composition is controlled in investigating the relationship between bank competition and stability following the works of Amidu & Wolfe (2013), Liu & Wilson (2013), Soedarmono et al. (2013) and Fang et al. (2014).

iv ***Loan quality***

Loan quality is calculated as a ratio of loan loss reserve to gross loan. It indicates a reserve for losses which is expressed as a percentage of the gross loan. It measures the extent of the gross loan which is provided for but not charges off. Banks require keeping more loan loss reserve with increasing the amount of nonperforming loan, which reduces both profitability and capitalisation (Basel Committee on Bank Supervision, 2009). As a result, it is used as a measure of loan quality or assets quality of a bank. Higher the value indicates poor quality of the banks' assets. Poor loan quality is expected to increase default risk or the probability of nonperforming loan. Thus, loan loss reserve is expected to affect bank stability negatively, as poor loan quality may make the banking system fragile. The study controls this ratio following the works of Laeven & Levine (2009), Tabak et al. (2012), Soedarmono et al. (2013), Fang et al. (2014) and Fu et al. (2014).

v *Foreign ownership*

Ownership structure plays an important role in the competition and risk-taking behaviour of the banking system (Mirzaei, Moore, & Liu, 2013). Ownership structure in the banking literature is classified into the foreign bank, and domestic bank in term of its effect on promoting competition and risk-taking through the channel of capitalisation and efficiency (Berger et al., 2009; Fang et al., 2014; Lee & Hsieh, 2014). In the presence of foreign banks, the banking market may become more competitive and more financially sound due to improving efficiency and increasing credit availability in the banking system. Foreign banks might employ more sophisticated and efficient risk management tools and a better internal auditing and control system (Fang et al., 2014). Similarly, foreign banks enjoy the better capacity to diversify their loan portfolio in different countries, and at the same time, they are less sensitive to the politically connected loan in the host country (Gormley, 2010). Also, the foreign banks are better capitalised and increase the supply of credit in the host country as they have an efficient and easy access to the international capital market (Levine, 1996). In recent studies such as Manlagñit (2011) and Mulyaningsih, Daly, & Miranti (2015), there is evidence that foreign banks are more efficient in lending operations and more competitive in loan market in Indonesia due to their lower overhead cost and lower loan rate. The presence of foreign banks may benefit local banks as well, because local banks may adopt better and efficient technology for auditing, risk minimisation tools and credit facility from foreign banks (Gormley, 2010). This study expects that foreign banks are better capitalised and financially sound, and they have fewer incentives to take more risk. To capture foreign ownership in examining the competition-bank stability nexus, this study uses a dummy variable which takes a value of 1, if the bank is a foreign bank holding more than 50% of share owned by foreigners. Otherwise, it takes a value of zero, considering the local bank holding 50%

or less ownership of the share by local entrepreneurs following the work of Berger et al. (2009).

ii ***Macroeconomic control variables***

Besides the bank-specific variables, the study also controls macroeconomic variables such as inflation and real GDP growth rate to address the potential omitted variable bias. Macroeconomic variables may also influence on the bank stability of a banking system.

i ***Real GDP growth rate***

The study includes real GDP growth rate in the analysis following Amidu & Wolfe (2013), Liu & Wilson (2013), Soedarmono et al. (2013), Fu et al. (2014) and Lee & Hsieh (2014); as it implies the fluctuations of economic activities or a movement in the business cycle which likely affects the performance of financial institutions in a country (Amidu & Wolfe, 2013, Liu & Wilson, 2013). Financial activities are pro-cyclical to the business cycle movement of a country. The financial institutions lend excessively during economic expansion and show scepticism during the contraction phase. During the economic expansion, when GDP is growing, the borrowers may earn better income which increases the capacity to repay their loans. This expected condition not only increases banks' profit margin but also decreases bad loan of the banks' balance sheet. As a result, banks require keeping less reserve against the bad loan which increases the capital position of the bank. This lending pattern may have implications for risk-taking tendency of a bank. Thus, real GDP growth rate is expected to affect the bank stability and equity positively and risk-taking negatively. Here, real GDP growth is calculated as the annual growth rate of real GDP.

ii ***Inflation rate***

Inflation rate has been used in many researches including Amidu & Wolfe (2013), Liu & Wilson (2013), Soedarmono et al. (2013), Cubillas & González (2014), Fang et al. (2014), and Lee & Hsieh (2014), as an indicator of macroeconomic instability due to its inverse consequences on the financial system and real economy. High inflation rate increases volatility in the price level, intensifies information asymmetry and distorts decision making of the bank (Liu & Wilson, 2013). Also, inflation reduces real wages of the borrowers when the wages are not adjusted with the inflation rate. This weakens the loan repayment capacity of the borrowers which increases nonperforming loan and leads banks to keep more reserve against the bad loan. A higher reserve against identified loss is not considered as a part of capital according to Basel II (Basel Committee on Bank Supervision, 2009). Hence, inflation is expected to affect bank risk-taking positively, and capitalisation and bank stability negatively. The study calculates inflation as the annual growth rate of the consumer price index (CPI) following the work of Amidu & Wolfe (2013).

3.2.2 Second Objective: Examine the moderating role of bank regulation on the relationship between bank competition and bank stability.

OECD (2010) and Fu et al. (2014) argued that the macroprudential regulation plays an important role in explaining the relationship between bank competition and stability. Bank regulation may effect bank stability (Berger, et al., 2009), and also the level of competition which subsequently affects on bank stability (Beck et al. 2013). Therefore, this thesis examine the moderating role of bank regulations on the relationship between bank competition and bank stability in the banking sector. To satisfy the mentioned objective this thesis also developed the following hypothesis:

Hypothesis 3: Bank regulation moderates the relationship between bank competition and bank stability.

3.2.2.1 Methodology: Econometric model specification to test hypothesis 3

In examining the role of bank regulation on the relationship between bank competition and stability, besides the persistent nature of banks in rents-seeking, the endogeneity problem may exist between bank regulation and stability. ASEAN-5 nations introduced liberalisation and deregulation in the early 1990s in order reap the efficiency gain of competition in the banking market which brought massive transformation in their risk-taking behaviour. It led to financial crisis during the 1997-98 period by increasing both credit boom and high nonperforming loan (Williams & Nguyen, 2005; Vithessonthi, 2014). In the aftermath of that crisis, the regulators responded to the financial crisis with different regulatory and supervisory initiatives which are reflected in the regulatory and supervisory indices, the level of bank competition and stability of banks in ASEAN-5. This study extends the dynamic model 2 to examine the role of regulation on the relationship between bank competition and stability in the following way:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.10)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.11)$$

This study designs the above two models with equations (3.10) and (3.11), because regulation may affect bank stability through the channel of competition, besides influencing bank stability independent of competition. As equations (3.10) and (3.11) are the extended version of equation (3.2), all dependent and explanatory variables of both equations (3.10) and (3.11) are the same as equation (3.2) except the vector "REG_{jt-1}" in equation (3.10) and the interaction term of competition and regulation "$REG_{jt-1} \times COM_{ijt}$" in equation (3.11). Here, $'REG'$ is the proxy of bank regulation comprises with capital regulation, activity restrictions, deposit insurance, and powerful official supervision. The vector "REG_{jt-1}" measures the effect of certain regulation on stability in independent of competition, or the effect of a certain regulation in less competitive environment in the market. In addition, the vector "$REG_{jt-1} \times COM_{ijt}$" measures interaction effect of a certain bank regulation and competition on bank stability indicating how a certain regulation effect on stability in the presence of more competition in the market. To control dynamics of bank regulation, the study takes the first lag of all regulation variables following Klompa & Haanb (2012), as there is a lag between any change in the regulation and its effect on competition and stability.

The study may find the following expected relationship of regulation, competition and stability for equation (3.10):

For the model where either Z-score or equity ratio is considered as the dependent variable (expect opposite for NPL ratio as the dependent variable):

1) If α_2>0 and $\alpha_4 > 0,$ and significant; then both competition and a certain regulation affects stability positively.

2) If α_2>0 and $\alpha_4 < 0,$ and significant, then bank competition affects stability positively, but, a certain regulation affects stability negatively.

3) If α_2<0 and $\alpha_4 > 0$, and significant, then, competition effect stability negatively, but, a certain regulation affects stability positively.

4) If α_2<0 and $\alpha_4 < 0,$ and significant, then both bank competition and a certain regulation affects stability negative.

The study may find the following expected relationship of regulation, competition and stability for equation (3.11):

For the model where either Z-score or equity ratio is considered as the dependent variable (expect oppositely for NPL ratio as the dependent variable):

1) If α_2>0, $\alpha_4 > 0$ and α_5>0 and significant; then competition affects stability positively, the regulation affects stability favourably if competition is less, and the regulation promotes stability in the presence of more competition, which support hypothesis 3.

2) If α_2>0, $\alpha_4 > 0$ and α_5<0 and significant, then competition affects stability positively, the regulation promotes stability if competition is less but, it affects stability adversely if competition is more, which support hypothesis 3.

3) If α_2>0, $\alpha_4 < 0$ and α_5>0 and significant, then, competition affects stability positively, the regulation affects stability negatively if competition is less, but it affects stability positively, if competition is more, which support hypothesis 3.

4) If α_2>0, $\alpha_4 < 0$ and α_5<0 and significant, then competition affects stability positively, the regulation affect stability negatively in both the case of less and more competition, which support hypothesis 3.

(a) *Measures of bank regulation*

To examine the role of bank regulation in shaping stability through the channel of competition, this study considers four macroprudential regulatory variables, namely capital regulation, activities restrictions, deposit insurance and powerful official supervision. Because, these variables remain in the central of the policy makers' agenda to promote stability and reduce risk-taking of banks. In addition, the Basel III framework, regulatory bodies and international organisations (such as World Bank, International Monetary Fund, Asian Development Bank) consider these regulatory variables as instruments for enhancing stability in the banking sector (Cubillas & González, 2014). Moreover, the 2008-09 global financial crisis highlighted the importance of these regulatory variables by rebooting a debate on designing these regulatory tools in the way of enhancing cooperation among the nations (OECD, 2010)

The study captures bank regulation, such as capital regulation, activity restrictions, deposit insurance and official supervision from the survey results of Barth et al. (2001) covering 1998-2000, Barth et al. (2006) covering 2001-2002 and Barth et al. (2008) covering 2003-2008, which are updated using the recent survey result of Barth, et al. (2013a) which covers 1999-2011. This is because bank regulation and supervision change slowly over the passage of time, and regulatory and supervisory data are only available at certain points of time.

i ***Capital requirements index***

Capital requirements are the mainstay of banking regulation which serve as a buffer against potential loss (Barth et al., 2013a; Repullo & Suarez, 2013). Capital regulation may affect banking stability positively. High capital requirements may induce the bank to function more prudently which reduces risk-taking and promote bank stability due to the 'capital-at-risk effect'(Hellmann et al., 2000; Repullo, 2004). This is because, when the capital requirements are imposed on the banks, banks' equity capital moves at risk, as the cost of defaults is adjusted with shareholders' equity. As a result, banks do not have the incentive to engage in risky lending or operations that could potentially push them to bankruptcy. Therefore, banks lend or invest prudently and also increase monitoring and controlling in investment process due to the equity-at-risk effect of capital requirements.

Capital regulation may influence bank stability through the channel of competition. Firstly, the capital requirements may serve as an entry barrier for the new entrants which allows the existing banks to increase market power which motivate them to take risk more prudently (Northcott, 2004). Secondly, high capital requirements, despite reduces market power by increasing the cost of capital and reducing the gross loan, it may also induce banks to set stricter loan granting criteria which in turn increases operational excellence and prudent risk-taking behaviour (Bolt & Tieman, 2004). Moreover, high capital requirements may induce banks to build a close relationship with the borrowers based on which banks can grant them the lower amount of loan in the highly regulated system. Therefore, this study expects that regulatory capital may promote bank stability by reducing the risk-taking incentives through the channel of competition.

This study adopts a capital requirements index showing capital stringency to understand the regulatory oversight of the capital in explaining the relationship between bank competition and stability from Anginer et al. (2014a) and Laeven & Levine (2009). This index incorporates both initial and overall capital stringency using the survey of Barth et al. (2001, 2006, 2008, 2013a), where initial capital stringency indicates whether certain source funds (such as assets other than cash and government securities and borrowed funds) may be considered as regulatory capital and whether these funds are officially verified by the regulatory or supervisory authority. The overall capital stringency shows whether a certain type of banking risk and certain type of market value losses are adjusted in determining the regulatory capital. The regulatory capital requirements do not measure statutory or regulatory requirements of bank capital. Rather, they measure the statutory approach to assess and verify the extent to which the capital of a bank is at risk. The regulatory capital index takes the value from 1 to 8, where a low value indicates less stringency of the capital requirements and a high value indicates greater stringency of the capital requirements. The construction of this index is explained detail in Appendix A.

ii Activity restrictions index

Activity restrictions are the regulatory restrictions on certain bank level activities such as insurance, securities and real estate or owning other non-bank financial institutions to prevent banks from risk-taking initiative in the absence of competition. As a result, these restrictions become main determinants of the scope of banks operation, the scope of diversification and earning charter value (Barth et al., 2001). In this connection, Barth et al. (2004) identified five theoretical factors to impose high restrictions on banking operations to reduce conflicts of interest, excessive risk exposure, difficulties to monitor and bring discipline and to increase competition and efficiency. The lack of restrictions allows banks to engage a broad range of activities which may increase conflicts of interest between banks and investors in securities underwritings, increase risk-taking incentives of the banks due to moral hazard effect, increase complexities in the banks which makes them difficult to monitor and disciple, and decreases the level of competition and efficiency.

However, the empirical literature such as Barth et al. (2001), Claessens & Laeven (2004), Barth et al. (2004), Barth et al. (2008), and Berger et al. (2009) show that activity restrictions have risk-taking effect on the banking system. The is due to the fact that the imposition of activity restrictions reduces the scope of operations, risk diversification, and scope of a financial conglomerate. In addition, restrictions increase competition on the loan market and reduce market power which influences banks' franchise value negatively and encourages banks to take more risk to increase profitability in a concentrated market. It may be due to the fact that banks tend to focus on traditional loan market and compensate the opportunity cost from other foregone business lines. As a result, in a concentrated market in less competition, the bank may focus on increasing profitability by lending to the risky borrowers. However, as activity restrictions increases competition in the market gradually, after a certain level of competition those activity restrictions may limit banks from taking excessive risk due to risk-shifting effect of Boyd & Nicolo (2005), because, borrowers' risk and banks' risk are perfectly correlated and risk is associated with the probability of bankruptcy. Also, if the restrictions are imposed to prevent banks from extending the risky line of business in the competitive market, this may also reduce banks' moral hazard of risk-taking. Thus, this study expects the effect of activities restrictions on bank stability may depend on the level of competition, and activity restrictions promotes bank stability through the channel of competition.

To capture activity restrictions, this study adopts an index from the works of Beck et al. (2006;2013) and using the survey of Barth et al. (2001, 2006, 2008, 2013a). The index may take maximum variation between the values from 4 to 16 to where a higher value indicates more restrictions on banking activities and owning and controlling non-bank firms. The construction of this index is explained in Appendix A.

iii ***Deposit insurance***

Deposit insurance is a common antidote in the banking system to reduce widespread occurrence of bank runs to protect the banking system from insolvency (Diamond & Dybvig, 1983). If depositors lose their confidence in the banking system, their attempt to withdraw their money from the banks at once, may render even solvent banks insolvent. Therefore, deposit insurance is required in the banking system to protect the payment system and increase the level of intermediation and ensure financial solvency of the banking system (Matutes & Vives, 2000).

With respect to the risk-taking effect of deposit insurance, Hellmann et al. (2000), Cordella & Yeyati (2002), Barth et al. (2004), and Martinez-Miera & Repullo (2010) showed that deposit insurance reduces risk-taking behaviour and enhances profitability and financial stability of the banking sector. In the presence of deposit insurance, depositors remain confident in the banking system which enable banks to borrow from depositors at a low rate which not only increases their charter value and but also give them low incentive to take excessive risk. Additionally, estimating the probability of a banking failure during the 2008-09 Global Financial Crisis, Anginer et al. (2014b) provided evidence that the countries that implemented explicit deposit insurance had low bank risk and were systematically stable.

However, deposit insurance may increase competition in loan markets by increasing the level of intermediation and more loanable funds. Deposit insurance provides a public safety net to the depositors which helps develop their confidence and motivates them to invest more in the bank. On the other hand, Keeley (1990), Demirgüç-Kunt & Detragiache (2002), Demirgüç-Kunt & Huizinga (2004), and Acharya (2009) argued that the presence of fixed rate deposit insurance depositors are protected by government safety net and they are less motivated to monitor bank operations. As such, deposit insurance may increase moral hazard of the banks to borrow at lower rate and lend it at higher rate while taking greater risk, which may offset the stabilisation benefits of the deposit insurance rendering the banking system fragile especially in competitive environments. Thus, this study expects the effect of deposit insurance on bank stability may depend on the level of competition.

To capture the deposit insurance coverage, the study considers a dummy variable for indicating the presence of deposit insurance in a country with the value zero and one; where, one refers to the existence of a deposit insurance scheme and otherwise, zero following the current literatures, for example, Fu et al. (2014), Anginer et al. (2014b). In order to construct the dummy variable, the study uses the surveys of Barth et al. (2001,2006, 2008, 2013a).

iv ***Supervisory power index***

The Bank of International Settlement (BIS) considers powerful supervision as part of pillar III of the Basel accords in order to foster private monitoring and brings discipline and governance in market and make the banking system stability. In addition, Levine (2003) claimed that official supervision may also increase competition in the market by improving corporate governance and level of financial intermediation. In this connection, Beck et al. (2006) argued that powerful official supervisors may not only increase moral hazard of the banks by influencing them to politically connected risky project due to their political biasness and private interest or 'private interest view', they may also concern the market failure due to their 'public interest view'. As a result, they may directly monitor and correct banks' risk-taking behaviour and bring them in discipline which may promote corporate governance and increase bank stability in the banking system. In this connection, Fogel, Morck & Yeung (2008) viewed government backed supervision may be a strong potent control mechanism of risk-taking behaviour of commercial banks in order to stabilise banking sector to support social and economic objective.

Barth et al. (2001, 2003, 2004) provided empirical support of risk-taking effect of official supervision, yet Agoroki et al. (2011) and Shehzad & Haan (2015) found that official supervision has a negative effect on risk-taking behaviour of the banks. The risk minimising effect of supervision may be due to efficiency gains of the banks in the competitive market, because Barth et al. (2013b) found evidence of efficiency enhancement effect of powerful supervisor who are independent and free from political biasness. It may also be attributed to profitability effect, because, Lee, Hsieh & Yang (2014) found strong evidence that official supervision increases profitability through revenue diversification. In a similar vein, Anginer et al. (2014a) and Lee & Hsieh (2014) found that powerful supervision reduces risk-taking behaviour and increases bank stability through risk diversification.

The effect of official supervision on bank stability may depend on government perception to achieve social and economic object of the country. To achieve the social and economic objective, if the government better protects the financial sector, and gives autonomy and freedom to supervisors to supervise and monitor the financial market without political and government biasness, then supervisors may be driven by public interest. In this circumstance, powerful official supervision positively affects competition and bank stability. In this connection, Zamorski and Lee (2015) reported that the governments of ASEAN countries desire to make the financial sector more protected in order to avoid social cost of market failure, and supervisors are concerned about market failure based on the experience of 1997-98 Asian Financial crisis. Therefore, this study may expect powerful official supervision may promote bank stability through the channel of competition.

The study adopts a supervisory power index from Anginer et al., (2014a) to capture the supervisory power of the regulators over the commercial bank. The index shows the supervisory authorities' power over bank director, management, shareholder and auditors to take preventive or corrective actions. The index is considered the supervisory power of the regulators and is expected to influence banking competition and bank stability. The index varies from 1 to 14 with a higher value indicating more powerful supervision of the bank regulators. The construction of supervisory power index is explained in Appendix A.

3.2.3 Third Objective: Examine the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector.

As Repullo and Suarez (2013) argued that the macro-prudent regulation restores bank stability or brings order in the banking system and reduces the likelihood of contagious bank runs during crisis period, these may also increase moral hazard of the banks and make the banking system vulnerable to the crisis during normal period. This thesis further examine the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank in the banking sector. In order to satisfy the above objective, the study further developed the following hypothesis.

Hypothesis 4: Financial crisis influences on the moderating role of bank regulation on the relationship between bank competition and bank regulation.

3.2.3.1 Methodology: Econometric model specification to test hypothesis 4

To test hypothesis 4, this study follows a three-step procedure. It firstly identifies the effect of financial crisis on the relationship between bank competition and stability. Next, it identifies the effect of regulation during financial crisis using an interaction term of regulation and crisis. Finally, the study investigates the effect of regulation through the channel of competition during financial crisis using an interaction term of regulation, competition and crisis, and compare that interaction term with the interaction term of regulation and crisis. This study extends the dynamic panel regression presented in equation (3.2) and forms the following equations (3.12), (3.13), and (3.14); where equation (3.12) identifies the effect of crisis on the relationship between bank competition and stability relationship by extending equation (3.2), equation (3.13) identifies the effect of banking regulation during crisis period on the relationship between bank competition and stability by extending equation (3.12), and equation (3.14) examines the effect of regulation on bank stability through the channel of competition during crisis by extending equation (3.13). The regression equation (3.12) to equation (3.14) are formulated in the following:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.12)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.13)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.14)$$

As equations (3.12) to (3.14) are extended from the equation (3.2), all the vectors of the equations are same except the vector *"$Crisis_t$"* in equation (3.12) to (3.14), "$Crisis_t \times REG_{jt-1}$" in equations (3.13) to (3.14), and "$REG_{jt-1} \times COM_{ijt} \times Crisis_t$" in equation (3.14).

The vector *"$Crisis_t$"* indicates financial crisis, and it is used in the equations (3.12) to (3.14) in order to identify the effect of financial crisis on bank stability. Financial crisis may affect bank stability negatively by exacerbating risk-taking behaviour of the banks, as it erodes franchise value, profit margin and equity capital of the banks and brings a disastrous effect on the banking system (Brownbridge & Kirkpatrick, 1999).

The vector "$Crisis_t \times REG_{jt-1}$" is an interaction term of regulation and crisis, and it is used in equations (3.13) to (3.14) to identify the effect of the regulation on bank stability during financial crisis. In response to the financial crisis, bank regulation and supervision are reformed, and banks are supported with public safety net subsidies in order to rebuild public trust and resort bank stability. In the same way, banks also adopt conservation approaches in order to avail competitive advantage by increasing capital buffer, reducing loan disbursement and comply with supervisors' guidelines. As a result, this variable may expect to increase bank stability and reduces risk-taking tendency.

Finally, the vector "$REG_{jt-1} \times COM_{ijt} \times Crisis_t$" is an interaction term of regulation, crisis and competition, and it is used in the equation (3.14) to identify the effect of bank regulation on bank stability through the channel of competition during financial crisis. As, banks lost profitability, capitalisation and franchise value during crisis, banks may face more competition in the market during crisis (Brownbridge & Kirkpatrick, 1999). In the presence of stringent regulation in response to that crisis, bank may behave conservatively in taking loan risk. This variable may expect to increase bank stability and reduce risk-taking tendency.

To capture financial crisis, following the work of Fu et al. (2014), this study constructs a dummy variable which takes the value 1, if the year is a crisis year; otherwise it takes value 0. As the commercial banks of the ASEAN-5 nations suffered from both the 1997-98 AFC and the 2008-09 GFC, the study considers 1997, 1998, 2008 and 2009 as crisis year following the works of (Nguyen et al., 2012a,b). Therefore, the crisis dummy takes a value of 1 for the year 1997, 1998, 2008 and 2009, and 0 for all other years from 1990 to 2014 excluding the crisis year. The regulation is captured with the aforementioned regulatory variables such as capital requirements index, activity restrictions index, deposit insurance and supervisory power index. Therefore, this study repeats equations (3.13) and (3.14) four times in order to capture all the four bank regulation, namely capital regulation, activity restrictions, deposit insurance and official supervision where in each equation competition is captured with H-statistic.

In the above equations (3.12) to (3.14), the sign of the coefficient α_4, α_5 and α_6 are examined. The variable α_4, α_5 and α_6 may have the following expected signs for either Z-score or equity ratio as dependent variable (opposite is expected for NPL ratio):

If $\alpha_4 < 0$,and significant in equations (3.12) to (3.14), indicate that financial crisis increases risk-taking behaviour and brings disastrous effect in the banking system, and support business cycle theory.

If $\alpha_5 < 0$, and significant in equations (3.13) and (3.14), indicate that bank the regulation (such as, capital regulation, activity restrictions, deposit insurance and official supervisor) exacerbates risk-taking behaviour of the banks during financial crisis, and support moral hazard effect.

If $\alpha_5 > 0$, and significant in equations (3.13) and (3.14), indicate that bank regulation (such as, capital regulation, activity restrictions, deposit insurance and official supervisor) reduces risk-taking behaviour of the banks during financial crisis, and support stabilisation effect of bank regulation.

If $\alpha_6 < 0$, and significant in equation (3.14), indicate that moral hazard effect of bank regulation (capital regulation, activity restrictions, deposit insurance and official supervisor) is channelled through the level of competition during financial crisis, support Hypothesis 4.

If $\alpha_6 > 0$, and significant in equation (3.14), indicate that stabilisation effect of bank regulation (capital regulation, activity restrictions, deposit insurance and official supervisor) is channelled through the level of competition during financial crisis, supports Hypothesis 4.

3.3 Estimation technique: Two-step system GMM

In examining the relationship between regulation, bank competition and stability this study formulates dynamic panel regression models presented in equations (3.1), (3.2), and (3.10) to (3.14) in order to deal with persistency of banks rents seeking and potential endogeneity between bank stability and main explanatory variables such as competition and bank regulation. The dynamic panel regression model is characterised by incorporating a lagged dependent variable as a regressor (Baltagi, 2009). In estimating the dynamic panel regression model, between Ordinary Least Square (OLS) and fixed effect, the FE is the preferred estimator as the OLS may be an inconsistent, invalid or bias estimator when some of the exogenous variables are associated with the unobserved heterogeneity effect (Baltagi, 2005). In addition, OLS ignores panel structure of the data, as a result it provides upward biased coefficient for the lagged dependent variable in the presence of unobserved heteroscedasticity (Bond, 2002, Roodman, 2009). On the other hand, despite fixed effect considers panel structure of the data, it does not consider correlation between lagged dependent variable and error term of the regression. As a result, it provides downward biased coefficient of the lagged dependent variable (Flannery and Hankins, 2013). In addition, fixed effect cannot capture the time invariant characteristics of the banks (Gujarati, 2008), such as bank ownership, bank regulation in certain extent which are included in the model of this study. In sum, although both OLS and fixed effect may capture persistent nature of banks in dynamic formulation, they provide serious econometric bias and inconsistent results due to the presence of the endogeneity problem or correlation between error term and lagged dependent variable (Hadad, Agusman, Monroe, Gasbarro, & Zumwalt, 2011).

To deal with such correlation between error term and lagged dependent variable or endogeneity problem, the model requires additional information incorporating instrumental variables, where, instrumental variables are uncorrelated with error term and correlated with exogenous variables and remain uninfluential to dependent variable (Wooldridge, 2015). To deal with instrumental variables to fix endogeneity problem OLS is augmented to Two Stage Lease Square (2SLS) method. Like OLS, 2SLS also fails to capture heteroscedasticity which is a common problem in cross country corporate data analysis due to cross country heterogeneity in corporations (Flannery & Hankins, 2013).

As a result, in the presence of heteroscedasticity, despite the coefficient estimates of the instrumental variables being consistent, the estimates of their standard errors are inconsistent which restrict making a valid interpretation, thereby making the estimators inefficient (Baltagi, 2008). Further, in the presence of heteroscedasticity, the diagnostic test result of endogeneity and the over identification restrictions of the instrumental variables would also be invalid (Berger et al., 2009). This type of estimation problem, due to the presence of heteroscedasticity, can be fixed by using Generalized Method of Moments (GMM) estimation with robust standard error (Hansen, 1982). The advantage of the GMM estimation is that it does not need the error terms' distributional assumptions, and it is more efficient than 2SLS because the GMM estimation addresses heteroscedasticity issue (Hall, 2005). The instrumental variables are the lagged variables among the regressors in the GMM estimation. It is unlikely that this lagged variable would be correlated with the unobserved heterogeneity effect, so the GMM can solve the endogeneity problem (Baltagi, 2008).

Arellano & Bond (1991) originated the standard GMM model, also known as first-differenced GMM. They applied the difference of each variable for both the dependent and explanatory variables in the regressions and introduced instrument variables from the lagged levels of the regressors. However, the lagged levels of the regressors could be a poor instrument if there is serial correlation in the errors. In this case, first difference GMM might result in imprecise or even biased estimators.

To overcome these shortcomings, the system GMM introduced by Arellano & Bover (1995) and Blundell & Bond (1998) developed the system GMM framework for searching efficient instrumental variables in order to use in dynamic panel model. The system GMM generates efficient estimators of the dynamic model particularly when the time period (T) is smaller than the number of groups (N). The system GMM estimators use the levels of equation to obtain a system of two equations—one in levels and one in differenced variables—as, by adding the second equation, supplementary instruments can be gained. Therefore, the variables in levels in the second equation are instrumented with their first differences, which are usually increasing efficiency.

Blundell & Bond (1998) demonstrated that the system GMM has smaller variances and is more efficient, thereby improving the precision in the estimation. Furthermore, it adjusts the biases of the time invariant estimates while the momentary condition ensures no correlation between the unobservable effect/time invariant effect/instrument variables particularly when the period is small. All in all, the dynamic panel addresses potential problems of endogeneity, heteroscedasticity and autocorrelation in the data.[17] Due to these benefits, this study opts to use two-step system GMM. In using the system GMM, Roodman (2006) suggests checking lagged dependent variable of system GMM estimates against the same lagged dependent variable calculated using dynamic OLS and dynamic fixed effect. Roodman (2006) argued that lagged dependent variable of GMM estimate must be within the lagged dependent values of dynamic OLS (provides maximum value) and dynamic fixed effect estimates (provides minimum value), in order to ensure system GMM provides efficient and accurate estimates.

Arellano & Bond (1991) by creation and supplementary assumption, indicated that the first differences of instrument variables are uncorrelated with the fixed effects. As a result, allowing the introduction of additional instruments is possible, which can considerably improve efficiency. The result is system GMM which constructs a set of two equations—the original, as well as the transformed one (Roodman, 2009). In addition, diagnostic tests, such as over identification and serial correlation tests, are applied to ensure there is no bias due to correlation with the error term.

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[17] Baltagi (2005) points up that the presence of a lagged dependent variable is a unique characteristic of a dynamic panel model

Above all, as pointed by Roodman (2006), the Arellano & Bond (1991) and Arellano & Bover (1995), Blundell & Bond (1998) dynamic panel estimates are becoming more popular. These estimators are typically applied in situations as featured by:

1) Number of period ‘T’ is small and number of group ‘N’ is large

2) The functional form of the relationship is linear

3) The dependent variable is dynamic on the basis of its previous realisations

4) All independent variables are not exogenous, some of them may correlate with error term

5) Autocorrelation and Heteroskedasticity may present within them, but not between them

6) Fixed individual effects

As all above mentioned situations prevail in this study which investigates the relationship between bank regulation, competition and stability in 180 commercial banks from ASEAN-5 countries over the period of 25 years starting from 1990 to 2014, the use of two step system GMM is more justified than other alternative methods. The number of year 24 is small and number of group 180 banks is large. The functional form of the relationship between bank competition and stability is linear. The dependent variable of this study is bank stability which is dynamic or persistent in nature. The explanatory variables such as competition and bank regulation may not be exogenous, they may correlate with error term. There may have heteroscedasticity among the banks size in ASEAN-5 countries due to their different stages of economic development (ADB, 2013), which may give rise to heteroscedasticity problem. As the five countries are considered time invariant, the fixed effect may present in error terms and may correlate with explanatory variable, competition and regulation. Moreover, as lagged dependent variable is included in the model to capture the dynamic of bank level data, it may give rise to autocorrelation problem in addition to endogeneity problems.

3.3.1 Instrumental variable

The study uses financial freedom and property right as additional instrument variables to address the potential endogeneity problem of the explanatory variables measuring competition and the banking regulation based on economic justifications following Berger et al. (2009) and Fu et al. (2014):

3.3.1.1 Financial freedom

It is an aggregated index of five indicators including government' financial service regulation, state ownership, financial market development, credit allocation and foreign participation in financial sector. Financial freedom measures the efficiency of the banking system as well as the freedom of the banking system from government intervention and control in the forms of banking regulation, credit allocation, deposit accumulation, types of financial services offering, dealing with foreign currencies, and foreign ownership in the banking system. It takes a score from 0 to 100 where, higher the score indicates less government intervention and more freedom which induces banks to improve efficiency and market power. Thus, financial freedom expects to influence the level of competition through influencing the market power of banks. Further, it reduces financial fragility of the bank through the channel of market power, as per franchise value theory of Keeley (1990), market power is negatively associated with risk-taking. However, greater financial freedom may also exacerbate the risk-taking attitude of the bank, especially if the existing bank regulation change banks' risk taking motivation. Thus, the study considers the index as instrumental variable in order to control endogeneity of market power and banking regulation with bank stability following Fu et al. (2014).

3.3.1.2 Property Right

Property right is an index that estimates an individual's ability to accumulate private property lawfully in a country. It determines the level to which private property right is protected by the laws and is enforceable by the government. The value ranges from 0 to

100. A higher score indicates stronger protection of property right of the individuals. The property right of a bank is expected to affect both bank competition and stability. This is due to the fact that property right encourages banks to innovate new products and services which helps them to capture the market share, and drives out the less efficient banks from the market. Thus, property right influences competition which renders the banks unstable through creative destruction as modelled by Schumpeter (1950). Therefore, the study uses the property right index following Amidu & Wolfe (2013) along with the financial freedom index developed by Heritage foundation[18] to control the endogeneity problem in the models.

3.3.2 Diagnostic test for system GMM estimation

This study uses a number of pre-diagnostic tests and post-diagnostic tests of GMM estimation, which are discussed in the following subjections.

3.3.2.1 Pre-diagnostic test for system GMM estimation

Before running system GMM, the presence of autocorrelation, heteroscedasticity, and endogeneity of the data set are tested applying Wooldridge test, Breush–Pagan/Cook-Weisberg test, and the Wu-Hausman test, respectively. In addition, this study uses First stage F-test in Two Stage Least Squares (2SLS) formulation to test whether instruments are valid in order to fix endogeneity problem of exogenous variables.

(a) *Autocorrelation problem*

Autocorrelation demonstrates correlation of a variable's current value with its lag values. The presence of autocorrelation in a panel data model biases its standard error and makes the estimates inefficient, which necessitate the researcher to identify and control autocorrelation involved to make the estimation less bias and more efficient (Drukker,

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[18] The Heritage Foundation is Washington based research and educational institution with the mission to formulate and promote conservative public policies based on the principles of free enterprise, limited government, individual freedom, traditional American values, and a strong national defense. It constructs indices for 184 countries such as financial freedom, property right, freedom from corruption etc. which is available at www.heritage.org/index

2003). To estimate autocorrelation, out of many methods available, this study applies thje Wooldridge test (2002) due to attractive features including requirement of relatively less assumptions, more flexibility, more robustness, and easy implementation (Drukker, 2003). The Wooldridge test uses residuals from the first differences of the regression model, which eliminates constant, individual effect and time invariant covariates. The test assumes null hypothesis as no first order autocorrelation. The rejection of null hypothesis indicates that the panel is suffering from autocorrelation problem.

(b) *Heteroscedasticity problem*

Lack of constant variance of the error term (homoscedasticity) of a data distribution is termed heteroscedasticity. Heteroscedasticity results from discrepancy of variable of interest in terms of its attributes, such as size, magnitude, which are very common in empirical data (Berger et al., 2009). The presence of heteroscedasticity violates the basic assumption of OLS. In addition, it biases standard errors which in turn bias test statistics and confidence interval that reduce efficiency of the estimates. This study uses the Breusch-Pagan/Cook-Weisberg test to identify heteroscedasticity, which is used to identify the linear form of heteroscedasticity. This tests the null hypothesis that variances of error are equal and constant, against alternative hypothesis that variances of error are a function of one or multiple variables. For this, the Breush-Pagan/Cook-Weisberg test Chi-square test are used. Rejection of the null hypothesis and the large value of Chi-square statistic indicate that heteroscedasticity is present in the panel data model, which needs to be corrected for efficient estimates.

(c) *Endogeneity problem*

Endogeneity problem arises in a regression model when one or more regressors is/are correlated with error term. This problem may arise due to omitted variable bias, reverse causality bias and measurement errors (Gujrati, 2008). In the presence of endogeneity problem, OLS fails to estimate the causal relationship between explanatory variables and dependent variable. To mitigate the bias due to endogeneity problem arising from any of the aforementioned three sources instrumental variables are incorporated in the model which are correlated to the endogenous variable and uncorrelated to the error term (Wooldridge, 2015).

To test whether the variable of interest of this study, competition is an endogenous variable, this study uses Durbin test and Wu-Hausman test following 2SLS estimates considering financial freedom and property right as instrumental variables of competition. Both the tests test null hypothesis that the variable indicating competition is an exogenous variable. The rejection of the null hypothesis indicates that competition is an endogenous variable and the regression model is suffering from an endogeneity problem between bank competition and stability. To test relevance of the instrumental variables this study further tests First Stage F-test which tests the null hypothesis that the instrumental variables are weak. The rejection of the null hypothesis indicates that the instrumental variables such as financial freedom and property right which are used to control endogeneity of competition are strong and relevant (Cubillas et al., 2014).

3.3.2.2 Post-diagnostic test for system GMM estimation

The estimates have to be validated before reporting the system GMM estimates. The validity of GMM estimates depends on the three conditions: (a) Instrumental validity (b) absence of second order serial correlation (c) Goodness of fit of the model. The post-diagnostic tests are explained in the following sub-sections:

(a) *Instrumental validity (Hansen's-J Test)*

One of the most crucial conditions of GMM estimates to be validated is that instruments are exogenous, that is, instruments are uncorrelated with the error term. Otherwise, identifying restrictions or the moment conditions will not be fulfilled, which are subject to increase with the increase of time (T). To validate the instruments to control endogeneity problem, overidentifying restrictions need to be as small as possible, or to be close to zero. To test validity of overidentifying restrictions, Hansen (1982) proposed a test commonly known as Hansen's-J test. The null hypothesis of this test is instruments are valid, exogenous, or uncorrelated with error term, and that excluded instruments are excluded from the equation. To validate the instruments and continue with GMM estimator, the null hypothesis should not be rejected. The rejection of the null hypothesis means that at least one of the instruments is invalid. To test the hypothesis, Hansen's J Test uses Chi-square statistic. However, as Roodman (2009) argued that despite instruments are valid individually based on Hansen's J test, the presence of too many instruments may invalidate the instrument collectively and bias the estimates, because they may over-fit endogenous variables. To correct this issue, Roodman (2009) suggests reducing the instrument's matrix width and use less instruments than the number of groups in the sample, where, in our case the number of group is 180.

(b) *Serial correlation in disturbance (Arellano-Bond Test)*

In addition to the instrumental validity by Hansen'J test, GMM estimates need to satisfy the conditions of first order and second order serial correlation in disturbance in order to check whether there are lags which invalid instruments. The Arellano & Bond test requires significant first order serial correlation. The other crucial condition that the test must satisfy is that absence of second order serial correlation (Beltagi, 2005). The existence of second order serial correlation implies that some lags invalidate the instruments which should be removed from the set of instruments. Arellano & Bond (1991) developed the M1 and M2 test to test first order and second order serial correlation in disturbance term respectively. The significant value of first order serial correlation (M1), and an insignificant value of second order serial correlation (M2) implies that the model is correctly specified and the GMM estimates are consistent. M1 and M2 test uses AR(1) and AR(2) statistic respectively.

(c) *The Goodness of fit (Wald Test)*

Another crucial condition that GMM estimates need to be satisfied for the goodness of fit of the model. The Wald test is used to test the goodness of fit of the model or data are consistent with a particular distribution. The Wald test demonstrates that the model fits the data distribution well. The null hypothesis of the Wald test is the coefficients of the model is simultaneously equal to zero. If the null hypothesis is not rejected, the variables of the GMM specification are not doing well in explaining the dependent variable. This test applies Chi-square statistic to test the null hypothesis.

3.4 Data and sample selection

The sample of the study consists of 223 commercial banks operating in ASEAN-5 nations which are considered as original members of ASEAN (Indonesia, Malaysia, Philippines, Singapore and Thailand) to examine the relationship of bank regulation, competition and stability. The study excludes Brunei, Cambodia, Laos, Myanmar and Vietnam for several reasons. Firstly, this study is looking for a unique banking market restructuring and deregulation in order to examine the nexus between bank regulation, competition and stability which are more prominent in ASEAN-5 countries. The banking industry of all of the ASEAN-5 nations suffered from considerable losses in the 1997-98 AFC and underwent a major banking reform and restructuring process aftermath of that crisis (Cook, 2008). Secondly, ASEAN implemented the ASEAN banking integration framework only in ASEAN-5 nations by 2020 at the first level as a part of AEC blueprint. The regional qualified banks are allowed to operate in all ASEAN-5 countries with the status of domestic bank (Yamanaka, 2014). This is due to the fact that the banking industry of ASEAN-5 becomes more regulated, efficient, competitive and sound comparing other member countries as a result of banking reform initiatives aftermath of 1997-98 AFC (Yamanaka, 2014). Besides, there is a big gap between ASEAN-5 and other members in ASEAN in term of banking credit, bank size, market capitalisation, banking infrastructure and stage of the banking sector development (ADB, 2013). Thirdly, the bank regulation of Brunei, Cambodia, Laos and Vietnam are missing in the survey made by Birth et al. (2001, 2006, 2008, 2013) who prepared and updated a database for bank regulation and supervision around the world. The other ASEAN countries except Vietnam are missing in the survey of Abiad, Detragiache, & Tressel (2008) who prepared a database of banking reform around the world. Moreover, the bank level data for calculating market power and stability are mostly missing for Myanmar in Bankscope database. For Myanmar, the number of bank year observations of the study period is only 28.

In order to ascertain the compatibility of regulatory requirements, the study focuses on only commercial banks of ASEAN-5 excluding other types of banks (such as, investment banks, saving banks and cooperative banks) and non-bank financial institution (such as, insurance, leasing etc.). This is because regulatory restrictions of commercial banks are different from other entities in the banking industry. The earlier studies of Asian banks such as Soedarmono et al. (2011; 2013), Liu et al. (2012), Nguyen et al. (2012b), Fu et al. (2014), Vithessonthi (2014), Mulyaningsih et al. (2015), Manlagñit (2015) and Chan et al. (2015) focused on commercial banks, as commercial banks account for 98.50% of financial assets in Indonesia, 88.00% in Malaysia, 88.63% in Philippines, and 70.82% in Thailand in 2010 (Barth et al., 2013a), 87.33% in Singapore (ADB, 2013). Moreover, commercial banks are expected to be more competitive than other types of banks because of additional exposure to competition from capital markets and foreign competitors (Leuvensteijn, Bikker, Rixtel, & Kok-Sørensen, 2007). Additionally, these banks tend to have more freedom in choosing their business mix, and face similar restrictions across countries.

The study covers a period from 1990 to 2014 in order to cover both the 1997-1998 AFC and the 2008-2009 GFC and the banking restructure and deregulation efforts in

ASEAN-5. The study period starts from 1990 in order to cover a few years before the 1997-1998 Asian financial crisis based on which ASEAN-5 adopted banking restructuring and deregulation strategies. Moreover, the data prior to 1990 are missing meaning that collecting data prior to 1990 is unfeasible. Particularly, the study considers a panel data approach to discern the changes in the bank observations over the period of 25 years starting from 1990 to 2014 to examine the nexus of the banking regulation, competition and stability in ASEAN-5 nations. The set of panel data are created considering the audited year-end income statement and balance sheet of the individual banks.

The study extracts the relevant data from the different sources presented in Appendix B. The bank level are extracted from the BankScope database, developed and distributed by Bureau Van Dijk-IBCA, to construct a sample of an annual, unbalanced panel from 1990 to 2014. The BankScope database is widely accepted and a resourceful financial database that contains around 30000 individual bank data around the world from early 1990s (Beger et al., 2005), Moreover, it provides data in a uniform currency of US dollar which provides assurance of accounting consistency among the countries in the study (Tabak et al., 2012). The study considers some restrictions in retrieving the bank level data from the BankScope database following the work of Soedarmono et al. (2013), and Chan et al. (2015), such as the banks are eliminated from the initial sample with less than three consecutive years' observations, as instead of full sample a three years rolling period is considered in estimating the standard deviations of ROA for calculating Z-score. Banks with high missing values in income statement variables used to calculate stability and competition using Panzar-Rosse H-statistic and also Lerner index which is used for robustness testing.

Table 3.3: Number of banks in the panel of annual series.

Country	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
1990	5	0	7	5	9	**26**
1991	6	0	7	5	9	**27**
1992	16	0	10	5	9	**40**
1993	21	4	11	6	9	**51**
1994	25	15	14	6	10	**70**
1995	25	20	16	8	11	**80**
1996	29	20	17	8	11	**85**
1997	46	21	21	9	14	**111**
1998	53	22	19	8	14	**116**
1999	57	22	21	7	15	**122**
2000	53	21	21	7	15	**117**
2001	50	21	20	6	15	**112**
2002	47	23	23	6	16	**115**
2003	49	24	24	7	16	**120**
2004	48	25	24	7	16	**120**
2005	45	17	22	9	17	**110**
2006	48	17	23	11	17	**116**
2007	48	17	21	13	18	**117**
2008	49	18	21	12	18	**118**
2009	51	19	21	13	18	**122**
2010	52	21	22	11	18	**124**
2011	49	27	22	6	17	**121**
2012	59	26	21	9	19	**134**
2013	59	25	21	9	19	**133**
2014	60	18	17	8	17	**120**
Total	**1050**	**443**	**466**	**201**	**367**	**2527**
No. of Banks	**84**	**32**	**27**	**16**	**21**	**180**

To avoid survivorship bias, the study included as many banks as possible considering also those which are not active during last 25 years. In acquisition and merger cases, the acquiring bank and target banks are considered individually as long as their data are reported individually. If the acquirer is a non-bank and un-consolidated data are not reported after the merger, the target bank is discarded from the sample following Nguyen et al. (2012b). The study excluded 43 banks due to the aforementioned restrictions in processing the retrieved data where four banks from Indonesia, 5 banks from Malaysia, 21 banks from Philippines, 10 banks from Singapore and three banks from Thailand. Thus, after eliminating the banks from our initial sample, the result is an unbalanced panel data from total 2527 observations at 180 commercial banks in ASEAN-5 nations; where, 1050 observations are collected from 84 commercial banks of Indonesia, 443 observation are collected from 32 commercial banks of Malaysia, 466 observations are collected from 27 commercial banks of the Philippines, 201 observations are collected from 16 commercial banks of Singapore and 367 observations are collected from 21 commercial banks of Thailand. The banks' distribution by year and country is listed in Table 3.3. The data which retrieved from Bankscope database are carefully verified with the individual bank's annual report.

Besides the Bankscope database, the study also uses annual report of individual banks, for some data which are missing in Bankscope. In addition, the study cross checks ownership information between Bankscope database and annual report of individual banks, because ownership is subject to change with the passage of time. The study considers regulatory variables such as capital regulation, activity restrictions, deposit insurance and official supervision in order to show the effect of bank regulation on the relationship between bank competition and bank stability. The data for the regulatory variables are collected from the World Bank regulation and supervision database,[19] developed by Barth et al. (2001) and updated by Barth et al. (2006), Barth et al. (2008) and Barth et al (2013a). As data are only available at certain points in time, information is used from the first, second, third and forth surveys to observe the 1998-2000, 2001-2003, 2003-2008, and 1999-2011 periods respectively. In addition, the study used a set of macroeconomic control variables such as inflation and GDP growth; and instrumental variable such as property right and financial freedom. The data relating to macroeconomic conditions is collected from the World Bank Development Indicator[20] (WB-DI). Meanwhile, the data for the instrumental variables are extracted from Heritage foundation

[19] Available at http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20345037~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html
[20] Available at http://data.worldbank.org/data-catalog/world-development-indicators

database.[21] The study uses STATA-13[22] econometrics data analysis tools to analyse the data as most comprehensive and widely used tool in analysing the relationship between the variables

3.5 Chapter summary

This chapter discussed the methodology used in this study to examine the relationship between bank regulation, competition and stability in ASEAN-5. It discussed methodology separately based on each of the three objectives of this study. This thesis formulates dynamic panel regression models to take account of dynamic nature of banks' stability and endogeneity problem of competition and bank regulation with stability, where the dynamic models are estimated using two-step system GMM considering financial freedom and property right as instrumental variable. In formulating dynamic models, this study uses a number of variables as presented in Appendix B, where bank stability is captured using Z-score, NPL ratio and equity ratio based both factor analysis and also theoretical consideration. Competition is captured using both most popularly used non-structural measure in bank literature, Panzar-Rosse H-statistic, and structural measure, HHI, and bank regulation is captured with capital requirements index, activity restrictions index, deposit insurance and supervisory power index using the survey results of Barth et al. (2001, 2006, 2008, 2013a). The models also consider a number of bank level and macroeconomic control variables. Finally, a summary of the research objectives and hypothesis statement is presented in Table 3.4, and a summary of the hypothesis statements and expected sign is presented in Table 3.5.

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[21] Available at http://www.heritage.org/index/heatmap
[22] As data management, data analysis and statistical softear, STATA is much convenient analysis tool for unbalance panel data. Because it is considered as more compete and integrated software package in compare to the alternative packages for statistical data, which provides every thing which are needed for data analsysis. data management and data graphics.

Table 3.4: Summary of research objectives and hypothesis statements.

Research Objective	Hypothesis Statement
Objective 1: To examine the influence of bank competition on bank stability in the banking sector.	H1: Bank competition promotes bank stability in the banking sector. H2: The relationship between bank competition and bank stability is non-linear
Objective 2: To examine the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector.	H3: Bank regulation moderates the relationship between bank competition and bank stability.
Objective 3: To examine the effect financial crisis on the moderating role of the regulation on the relationship between bank competition and bank stability in the banking sector.	H4: Financial crisis influences on the moderating role of bank regulation on the relationship between bank competition and bank stability.

Table 3.5: Summary of hypothesis statements and expected sign

Hypothesis Statement	Expected Sign
H1: Bank Competition promotes bank stability in the banking sector	If α_2>0 and significant for dependent variables Z-score and equity ratio, or, $\alpha_2 < 0$ and significant for dependent variable NPL ratio.
H2: The relationship between bank competition and bank stability is non-linear	If α_2>0 and α_3 <0 and significant, for the dependent variable Z-score and equity ratio, or, α_2 <0 and $\alpha_3 > 0$ and significant for dependent NPL ratio.
H3: Bank regulation moderates the relationship between bank competition and bank stability.	If α_2, α_4 and α_5 are significant for dependent variable Z-score and equity ratio, and opposite sign for NPL ratio.
H4: Financial crisis influences on the moderating role of bank regulation on the relationship between bank competition and bank stability	If α_2, α_5 and α_6 are significant for dependent variable Z-score and equity ratio, and opposite for NPL ratio.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the descriptive statistics of the variables, tests the hypotheses and discusses the empirical findings in line with the objectives of this study. Section 4.2 provides the descriptive statistics of the variables used measuring bank regulation, competition, stability, and also the control variables, and section 4.3 presents the correlation matrix of the variables to understand the bivariate relationship among the variables. Section 4.4 presents long run equilibrium test for H-statistic. Section 4.5 discusses the empirical results in the line of research objectives, followed by their respective robustness checking. The empirical results of the objective 1 with respect to the influence of bank competition on stability are discussed in section 4.5.1. The empirical results of objective 2 with respect to the moderating role of bank regulation on the relationship between bank competition and stability are discussed in section 4.5.2. The empirical results of objective 3 with respect to the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and stability is discussed in section 4.5.3. Finally, a summary of this chapter is presented in section 4.6.

4.2 Descriptive Statistics

In preparing the data before running the regression models, this study removes the extreme values of some variables that present high skewness in the distribution to eliminate the estimation errors. The study removes extreme 2.5% values of the variables that are right skewed or left skewed following the work of Soedarmono et al. (2013). However, such systematic removal may be of concern, despite being common in the literature. It may systematically remove vital information of a particular variable, especially in crisis periods. This study cautiously ensures that it removes only obvious extreme values due to data collection error. Thus, the study only cleans outliers of some variables such as NPL ratio, equity ratio, Z-score, loan composition, loan quality, operational efficiency and total assets.[23] For the NPL ratio and equity ratio, the study removes both their lowest and highest value, because the initially NPL ratio and equity ratio are ranged from -5.98 to 102.94 and from -139.214 to 103.64 respectively, which are not credible value in economic sense. The study cleans both 2.5% highest and 2.5% lowest value of both NPL ratio and equity ratio.[24] Regarding Z-score, loan quality, loan composition, operational efficiency, and total assets, this study only removes highest 2.5% value of the variables, because these variables are rightly skewed in their distributions.[25]

The regional descriptive statistics of the variables such as bank regulation, competition, stability and control variables of this study are presented in Table 4.1. A country-wise-summary of the descriptive statistics is presented in Table 4.2 for comparison purposes. The first parts of Tables 4.1 and 4.2 report the variables used for estimating the H-statistic. This includes of input prices (such as price of fund, labour and capital), output prices (such as price of loan or output). These are also used to represent the state of the development of the banking markets in ASEAN-5, such as the banking markets of Singapore, Thailand and Malaysia are larger and more developed based on the average value of total assets, input and output factor prices in compare to that of Indonesia and Philippines. The average total assets of Singaporean, Thailand and Malaysian banks are $US 37,623.621 million, $US14,700.232 million, and $US10,092.55 million, respectively. On the other hand, the average value of total assets of Indonesian banks is $US 3439.636 million, and that of the Philippines banks is $US 1353.12 million which are even lower than the regional average of $US8810.27.

[23] Where, loan composition is a ratio of net loan to total assets, loan quality is a ratio of loan loss reserve to total assets, operational efficiency is a cost to income ratio.
[24] In data cleaning the study applies different cut off point in order to ensure robustness of the results. Such as the study removes 1% extreme value instead of 2.5 %. However, the results remain unaltered.
[25] The study also use 1% highest value instead of 2.5%, the results remain unaltered.

Table 4.1: Descriptive Statistics of ASEAN-5

Variables	Average	Stand. Dev.	Maximum	Median	Minimum
Input and Output Variables					
Price of Fund	.057	.058	.761	.043	.001
Price of Labour	.011	.011	.166	.009	0
Price of Capital	.014	.014	.209	.012	-.001
Price of Output	.079	.049	.502	.072	0
Dependent Variables: Bank stability Measures					
Z-score	76.635	163.721	3544.12	39.464	-8.822
NPL Ratio	8.578	9.6012	62.550	4.576	0.03
Equity Ratio	12.563	9.983	56.147	10.569	.09
Variables Measuring Competition					
H-Statistic	.550	.285	1.497	.567	-.475
HHI in Loan	.130	.058	.454	.119	.076
Variables Measuring Banking Regulation					
Capital Requirements Index	5.176	1.436	7	6	3
Activity Restrictions Index	11.050	2.199	15	11	8
Deposit Insurance	.697	.459	1	1	0
Supervisory Power Index	11.841	1.102	13	12	10
Bank Specific Control Variable					
Loan Composition	55.248	19.821	99.700	59.150	0
Bank Size	7.472	1.922	12.669	7.475	.617
Loan Quality	6.092	9.756	92.444	3.103	0
Foreign Ownership	.340	.474	1	0	0
Operational Efficiency	59.901	48.792	873.580	52.227	.662
Macroeconomic Control Variable					
Inflation Rate	6.575	8.512	58.387	5.047	-.846
GDP Growth Rate	4.677	3.957	15.240	5.317	-13.127
Observations			2527		

This table presents descriptive statistics of the variables for ASEAN-5 region including mean, standard deviation, maximum, median and minimum value. ASEAN-5 includes Indonesia, Malaysia, the Philippines, Singapore and Thailand. Price of fund is the ratio of interest expenses to total assets, price of labor is the ratio of personnel expenses to total assets, price of capital is the ratio of administrative and other operating expenses to total assets, price of output is ratio of interest income to total assets. The input and output variables are used to calculate H-statistic. Other variables and data sources are defined in Appendix B

The larger size of total assets of the Singaporean, Thailand and Malaysian banks may be attributed to the higher rate consolidation and resulting from the higher concentration in the banking market as a result post-AFC crisis bank restructuring drives. The number of mergers in Malaysia, Thailand and Singapore during 2001-2012 are 17, 14 and 12 respectively against five mergers in Indonesia and four mergers in the Philippines (Rao-Nicholson, Salaber, & Cao, 2016). The resulting average concentration ratio of the large five banks in total assets becomes 0.97, 0.83 and 0.71 in Singapore, Malaysia and Thailand against 0.70 in the Philippines and 0.68 in Indonesia during 1999-2014 (Khan et al., 2016).

Table 4.2: Country-wise Descriptive Statistics

	Indonesia	Malaysia	Philippines	Singapore	Thailand
Input And Output Variables					
Price of Fund	.078(.082)	.033(.025)	.058(.040)	.026(.021)	.044(.041)
Price of Labour	.015(.010)	.006(.003)	.016(.016)	.015(.121)	.009(.005)
Price of Capital	.016(.017)	.006(0.00)	.024(.019)	.009(.050)	.014(.008)
Price of Output	.110(.059)	.049(.022)	.075(.039)	.036(.021)	.063(.029)
Dependent Variables: Bank stability Measures					
Z-score	65.18(147.16)	71.57(119.19)	101.75(232.6)	113.621(139.302)	63.341(155.60)
NPL ratio	7.648(10.587)	5.888(7.903)	11.277(13.628)	3.437(3.121)	11.206(10.284)
Equity ratio	9.79(14.859)	10.851(6.992)	14.674(8.413)	18.774(17.598)	10.752(10.269)
Explanatory Variables: Measures Of Competition					
H-Statistic	.696(.183)	.500(.228)	.478(.320)	.321(.359)	.598(.370)
HHI for loan	.098(0.025)	.134(.037)	.125(.013)	.304(.014)	.129(.027)
Explanatory Variables: Banking Regulation					
CapitalRequirements Index	5.23(1.495)	4.557(1.501)	4.656(1.393)	5.632(.484)	5.057(.999)
Activity Restrictions Index	8.918(.997)	13.327(.469)	13 (0)	10(0)	12.501(1.837)
Deposit Insurance	1(0)	.5192(.500)	.648(.478)	.537(.499)	.196 (.398)
Supervisory Power Index	10.541(.499)	12.038(1.000)	11.504(.500)	11.895(1.451)	10(0)
Bank Specific Control Variables					
Loan Composition	56.01(18.894)	51.057(21.026)	46.795(15.602)	52.549(23.489)	70.337(14.185)
Bank Size	6.636(1.776)	8.152(1.512)	7.200(1.571)	8.606(2.360)	8.766 (1.572)
Loan Quality	6.655(11.245)	4.242(4.216)	7.384(12.173)	2.938(3.323)	6.155(7.247)
Foreign Ownership	.345(.475)	.339(.474)	.320(.467)	.388(.488)	.327(.469)
Operational Efficiency	60.809(51.33)	40.473(25.528)	71.625(47.595)	51.125(24.835)	70.899(64.029)
Macroeconomic Control Variables					
GDP Growth Rate	4.429(4.323)	5.350(3.822)	4.459(2.114)	6.196(4.251)	4.023(4.341)
Inflation Rate	10.739(11.66)	2.565(1.237)	5.539(2.802)	2.031(1.734)	3.300(2.075)
Observations	1050	441	466	201	367

This table presents county-wise descriptive statistics of the variables for Indonesia, Malaysia, the Philippines, Singapore and Thailand including mean and standard deviation. Price of fund is the ratio of interest expenses to total assets, price of labour is the ratio of personnel expenses to total assets, price of capital is the ratio of administrative and other operating expenses to total assets, price of output is ratio of interest income to total assets. The input and output variables are used to calculate H-statistic. Other variables and data sources are defined in Appendix B. The values in the parenthesis are showing standard deviation.

In a similar vein, the banks from Singapore, Malaysia and Thailand enjoy lower input factors prices than other member states in the region such as Indonesia and the Philippines. For example, the price of fund is lower in Singapore (0.026) and Malaysia (0.033) followed by Thailand (0.044) and it is higher in the Philippines (0.058) and Indonesia (0.078). Likewise, the price of capital is lower in Malaysia (0.006), Singapore (0.009) followed by Thailand (0.014) and it is higher in Indonesia (0.016) and the Philippines (0.024). Similarly, the price of labour is lower in Malaysia (0.006) and Thailand (0.009) and it is higher in Indonesia (0.015) and the Philippines (0.016). The stage of development of the banking market of Singapore, Malaysia and Thailand is also reflected in the lower average of output prices in the region with the value of 0.036, 0.049, 0.063 respectively against the

Philippines (0.075) and Indonesia (0.110). The low input prices and output prices in Singapore, Malaysia and Thailand is attributed to the high efficiency gain due to adaptation of high consolidation strategy. Rao-Nicholson et al. (2016) argued that consolidation improves performance of the banks due to gain in economics of scale and scope (Pangarkar & Lim, 2003) and synergistic effect (Larsson & Finkelstein, 1999). In addition, Banna, Noman, & Syed (2014) found the average technical efficiency score of Singaporean, Malaysian and Thai commercial banks is 0.86, 0.73 and 0.71 respectively against that of 0.50 and 0.49 of Indonesian and Philippine banks respectively during the 2004 to 2013 period.

The tables also demonstrate the state of Bank stability of the region with average value of Z-score, NPL ratio, equity ratio. Table 4.1 exhibits that the average Z-score of ASEAN-5 is 76.6352, NPL ratio is 8.052 and equity ratio is 13.292. These suggest that the banking system of ASEAN-5 is fairly sound, and financially stable with lower NPL loan and higher capitalisation due the adaptation of stringent banking regulatory reform strategies in the form of capital regulation, deposit insurance and official supervision, especially aftermath of the 1997-98 AFC. Table 4.2 further demonstrates that the most financially stable banks in the region come from Singapore with higher average Z-score of 113.621 and the least financially stable banks come from Thailand with lower average Z-score of 63.341. The higher Bank stability of Singaporean banks in the region could be a result of the lowest NPL ratio (3.437 %) and highest equity ratio (18.774) in the region. Berger et al. (2009) argued that high capitalisation may be used as a risk management strategy to reduce credit risk and insolvency risk. In addition, more stringent regulation and supervision over the Singaporean commercial banks could also be the reason of greater Bank stability in Singapore, where the commercial banks in Singapore are required to maintain a minimum of 12.5% risk weighted capital which is 2% more than the Basel III accord of 10.5% (BIS, 2014), and also the single bank supervisor in Singapore is more powerful to execute on-site examination of banking operations of the commercial banks, even Singapore introduces first consolidated supervision in the region to allow all foreign subsidiaries of local banks and the parent supervisor of foreign banks to monitor the foreign banks in Singapore upon approval of the Monitory Authority of Singapore, where, commercial banks are required to establish risk management control systems complying with the nature of business (Monetary Authority of Singapore; 2016).

On the other hand, the high fragility in Thai banking sector could be the result of comparatively high NPL ratio (11.206 %) indicating more credit risk and low equity ratio indicating less bank capitalisation (10.752%). Additionally, the single Thai bank supervisor is also less powerful to execute on-site examination of bank operations while it is only legally liable for its actions in the region (Lee & Park, 2009). Further, the activity restrictions over the Thai commercial banks are also very stringent where commercial banks are prohibited to involve in securities transactions, and restricted to the expand business lines in insurance, real estates and also owning non-financial firm (Lee & Park, 2009).

Next, the market structure measures such as H-statistic, and HHI are reported to explain the level of competition and concentration in the region. Table 4.1 demonstrates that average the level of competition in the region as measured by H-statistic is 0.5503 which is similar to 0.53 of Liu et al. (2012). This implies that the commercial banks of ASEAN-5 face monopolistic competition and do not necessarily face acute competition in the banking market, because ASEAN banks especially Indonesia, Malaysia, Philippines and Thailand are extremely regulated by their respective central bank as a result of the adaptation of the post-AFC banking restructuring strategies, where commercial banks enjoy limited power to set or influence on loan prices (Chan et al., 2015). In addition, the loan concentration of ASEAN-5 based on HHI, on the other hand, is 0.1304, which is similar to 0.16 (HHI) of Khan et al. (2016). The greater degree of concentration in ASEAN banks may be attributed to the high degree of consolidation where ASEAN experienced the second largest consolidation which accounted for 25% every year until 2003 (Soedarmono et al., 2013). However, the region is divergent in terms of the level of concentration due to divergence in market structure and stage of the banking sector development (Asian Development Bank, 2013), and institutional framework including regulatory quality (Chan et al., 2015). Among the ASEAN-5 in Table 4.2, high concentration is found in Singapore (0.304), followed by Malaysia (0.134) and the low loan concentration is observed in Indonesia (0.098) followed by the Philippines (0.125).

Table 4.2 shows that Indonesian banks face maximum competition in the region with highest H-statistic (0.696) following Thai banks with H-statistic (0.598). The reason for the high banking sector competition in Indonesia may be the result of least concentration with lowest value of HHI (0.098) resulting from the less number of consolidation deals (5) accompanying on 7% of all deals in the region in during 2001-2012 (Rao-Nicholson et al., 2016). The highest competition in the Indonesian banking sector may also be attributed to the maximum liberalisation of the activity restrictions reflected in lowest activity restriction index (8.918) in the region. On the other hand, Singaporean banks faces minimum competition in the region with H-value of 0.321 following the Philippines with H-value of 0.478. The least competition in the Singaporean banking market may be attributed to the highest concentration with maximum value of HHI (0.304) resulting from high degree of consolidation where only five domestic commercial banks owned by three groups of industries are operating in the end of the year 2012[26].

[26] http://www.singapore-window.org/sw02/021121s2.htm

The tables also present the descriptive statistics of the bank regulation in terms of regulatory environment, the commercial banks of ASEAN-5 nations in Table 4.1 faces high regulatory restrictions in controlling the market power with objective to create the banking industry financially stable. The activity restrictions index of commercial banks is 11.0503 on a scale of 16, which is similar to the score of 11.71 of Nguyen et al. (2012a) and 10. 84 of Fu et al. (2014), capital requirements index is 5.17 on scale of 8 which is similar to 5.04 of Barth, et al. (2013a), deposit insurance is 0.6972 on scale of 1.0 which is also similar to 0.86 of Fu et al. (2014), and supervisory power index is 11.8413 on a scale of 14 which is similar to the score 11.63 of Manlagñit (2015). Table 4.2 demonstrates that among the ASEAN-5, in terms of activity restrictions, banks from Malaysia (13.327) face greater restrictions to engage in insurance and other non-bank activities, and banks from Indonesia (8.891) face less restrictions for such activities. These results are the indications of most liberalised Indonesian banking and least liberalised Malaysian banks in the region which could cause the more competition in Indonesia and less competition in Malaysia. In case of capital requirements, banks from Singapore (5.632) face most stricter capital requirements, on the contrary, banks from Malaysia (4.557) enjoys least stricter capital requirements in the region. The highest capital requirements make Singaporean banks most efficient in loan portfolio risk management in the region which is reflected in their Bank stability in term of lowest credit risk measured with NPL ratio (3.437) and highest financial solvency measured with Z-score (113.621) and capitalisation measured with equity ratio (18.774).

Table 4.2 further demonstrates that Indonesian banks faces most explicit deposit insurance reflexed in the highest score in dummy variable of 1.0; and Thai banks face the least explicit deposit insurance in the region. The most explicit deposit insurance score in Indonesia and least explicit deposit insurance score in Thailand is the result of time of inception of the formal explicit deposit insurance in the banking industry. The bank regulation and supervision survey of Barth et al. (2001) which covered 1998-2000 includes only Indonesia as a country where explicate deposit insurance is introduced. Explicit deposit insurance was introduced in Thailand in 2011 (Barth et al., 2013a). The explicit deposit insurance may cause Indonesian banks to increase government safety net subsidies and depositors' confidence in the banking system which are reflected in higher levels of intermediation measured with higher loan ratio (56.01%) to become the most competitive banking market measured with H-statistic (.696) in the region.

Turning to official supervision, the most stringent official supervisor comes from Malaysia with the highest score in stringent supervisory power index of 12.038 in Table 4.2. The least stringent official supervisor comes from Thailand with the lowest score in stringent supervisory index of 10.0 in the region. These results suggest that the supervision of Malaysian banks is more powerful to monitor and control the risk taking operations of the commercial banks in Malaysia. Malaysian banks face lower credit risk measure with NPL ratio (5.888), and higher financial solvency measured with Z-score (71.57) despite holding lowest score in capital stringent index (4.557). Despite a few divergences observed among ASEAN-5 countries with respect to the regulatory framework, the governor of the central banks of ASEAN-5 endorsed ABIF in 2011, and as a precondition of that the member states started to bring harmonisation in banking regulation. Such as, all member nations introduced deposit insurance and adopted Basel III accords in order to enhance risk management capacity, market discipline and Bank stability.

In term of bank characteristics, Tables 4.1 and 4.2 show that the primary banks that originated from Singapore and Thailand following Malaysia, and regionally, smaller banks come from Indonesia and the Philippines, having a higher average of total assets. However, the level of intermediation, captured with the ratio of net loan to total assets, is at its maximum in Thailand (70.37), followed by Indonesia (56.005) and Singapore (52.549), and less in Malaysia (51.057) and the Philippines (51.057). More efficiency in banking operations, based on the cost to income ratio, comes from Malaysian banks (40.473), followed by Singapore (51.125) and Indonesia (60.809). High assets quality in lending operations, based on loan loss reserve to gross loan, come from Singaporean banks (2.938), followed by Malaysian Banks (4.242) and Thailand banks (6.155), and lower assets quality come from the banks from the Philippines (7.384), followed by Indonesia (6.636). Foreign penetration, measured with foreign ownership dummy, is high in Singapore (0.388) followed by Indonesia (0.345). This indicates foreign banks enjoy less restrictions and more banking friendly environment in Singapore which make it the region's banking hub.

Tables 4.1 and 4.2 also depict descriptive statistics of regional and country-wise macroeconomic conditions of ASEAN-5 capturing annual inflation rate and real GDP growth rate. These variables are used in our models to control macroeconomic conditions in the relationship between bank regulation, competition, and stability. The country-wise data on annual inflation rate and GDP growth rate show that ASEAN-5 are not resemble in terms of macroeconomic conditions. Despite the countries like Singapore, and Malaysia have dynamic and satisfactory economic conditions with higher GDP growth rate and lower inflation rate, the countries like Indonesia and The Philippines are more economically vulnerable due to high inflation and lower GDP growth rate. These macroeconomic variables may influence the bank stability in their respective banking system.

Table 4.3 describes the level of bank competition and stability in the banking system of ASEAN-5 on annual basis from 1990 to 2014, where competition is captured with H-statistic and concentration ratio HHI, and bank stability is captured with natural logarithm of Z-score, NPL ratio and Equity ratio. Figure 4.1 depicts ASEAN-5's the natural log of

Z-score and H-statistic for the same period, to better understand the nature of the competition-stability nexus. The figure demonstrates that the *ln*Z-score moves cyclically with H-statistic across the years. A sharp decline in the Z-score's log is observed during the AFC in 1997-1998. After this event, it increases, albeit with some fluctuations. The same trend is also observed in H-statistic, demonstrating that the overall banking risk was sharply increased in the region during the AFC due to sharp decline in level of competition.

Table 4.3: Yearly average measures of bank competition and stability for ASEAN-5 from 1990 to 2014.

Year	H-statistic	HHI(Loan)	Z-score	NPL Ratio	Equity Ratio	Observations
1990	.229	.218	52.687	5.055	10.190	22
1991	.577	.215	40.483	5.538	10.181	26
1992	.721	.201	92.551	5.451	11.571	40
1993	.754	.198	59.355	5.674	11.292	50
1994	.859	.159	64.266	4.942	11.172	69
1995	.704	.154	111.143	5.221	12.805	78
1996	.676	.143	128.156	6.347	13.887	82
1997	.545	.138	58.270	11.145	13.839	109
1998	.239	.141	23.930	20.423	5.564	96
1999	.314	.138	29.037	21.11	7.262	102
2000	.379	.122	28.298	16.606	12.328	109
2001	.364	.121	46.576	15.285	11.849	106
2002	.451	.119	78.307	13.16	14.178	110
2003	.410	.118	64.413	10.65	14.228	117
2004	.479	.116	71.511	9.43	14.097	118
2005	.575	.129	97.366	7.326	14.709	108
2006	.384	.123	76.636	6.753	14.490	116
2007	.506	.123	76.614	4.804	13.934	117
2008	.670	.124	89.361	4.627	13.469	117
2009	.633	.125	69.544	4.939	13.694	122
2010	.658	.120	77.183	4.769	13.564	124
2011	.622	.117	96.927	3.973	13.081	120
2012	.676	.115	86.849	3.797	12.781	134
2013	.748	.115	132.511	3.994	12.232	133
2014	.727	.115	128.505	3.425	12.694	120

This table reports yearly average value of H-statistic, Lerner index, HHI, Z-score, NPL ratio and equity ratio for ASEAN-5 from 1990 to 2014. ASEAN-5 includes Indonesia, Malaysia, the Philippines, Singapore and Thailand. The description of variables and sources of the data are provided in Appendix B.

The log of the Z-score during the global financial crisis, reveals that initially the *ln*Z-score declined, then moves upward, consistent with the work of Fu et al. (2014). This implies that the region was initially affected with the GFC, but dramatically recovered from the crisis. During the same period, a downward slope in H-statistic is observed implying that during the 2008-2009 GFC, ASEAN banks suffered from high risk pressure due decreased in competition and increased market power.

Figure 4.1 demonstrates that log of the Z-score and H-statistic increase when ASEAN central banks endorsed ABIF in 2011 which allows qualified banks from ASEAN-5 to expand cross boarder operations in other member state of ASEAN-5 with home field advantages. This implies that ABIF enhances bank stability by increasing the level of competition.

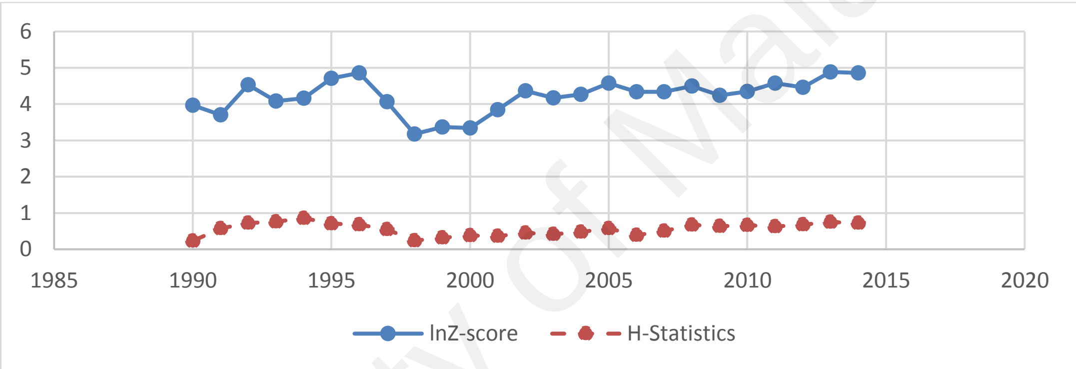

Figure 4.1 Relationship between *ln*Z-score and H-statistic of ASEAN- 5 during 1990-2014.

Note: Fig 4.1 presents co-movement *ln*Z-score, H-statistic and Lerner index in ASEAN-5 from 1990 to 2014. ASEAN-5 includes Indonesia, Malaysia, the Philippines, Singapore and Thailand. Definition of *ln*Z-score, H-statistic and Lerner index, and source of their data collection are presented in Appendix B.

Figure 4.2 shows that equity ratio moves cyclically and NPL ratio moves counter cyclically with *ln*Z-score across the years during 1990-2014. This demonstrates that high equity ratio may enhance bank stability along with *ln*Z-score, while high NPL ratio may undermine it.

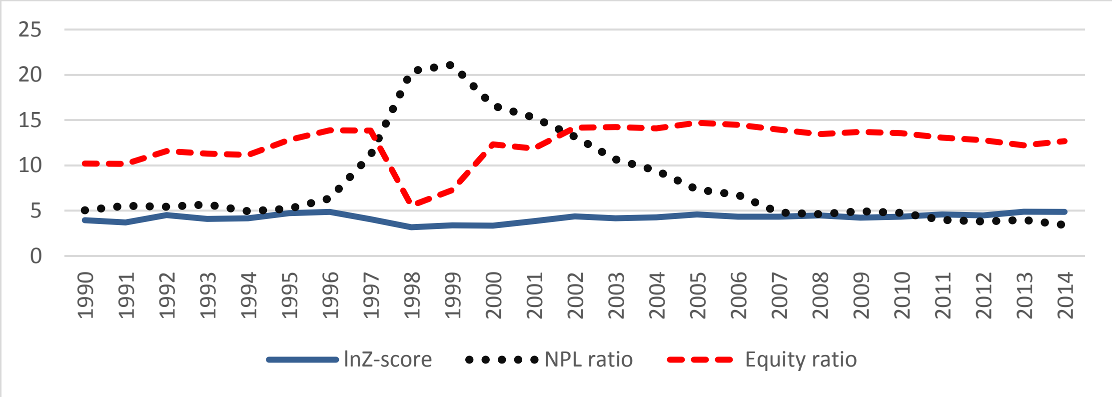

Figure 4.2 The relationship among *lnZ*-score, NPL ratio and Equity ratio of ASEAN-5 from 1990-2014

Note: Fig 4.2 presents the relationship among *ln*Z-score, NPL ratio and equity ratio in ASEAN-5 from 1990 to 2014. ASEAN-5 includes Indonesia, Malaysia, the Philippines, Singapore and Thailand. Definition of *ln*Z-score, NPL ratio and equity ratio, and source of their data collection are presented in Appendix B.

The overall results of Figures 4.1 and 4.2 suggest that more competition is favourable for the development of the ASEAN banking sector which increases stability of banks by increasing financial solvency and capitalisation and decreasing credit risk.

4.3 Correlation Matrix

Before estimation of the regression equations, this study analyses the correlation coefficients between variables of the equations. Correlation analysis is performed for two reasons. Firstly, it shows a bivariate relationship between a dependent variable and an explanatory variable which help to explore the direction and strength of the relationship between them, regardless of the existence of other variables. Secondly, it indicates multicollinearity problem,[27] if any, which may cause estimation bias, if the correlation coefficient between two variables is high. This study considers the correlation coefficient of 0.50 as a cut-off rate to identify existence of multicollinearity problem if their respective correlation coefficient exceeds the cut-off rate following the work of Chan et al. (2015).

[27] Multicollinearity problem presents if a regressor is highly correlated with one or more regressor in multiple regression model. Multicollinearity is considered as a problem because it undermine the statistical significance of regressors (Allen, 1997)

Table 4.4: Pearson Pair-wise Correlation Matrix of the Dependent Variables (*ln*Z-score, NPL ratio and equity ratio) and non-dummy Independent Variables.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Z-score (1)	1.000													
NPL ratio (2)	-.063 ***	1.000												
Equity ratio (3)	.067 ***	-.081 ***	1.000											
H-statistic (4)	.008 **	-.192 ***	.001	1.000										
HHI (5)	-.037 *	.072 ***	-.071 ***	-.237 ***	1.000									
Loan composition (6)	.009	-.116 ***	-.185 ***	.161 ***	-.011	1.000								
Bank size (7)	.077 ***	-.181 ***	.354 ***	.091 ***	.203 ***	.157 ***	1.000							
Operational Efficiency (8)	-.050 **	.179 ***	.010	-.030	-.072 ***	-.095 ***	-.147 ***	1.000						
Loan Quality (9)	-.064 ***	.658 ***	-.086 ***	-.157 ***	-.044 ***	-.293 ***	-.223 ***	.143 ***	1.000					
Capital Requirements Index (10)	.090 ***	-.282 ***	.084 ***	.250 ***	-.169 ***	-.023	.133 ***	.011	-.165 ***	1.000				
Supervisory Power Index (11)	.039 **	-.208 ***	.033 *	-.007	-.195 ***	-.208 ***	-.142 ***	-.069 ***	-.092 ***	.586 ***	1.000			
Activity restrictions Index (12)	-.008	.162 ***	-.063 ***	-.153 ***	.204 ***	-.034 ***	.191 ***	-.008	.053 ***	.580 ***	-.545 ***	1.000		
Inflation Rate (13)	-.075 ***	.251 ***	-.211 ***	-.135 ***	-.127 ***	-.095 ***	-.298 ***	-.012	.310 ***	.552 ***	.114 ***	-.216 ***	1.000	
GDP Growth (14)	.065 ***	-.290 ***	.154 ***	.265 ***	.102 ***	.067 ***	.128 ***	-.042 ***	-.283 ***	.159 ***	.090 ***	-.031	-.514 ***	1.000

This table provides Pearson pair-wise correlation of the variables of this study. The description of the variables and sources of data are provided in Appendix B.
, and * indicating the coefficient are significant at 1 % , 5 % and 10 % respectively.

Table 4.4 illustrates the Pearson pair-wise correlation coefficient of all dependent and non-dummy independent variables used in the models, as well as the level of significance. This table demonstrates that the dependent variables are significant correlated with the independent variables in most cases, despite their bivariate correlation coefficients are low. The dependent variable *ln*Z-score is positively related with H-statistic (0.008) and negatively related with HHI (-0.037), indicating that greater competition and less concentration promote financial solvency; and *ln*Z-score is positively related with capital requirements index (0.090) and supervisory power index (0.039), and negatively related with activity restrictions index (-0.008), indicating that both stringent capital requirements and official supervision promotes financial solvency, while activity restrictions undermine it. The NPL ratio is negatively related with H-statistic (-0.192) and positively related with HHI (0.072), indicating that less competition and high concentration increases the risk-taking behaviour of the banks. It is negatively related with both capital requirements index (-0.282) and supervisory power index (-0.208) and positively related with activity restrictions index (0.162), indicating that both stringent capital requirements and official supervision decrease the risk-taking behaviour of the banks, while activity restrictions increase it. The final proxy of financial stability as dependent variable equity ratio is positively related with H-statistic (0.001) and negatively related with HHI (0.071), indicating that more competition and less concentration induce banks to hold more equity capital. It is also positively related with capital requirements index (0.084) and supervisory power index (0.033), and negatively related with activity restrictions index (-0.063), indicating that both stringent capital requirements and official supervision increase banks' capitalisation and activity restrictions reduce it.

The correlation matrix table demonstrates that independent variables are not highly correlated between them, because their pair-wise correlation coefficients are less than the cut-off rate of 0.50 (except 0.586 between capital requirements index and supervisory power index, 0.580 between capital requirements index and activity restrictions index, and -0.545 between supervisory power index and activity restrictions index). Despite the presence of high correlation coefficient is observed between regulatory variables (such as, between capital requirements index and supervisory power index, between capital requirements index and activity restrictions index, and between supervisory power index and activity restrictions index) these do not bias the estimation process, because regulatory variables, such as capital requirements index, activity restrictions index, and supervisory power index are regressed in the models separately. Therefore, the regressors are free from serious multicollinearity problem.

4.4 Long-run Equilibrium Test for H-statistic

The validity of H-statistic depends heavily on the assumption of long-run equilibrium condition, especially for monopolistic and perfect competition market. This is because under the equilibrium, return rate and input factor prices are not correlated significantly, indicating prices do not effect rate of return (Apergis, el al. 2016). The study performs a run long-run equilibrium test by estimating equation (3.9) applying both the OLS and fixed effect model. The long-run equilibrium test provides the E-statistics which are reported in Table 4.5.

Table 4.5: Long-run Equilibrium Test of H-statistic for ASEAN-5 countries from 1990-2014 period.

Variable	Indonesia		Malaysia		Philippines		Singapore		Thailand	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
lnW1	-.0031	-.0013	.0012	.0043	.0026	-.0012	.0012	.0013	.0021	.0028
	(.0258)***	(0.03)***	(.0312)	(.0363)	(.0299)	(.0408)	(.0323)***	(.0408)***	(.0381)	(.0447)
lnW2	-.0036	.0093	.0025	.0020	.0197	-.0173	.0011	.0021	-.0044	.01242
	(.0314)	(.0430)	(.0403)	(.0758)***	(.0628)	(.0875)	(.0377)	(.0474)	(.0789)	(.0983)
lnW3	-.0183	-.0152	-.0017	-.0058	.0018	.0039	.0030	-.0032	.0067	-.0131
	(.0204)	(.0213)	(.0389)	(.0487)	(.0899)**	(.0885)***	(.0468)	(.0492)	(.0657)	(.0907)
lnX1	.0156	.0542	.0218	.0170	.0193	.0142	.0179	.0194	.0153	.0142
	(.0338)***	(.0416)***	(.0512)***	(.0612)**	(.0625)***	(.0648)**	(.0529)***	(.0957)	(.0590)	(.0785)
lnX2	-.0916	-.0752	.0402	.0579	-.0528	.0347	-.0263	.0262	.0312	.0236
	(.0314)***	(.0318)**	(.0268)	(.0364)	(.0486)	(.0643)	(.0325)	(.0537)	(.1276)	(.1582)
lnX3	.0375	-.0540	.0131	.0101	.0355	-.0420	.0518	.0151	.0861	-.0334
	(.0099)***	(.0196)***	(.0158)	(.0298)	(.0196)*	(.0428)	(.0158)***	(.0445)***	(.0206)	(.0477)
Constant	-.5303	.3598	.0701	.9573	1.1194	1.8529	.0358	-.4874	-2.0296	-.8166
	(.1948)***	(.2690)*	(.2666)	(.4913)**	(.4303)***	(.5114)***	(.1276)*	(.1159)*	(.6417)	(.2120)
Observations	957	957	426	426	434	434	190	190	302	302
R2	0.22	0.19	0.482	0.219	0.41	0.20	0.30	0.13	0.26	0.16
E-statistic	**-0.03**	**-.01**	0.00	0.00	**0.03**	**-0.02**	0.00	0.00	0.00	0.00
F-test, E=0	46.75	28.80	4.59	5.08	3.09	6.10	14.69	4.38	17.45	8.00
	(000)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly. The details of this table is provided in Appendix C.

Table 4.5 reports country-wise E-statistics which demonstrates the presence of long-run equilibrium in most of the countries during 1990 to 2014 except the Indonesian (E-statistic of -0.03 in OLS and -0.01 in fixed effect) and the Philippine (E-statistic of 0.03 in OLS and -0.02 in fixed effect) banking systems. The disequilibrium condition may be due to the fact that in a free entry equilibrium of homogenous banks, the market mechanisms (demand and supply of banks products) would equalise return on assets among the banks in order that the return on assets becomes independent of input prices (Shaffer, 1982).

The presence of disequilibrium in the Indonesian and Philippine banking systems may raise particular concern due to the breach of the assumption of long-run equilibrium condition of H-statistic. These results are similar to Liu et al. (2012) who showed evidence of disequilibrium for Indonesia and Philippines in both OLS and fixed effect estimations. It is also supported by the literature reported in the Appendix D. In supporting the existence of long-run disequilibrium, Goddard and Wilson (2009) argued that in reality the adjustment towards long-run equilibrium is not always instantaneous. In a similar vein, Bikker et al. (2012) argued that the long-run equilibrium test of Panzar-Rosse H-statistic is actually test of long-run competitive equilibrium which is a joint test of both long run structural equilibrium and competitive conduct. Bikker et al. (2012) showed that the return of assets may not be zero even if the market is in state of structural equilibrium. Under such a circumstance, the competition estimates using H-statistic for Indonesia and the Philippines are to be used with certain care.

4.5 Results and Discussion of Research Objectives

This section reports and discusses regression results with respect to the objectives of this study. Section 4.5.1 discusses the results of the first objective to examine the influence of bank competition on stability of the banking institutions followed by the robustness tests of the results in section 4.5.1.1. Section 4.5.2 discusses the results of the second objective to examine the moderating role of bank regulation on the relationship between bank competition and stability followed by the robustness tests of the results in section 4.5.2.1. Section 4.5.3 discusses the results of third objective to examine the effect of financial crisis on the mediating effect of bank regulation on the relationship between bank competition and stability followed by the robustness tests of the results in section 4.5.3.2. Finally, a summary of all objectives is presented in section 4.5.4.

4.5.1 First Objective: Examining the effect of bank competition on bank stability in the banking sector

To satisfy the first objective, this study develops two hypotheses in Chapter 3, where Hypothesis 1 is 'bank competition promotes stability in the banking sector' and Hypothesis 2 is 'the relationship between bank competition and stability is non-linear'. This study designs two dynamic regression models where equation (3.1) to test Hypothesis 1 and equation (3.2) to test Hypothesis 2, which are reproduced as follows:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.1)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.2)$$

All the subscripts and variables in both equations (3.1) and (3.2) are retained as same as in Chapter 3. In order to estimate the above equations (3.1) and (3.2), this study applies the two-step system GMM consider financial freedom and property right as instrumental variables in order to deal endogeneity issue between bank competition and stability. The GMM estimates of equations (3.1) and (3.2) are reported in Tables 4.6 and 4.7. Models 1 and 2 present the GMM estimates of the above equations considering *ln*Z-score as dependent variable, models 3 and 4 present the estimate considering NPL ratio as dependent variable, and models 5 and 6 present the estimates considering equity ratio as dependent variable. As alternative measures of bank competition, as the main explanatory variable, the variable of interest H-statistic is used in models 1, 3 and 5, and HHI is used in models 2, 4 and 6. Meanwhile, before running the GMM, this study runs pre-diagnostic Wooldridge test, Breush-Pagan/Cook-Weisberg test, and Wu-Hausman test, the estimates of which are reported in the bottom of the Tables 4.6 and 4.7 to check serial correlation, heteroscedasticity and endogeneity issue of the unbalanced panel respectively. The significant value of Wooldridge test, Breush-Pagan/Cook-Weisberg test and Wu-Hausman test indicate that this unbalanced panel involves serial correlation, heteroscedasticity and endogeneity issues.

To handle the issues, this study runs first stage F-test using 2SLS regression to check instrumental validity, the significant value of first stage-F statistics indicates that the instruments are weak and invalid in 2SLS regressions meaning that fixed effect instrumental variable estimator are also likely to be bias in the way of OLS estimators. This justifies use of two-step system GMM of Arellano and Bover (1995) and Blundell and Bond (1998), as Roodman (2006) argued that the system GMM can handle serial correlation, heteroscedasticity and endogeneity issues and provides more efficient estimates.

In addition, the insignificant value of Hansen's J test ensures the validity of overidentifying restrictions indicating that instrumental variables used for handling endogeneity problem are valid. That is, instruments are uncorrelated with error term and handled the endogeneity problem. Thus, heteroscedasticity problem is also handled, because, the presence of heteroscedasticity and overidentification restrictions would not be validated (Baum, Schaffer, & Stillman, 2003). In addition, significant value of AR (1) and insignificant value of AR(2) indicates that serial correlation is present in the level, but it is absent in the first difference. Moreover, significant value of Wald test implies that all models are correctly specified.

Table 4.6: Two-step System GMM results of the effect of bank competition on bank stability of ASEAN-5 from 1990 to 2014

Dependent Variable	*ln*Z-score	*ln*Z-score	NPL ratio	NPL ratio	Equity ratio	Equity ratio
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *ln*Z-score NPL Ratio & Equity Ratio	.6668 (.0283)***	.6571 (.0328)***	.5615 (.0726)***	.6097 (.0582)***	.4284 (.0723)***	.4177 (.0751)***
H-statistic	.2545 (.1199)**		-3.4312 (.9161)***		.3366 (.7531)	
HHI		-.3177 (.6043)*		11.4109 (4.5283)**		-3.5556 (4.2815)
Loan Composition	-.0102 (.0025)***	-.0132 (.0034)***	.1436 (.0265)***	.1005 (.0171)***	-.0221 (.0209)	-.0355 (.0162)**
Loan Quality	-.0237 (.0082)***	-.0319 (.0102)***	.4146 (.1062)***	.3776 (.0831)***	.0152 (.0643)	.0041 (.0505)
Bank Size	.0136 (.0281)	.0399 (.0334)	-.6701 (.5419)	-.6428 (.3112)**	-.5226 (.3128)*	-.9487 (.2680)***
Operational Efficiency	-.0051 (.0020)***	-.0030 (.0024)	.0181 (.0250)	.0092 (.0139)	-.0001 (.0155)	-.0023 (.0080)
Foreign Ownership	.2321 (.0870)***	.1745 (.0900)***	-.0646 (.5941)	-.6839 (.5868)	.6033 (.2957)*	.9305 (.3488)***
GDP Growth Rate	.04539 (.0089)***	.0496 (.0093)***	-.3063 (.0671)***	-.2668 (.0621)***	.0044 (.0429)	.0093 (.0353)
Inflation Rate	-.0013 (.0059)	-.0038 (.0060)	.0198 (.0454)	.0819 (.0498)*	-.0494 (.0473)	-.0886 (.0399)**
Constant	1.7201 (.3065)***	1.9545 (.3316)***	-.03801 (3.7126)	-2.2448 (2.1766)	12.0787 (3.6479)*	15.2524 (2.9757)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	160	121	82	160	120	160
Wald Test (P-value)	1461.36 (0.00)	993.83 (0.00)	731.61 (0.00)	878.45 (0.00)	86.44 (0.00)	161.04 (0.00)
AR(1) (P-value)	-6.85 (0.00)	-6.87 (0.00)	-3.97 (0.00)	-4.09 (0.00)	-3.72 (0.00)	-3.64 (0.00)
AR(2) (P-value)	1.43 (0.154)	1.32 (0.187)	-0.21 (0.832)	-0.37 (0.713)	-0.86 (0.388)	-1.02 (0.306)
Hansen's J Test (P-value)	155.67 (0.337)	125.62 (0.146)	77.40 (0.282)	155.74 (0.336)	124.28 (0.150)	154.21 (0.368)
First Stage F-test (P-value)	5.0538 (0.02)	207.596 (0.00)	5.5130 (0.01)	213.851 (0.00)	5.5131 (0.01)	213.851 (0.00)
Wu- Hausman Test[28] (P-value)	42.6541 (0.00)	20.7436 (0.00)	90.4761 (0.00)	67.333 (0.00)	51.9294 (0.00)	45.8921 (0.00)
Breush – Pagan/Cook-Weisberg Test (P-value)	79.04 (0.00)	79.24 (0.00)	3148.21 (0.00)	3096.99 (0.00)	22.38 (0.00)	21.55 (0.00)
Wooldridge Test (P-value)	277.603 (0.00)	79.24 (0.00)	60.012 (0.00)	60.275 (0.00)	180.766 (0.00)	175.244 (0.00)

This table presents two-step system GMM estimates with robust standard error in the parenthesis of the following equation (3.1) to test Hypothesis 1

$$\mathrm{STAB}_{ijt} = \alpha_0 + \alpha_1 \mathrm{STAB}_{ijt-1} + \alpha_2 \mathrm{COM}_{ijt} + \beta \mathrm{BANK}_{ijt} + \theta \mathrm{MACRO}_{jt} + \gamma(\mathrm{YEAR})_t + \lambda_i + \varepsilon_{ijt} \quad (3.1)$$

The details of this table are provided in appendix C.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

[28] Despite this study estimates both Durbin Test and Wu-Hausman Test to test endogeneity problem in 2SLS framework, only Wu-Hausman Test is reported.

In testing Hypothesis 1, model 1 of Table 4.6 demonstrates the effect of bank competition proxied by H-statistic along with control variables on *ln*Z-score. The results demonstrate that the coefficient of H-statistic in model 1 is positive and significant on *ln*Z-score, demonstrating that the level of bank competition is directly proportional to the degree of bank stability in banking sector of the ASEAN-5 countries. Similarly, model 2 considers HHI as a traditional competition measure through concentration ratio.[29] The sign of the coefficient of HHI is negative, demonstrating that concentration undermines bank stability. With respect to Z-score as a measure of bank solvency, the results suggest that the more bank competition promotes bank stability in the ASEAN countries, which support Hypothesis 1.

Models 3-4 of Table 4.6 report system GMM estimate of equation (3.1) considering NPL ratio as a proxy of bank stability. The negative coefficient of H-statistic on NPL loan ratio in model 3 imply that the level of competition is reversely proportional to the level of credit risk. In a similar vein, the coefficient of HHI in the model 4 is positive, suggesting that lack of competition in concentrated loan market induces banks to take greater credit risk. The results with respect to the NPL ratio this study suggests that less competition induces banks to take greater credit risk, in other word, more competition induces banks to take less credit risk which may also promote stability of the banking sector of the ASEAN countries, also support Hypothesis 1.

The bank stability is also measured by equity ratio in models 5-6 of Table 4.6. The positive coefficient of H-statistic and negative coefficient of HHI on equity ratio demonstrate that competition in model 5 is directly proportional to the capitalization ratio, while concentration in model 6 is reversely proportional to the capitalisation ratio. These results demonstrate that more competition in less concentrated the banking market

[29] As explained earlier, the HHI is a ratio of concentration which is reversely related to the level of competition, that is, high concentration signifies less competition in the banking market.

encourages banks to be more capitalised which may increase their capital buffer and increase capacity to face unexpected financial shock. This promotes bank stability and supports Hypothesis 1.

The overall results of Table 4.6 imply that competition increases bank solvency, induces banks to hold more equity, and to assume less credit risk. In other words, concentration undermines bank solvency, induces banks to be less capitalised and induces to take less credit risk. The overall findings are consistent with the competition-stability view by Boyd & Nicolo (2005). This may be due to the fact that greater concentration provides incentive to enjoy more market power to the banks to set high loan price in order to earn high profit margin. The high loan price, resulting from high profit margin expectation of the large banks, may increase the moral hazard among the borrowers to choose risker projects which consequently increases their probability of default. The default risk of the borrowers may shift to the bank and contribute to increasing the bank's credit risk and make it a fragile institution due to risk shifting effect as identified by Boyd and Nicolo (2005). They assumed a perfect correlation between borrowers' risk and bank risk. On the other hand, with increases in the level of competition in the market, banks gradually loss their market power to set higher interest rate and earn high profit margin, which tends to push down interest rate of the loan. In competitive markets, banks also adopt conservative approach in selecting the potential borrowers and taking credit risk. High nonperforming loans resulting from high risk-taking in competitive market imply greater potential loss, which drives banks to hold more loan loss reserves which reduces both profit and capital.[30] Therefore, to protect erosion of profit and capital in competitive markets, banks focus on improving efficiency of risk management system and reducing information asymmetry in order to maintain high quality loan portfolio and keep

[30] Banks require to keep loan loss reserve against risk weighted assets. Only 1.25 percent of risk weighted assets in that reserve is considered as tier-2 capital. however, the reserve which is kept against know deterioration of assets quality or non-performing loan is not qualified to include as capital part in Basel II accord(Basel Committee on Bank Supervision, 2009). This means that bank losses both profit and capital with increasing non-performing loan.

nonperforming loan at lower levels (Demirgüç-kunt & Pería, 2010). To improve the efficiency of the risk management system, banks review their investment strategies and focus on improving risk assessment and screening technologies, and increasing expertise and skills of the risk officers (Weill, 2013). Competition also influences the conduct of the banks to be more innovative to design and render quality financial services to the borrowers which also likely to improve quality of loan portfolio and promote bank stability of them (Apergis, et al., 2016).

As mentioned before, competition is positively related to equity ratio, but concentration is negatively related to equity ratio. With respect to the first relation, as prudent risk management strategy improves the risk management system and keep the nonperforming loan lower, banks hold more equity, even more than the minimum capital requirements (Schaeck & Cihak, 2007, Berger et al., 2009). This is because, a high capital ratio may mitigate insolvency risk of the bank by providing a buffer against potential negative shock in the due course of lending operations. As a result, high equity ratio may contribute to promote bank stability in a competitive market by increasing expected life as well as future expected value of cash inflows of the banks (Bolt & Tieman 2004). The finding suggests that bank stability in a banking sector may channel through higher equity capitalisation rate in competitive market. This finding is supported by Allen, Carletti, & Marquez (2011) who argued that competition encourages banks to hold more equity capital, and this also empirically supported by Schaeck & Čihák (2014). On the other hand, with respect to the second relation, negative relationship between bank competition and equity ratio, large banks in concentrated market may consider themselves as too-systematically-important-to-fail which induces them to hold less equity. In concentrated markets, only a few large banks may exist which receive subsidies and capital supports from regulatory authorities as 'too-big-to-fail' or 'too-systematically-important-to-fail' policy considering them as systematically important banks (Acharya et al., 2012; Barth et al., 2012). Thus, high concentration may increase bank fragility by inducing banks to hold less equity capital. On the other hand, competition may increase bank stability by inducing banks to hold more equity as one of the prudent risk management strategy in the banking system.

The threat of bank fragility resulting from high concentration is not surprising for ASEAN countries. This is because an adoption of high consolidation policy aftermath of the 1997-98 AFC in the form of privatisation, merger and acquisition decreases the number of existing banks from 453 in 1997 to 264 in 2001 (Kishi, 2001), and renders the banking market more concentrated in this region by letting a few banks to grow as dominating players in the region (Soedarmono et al., 2013; Sufian & Habibullah, 2013, 2014). The threat of consolidation is raised when the dominating banks consider themselves as 'too-big-to- fail' banks, which incentivises them to take more risks because they believe that the policy makers come up with rescue packages if they face financial distress. On the other hand, this emerging region adopted the policy of financing for long term growth in some priority sectors. The concentrated banking system mobilises their resources to the defined priority sectors, which makes their borrowers "too-large-to- fail". As a result, nonperforming loans of the big borrowers tend to be higher due to the lack of incentive for formulating a proper credit culture due to perceiving themselves as 'too-big-to-fail' banks in concentrated market. Additionally, commercial banks are the pre-dominate sources of financial intermediation in the region with handing more than 82% of financial assets due to the presence of an underdeveloped capital market (ADB, 2013). This may also contribute to increasing the size of the banks with too-big-to-fail problem which may take high risk and increase the threat of bank fragility.

Banks' lower risk profiling by keeping the NPL ratio lower in a competitive market may also be explained in terms of bank response with respect to the depositors' behaviour in the market. In a competitive market, depositors remain well-informed regarding the risk profiling of the banks and enjoy more alternatives to place their deposits (Matutes & Vives, 2000). Under such as a circumstance in a competitive market, if depositors perceive that banks are taking more risk, they may penalise banks by moving their deposits to a safer place. Nevertheless, even though depositors are not well-informed about the bank's risk profiling as it is true in many cases, depositors may have signals that help them to understand the risk-taking behaviour of the bank. Such a signal may come to the depositors from the deposit interest rate offered by the banks. A rapidly increasing of interest rate gives signal to the depositors that the bank is very aggressive in risk-taking. Under such conditions, continuously increasing the deposit rate beyond a certain level may not be attractive to the depositors, because excessively high deposit rates may induce banks to engage in high risk-high return projects. This may give depositors a negative signal and induce them to move their deposit to a safe place or credit rationing may take place in the deposit market as pointed out by Stigliz & Weiss (1981).

The findings are consistent with earlier studies, which focused on a particular geographical area, such as the European Union by Schaeck & Čihák (2008; 2014). Schaeck & Čihák (2008) found that competition proxied by Boone indicator granger causes bank stability proxied by Z-score, and then found that competition promotes stability through the channel of profit efficiency during 1995-2005 period. Schaeck & Čihák (2014) further found that found that competition has a stability enhancing effect by using a Boone indicator as a competition measure and the Z-score as stability during the 1995 to 2005 period. Furthermore, in investigating the cause of the 2008-2009 GFC, OECD (2010) also found that competition is supportive for bank stability in OECD countries by reducing the probability of crisis. It found that it is not competition rather loose monetary policy, global imbalances in asset and real estate markets, poor regulatory and institutional frameworks and funding structure of bank are responsible for the crisis.

Further, the findings are consistent with Asian emerging countries studied by Liu et al. (2012) and Soedarmono et al. (2013), where Liu et al. (2012) captured competition using H-statistic and risk-taking using loan loss reserve ratio, loan loss provision ratio, standard deviation of ROA and Z-score from 1998-2008. Soedarmono et al. (2013) captured competition using Lerner index and efficiency adjusted Lerner index as measurements of competition, and the Z-score, standard deviation of ROA, and capitalisation ratio as stability measurements during the period from 1994 to 2009. The results are also consistent with studies on broader areas, US and 134 non-industrialized countries as the work of Boyd et al., (2006) during 1993-2004 period found that concentration ratio (HHI) inversely related with stability measured by Z-score and level of intermediation measured by loan to total assets ratio suggesting that competition promotes bank stability by promoting level of intermediation in the market. Further, the work of Anginer et al. (2014) which found a negative relationship between systematic fragility and competition, measured with a Lerner index and H-statistic, on 1,942 banks from 68 counties during the period of 1998 to 2010.

In addition, the findings are partially consistent with the findings of Fu et al. (2014), who focused on the Asia Pacific region from 2003-2010. This study finds that the large three banks concentration ratio (CR3) significantly foster bank fragility captured by both the Z-score and probability of default approach from the work of Merton (1974) for both listed and non-listed banks. It supports the competition-stability view, despite the finding of low market power measure by Lerner index in the banking market which induces high risk exposure, supporting the competition-fragility view.

The divergent results may be attributed to the use of different data set from 14 Asian-pacific countries and different control variables which may affect the relationship between bank competition and stability or risk-taking behaviour of the banking industry. Fu et al. (2014), consider banking regulatory variables such as deposit insurance, capital regulation and entry restrictions as well as crisis dummy control macroeconomic volatility which may influence for getting different results.

To test Hypothesis 2, this study extends the basic equation (3.1) to (3.2) adding a quadratic term of the variable of interest measuring competition to check non-linear relationship or inverted U-shaped relationship between bank competition and stability following the works of Berger et al. (2009), Tabak et al. (2012), and Fu et al. (2014), and Kasman & Kasman (2015). The motivation of addition a quadratic term of competition is examine whether both risk-shifting effect and franchise value effect of competition is concurrently applied together in the banking sector, and if it does, to determine the threshold level of competition where the effect of bank competition on stability/ fragility change.[31] Table 4.7 reports the system GMM estimates of the extended equation (3.2) to examine non-linear relationship between bank competition and stability of the ASEAN countries during 1990-2014 considering *ln*Z-score in models 1 and 2, NPL ratio in models 3 and 4 and equity ratio in models 5 and 6 as proxy for bank stability. The level of competition is captured by H-statistic in models 1, 3 and 5, and HHI in model 2, 4 and 6. Based on significant value of the test statistic of the Wooldridge Test, Breush-Pagan/Cook-Weisberg Test and Wu-Hausman Test, it is evident that serial correlation, heteroscedasticity and endogeneity problem are present in the unbalanced panel data set which justify the use of the system GMM specification as this method is useful to handle serial correlation, heteroscedasticity and endogeneity problems. In addition, a significant value of post-diagnostic test statistic of the GMM such as first stage F-test, and insignificant value of Hansen's J test and AR(2) ensures that instrumental variables used to control endogeneity problem are relevant and valid, and there is no serial correlation at second order, which ensure the GMM models are correctly specified.

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[31] A quadratic term is used in the model to examine the marginal effect of change in independent variable on dependent variable is diminishing or increasing (Wooldridge, 2015)

Model 1 of Table 4.7 shows that bank competition is captured with H-statistic and dependent variable is *ln*Z-score, the coefficient of H is positive (.7443) and significant at 1 percent in linear term, but it turns negative for quadratic term (-.4877) and significant at 5 percent, demonstrating that the relationship between bank competition and stability is non-linear. This suggests that the relationship between bank competition and stability is inverted U-shaped. This suggests that the marginal effect H-statistic on *ln*Z-score is diminishing. That is, the slope of the change of *ln*Z-score with the change of H-statistic of equation (3.13) or $\frac{\Delta \text{Ln Z-score}}{\Delta \text{H}} \cong \alpha_1 + 2\alpha_2\text{H}$ or.7443-2(0.4877) H is lower with getting the value of H is higher which is presented in Figure 4.3. If H is 0.3, the slope is 0.4517, if H is 0.5, the slope gets reduced to 0.2566, and the slope becomes negative such as -0.0360 if H is 0.80.

This means that bank stability increases with increasing in bank competition up to a certain level, thereafter the effect of bank competition on bank stability is reversed. The inflection point, of the variable of interest or H-statistic, on which reverse happens can be calculated to determine the threshold value[32], such as inflection point of H or $\text{H}^* = \left|\frac{\alpha_1}{2\alpha_2}\right|$ or $\left|\frac{0.7443}{2(-0.4877)}\right| = 0.7631$. This inflection point indicates that bank stability benefits measured with *ln*Z-score of competition measured with H-statistic is 0, if H is 0.7631. Any value of H beyond the inflection point (0.7631), competition has a fragility effect. Lind & Mehlum (2010) argued that the opposite sign and significant value of α_1 and α_2 are weak and flawed estimations of the non-linear relationship between two variables, because sometimes these may provide misleading inferences. Therefore, as an additional test, this study applies the Sasabuchi-test of Sasabuchi (1984) to test the non-linear relationship between bank competition and stability.

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[32] Inflection point is the coefficient on linear term over twice the absolute value of the coefficient on quadratic term of the variable of interest.

Table 4.7: Two-step System GMM results for the effect of bank competition onbank stability of ASEAN-5 from 1990 to 2014

Dependent Variable	***ln*Z-score**	***ln*Z-score**	**NPL ratio**	**NPL ratio**	**Equity ratio**	**Equity ratio**
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *ln*Z-score,	.6535	.6604	.5994	.5883	.4400	.4215
NPL ratio & Equity ratio	(.0297)***	(.0271)***	(.0622)***	(.0568)***	(.0721)***	(.0728)***
H-statistic	.7443		-7.0877		2.3348	
	(.2412)***		(2.328)***		(1.4110)*	
(H-statistic)^2	-.4877		3.7875		-2.3459	
	(.1963)**		(1.847)**		(1.2108)*	
HHI		-7.9555		136.7103		-59.1708
		(2.399)***		(20.51)***		(18.97)***
(HHI)^2		18.7167		-321.6379		150.9356
		(6.133)***		(53.87)***		(48.24)***
Inflection Point	0.7631	0.2125	0.9357	0.2172	0.4976	0.1960
Loan Composition	-.0076	-.0104	.1315	.1172	-.0386	-.0487
	(.0027)**	(.0026)***	(.0219)***	(.0168)***	(.0168)**	(.0182)***
Loan Quality	-.0198	-.0239	.3805	.3437	.0101	.0061
	(.0076)**	(.0093)***	(.0855)***	(.0842)***	(.0542)	(.0449)
Bank Size	.0119	.0226	-.6095	-.6529	-.5154	-.7931
	(.0314)	(.0304)	(.4282)	(.3061)**	(.2719)*	(.2513)***
Operational Efficiency	-.0053	-.0051	.0245	.0006	-.0119	-0.0001
	(.0020)**	(.0023)**	(.0161)	(.0173)	(.0101)	(.0102)
Foreign Ownership	.2119	.2028	-.6300	-.3907	.8276	.3064
	(.0894)**	(.0869)**	(.5885)	(.5954)	(.3008)***	(.3255)
GDP Growth Rate	.0452	.0496	-.2458	-.2842	.0043	.0188
	(.0085)***	(.0095)***	(.0599)***	(.0605)***	(.0342)	(.0332)
Inflation Rate	-.0058	-.0035	.0617	.0803	-.0841	-.1061
	(.0056)	(.0062)	(.0482)	(.0505)	(.0409)**	(.0410)***
Constant	1.5519	2.3916	-.2001	-10.8155	11.2624	19.3183
	(.3032)***	(.3177)***	(3.0418)	(2.6224)***	(3.2698)***	(3.6360)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	160	160	121	160	160	160
Wald Test (P-value)	1815.72	1633.08	887.21	930.19	170.53	220.81
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR(1) (P-value)	-6.79	-6.81	-4.10	-4.07	-3.81	-3.71
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR(2) (P-value)	1.37	1.38	-0.18	-0.37	-1.11	-1.17
	(0.172)	(0.169)	(0.856)	(0.713)	(0.267)	(0.240)
Hansen's J Test (P-value)	152.3	148.77	120.11	154.68	152.10	154.29
	(0.386)	(0.467)	(0.220)	(0.337)	(0.392)	(0.345)
First Stage-F-test	2.95115	320.488	2.76914	326.509	2.7691	326.509
(P-value)	(0.08)	(0.00)	(0.09)	(0.00)	(0.08)	(0.00)
Wu- Hausman Test	43.780	20.1631	92.6714	57.5631	51.9553	41.6906
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Breush – Pagan/Cook-	79.35	83.43	3166.61	3180.87	22.84	27.58
Weisberg Test (P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wooldridge Test (P-value)	275.021	243.960	59.829	60.166	179.422	175.357
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sasabuchi-test (P-value)	1.81(.035)	2.76(.003)	1.24(.108)	5.34(0.000)	1.82(.034)	3.04(.001)

This tables presents the system GMM estimates with robust standard error in parenthesis using the follow equation (3.2) to test Hypothesis 2:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.2)$$

The details of this table are provided in Appendix C.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

The significant test statistics of Sasabuchi-test (t-value) also indicates that bank competition maintains a non-linear relationship with bank stability in ASEAN-5 countries.

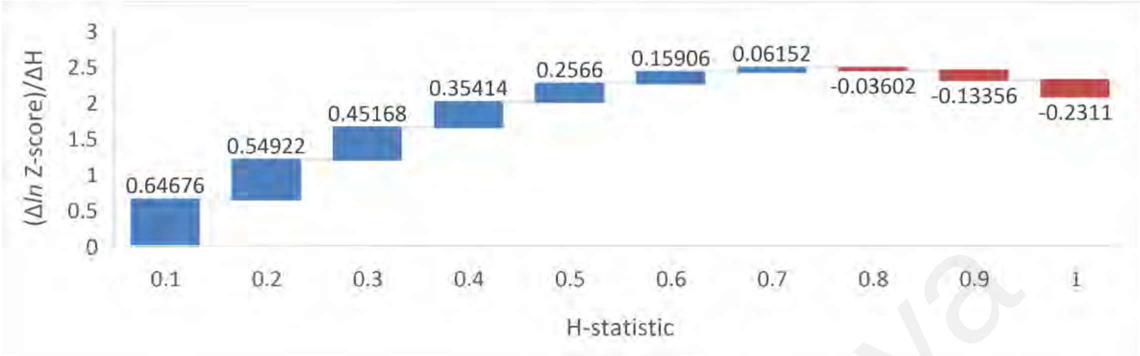

Figure 4.3 Diminishing marginal return in *lnZ*-score with increasing the value of H-statistic

Note: Figure 4.3 shows the coefficient of the regression equation (3.2) presented in model 1 of Table 4.7.

Wooldridge (2015) argues that the inflection point can be used to explain the percentage of the data distribution beyond the inflection point. The inflection point of model 1 is 0.7631, which is approximate 90^{th} percentile, indicating that 90% of the data distribution is lying below the inflation point (0.7631). The remaining 10% of the data lying after the inflection point can be ignored. This result suggests that 90% of the H-statistic value implies stability enhancing effect. Thus, greater competition enhances stability of banks in the ASEAN countries. Wooldridge (2015) further claimed that sometime the inflection point gives a bias value due to omission of some important variables that may influence the relationship between the variable of interests with a partial effect on explanatory variable through interaction. For this reason, the explanation of the non-linear relationship should be done with care.

Model 2 of the Table 4.7 captures the *lnZ*-score as a measure of bank stability and competition with HHI. The coefficient of HHI is negative (-7.9555) and significant in linear terms, but it is positive for quadratic term (18.7167) and significant, demonstrating that the relationship between bank competition and stability is also non-linear. The relationship between bank concentration and stability is U-shaped. This suggests that the marginal effect HHI on *lnZ*-score is increasing. That is the slope of the change of *lnZ*-score with the change of HHI of equation (3.2) or $\frac{\Delta ln\text{Z}-\text{score}}{\Delta\text{HHI}} \cong \boldsymbol{\alpha_1 + 2\alpha_2}\textbf{HHI}$ or -7.9555+ 2(18.7167) HHI is increasing with getting the value of HHI is higher which is presented in Figure 4.4. If HHI is 0.11, the slope is -3.8378, if H is 0.13, the slope gets increased to -3.08916, and the slope becomes positive such as 0.6541 if HHI is 0.23. This means that the condition of decreasing in *lnZ*-score with an increase in HHI-statistic continues up to a certain level, after that the value *lnZ*-score will increase with any increase in HHI-statistic. That is, fragility effect of bank concentration continues up to a certain level, thereafter the effect of bank concentration on fragility turns to stability. Under this circumstance, inflection point of the variable of interest or HHI-statistic can be calculated to determine the maximum value of HHI-statistic which is considered as threshold HHI value, where inflection point of HHI is calculated as $\textbf{HHI}^* = \left|\frac{\alpha_1}{2\alpha_2}\right|$ or $\left|\frac{-7.9555}{2(18.7167)}\right|$= 0.2125. The non-linear relationship between HHI and *lnZ*-score is also tested using Sasabuchi-test. A significant t-value indicates that the relationship between bank concentration and stability is non-linear or U-shaped.

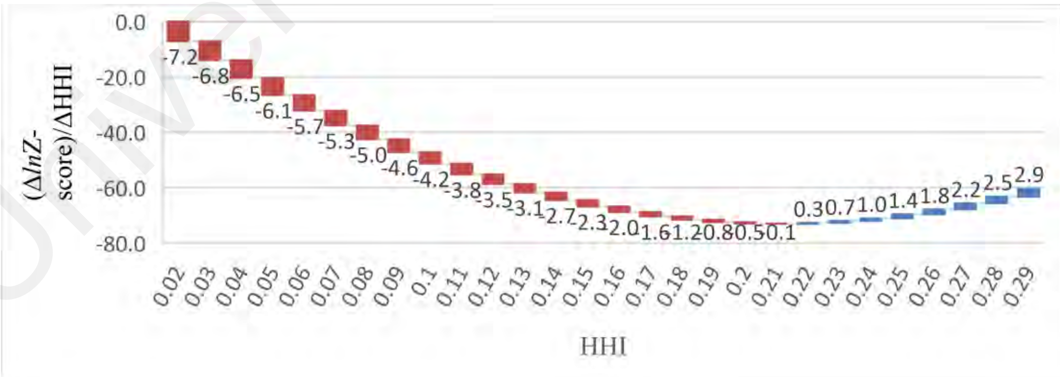

Figure 4.4 Increasing marginal return in *lnZ*-score with increasing the value of HHI

Note: Figure 4.4 shows the coefficient of the regression equation (3.2) presented in model 2 of Table 4.7.

On the other hand, the inflection point of model 2 is maximum at 0.2125 which is approximately corresponding to 95th percentile, indicating that 95% of the data distribution of HHI is lying below the inflection point, and only 5 percent of the distribution is lying right to the inflection point, which can be ignored (Wooldridge, 2015). Thus, this result suggests that higher concentration and less competition in the banking market of ASEAN countries lead greater insolvency and fragility.

Similarly, the non-linear relationship is observed in all other models in Table 4.7, such as in model 3 where H-statistic is regressed on NPL ratio with negative and significant coefficient in H (-7.0877) and positive and significant coefficient in quadratic value of H (3.7875). The marginal effect H-statistic on NPL ratio is presented in Figure. 4.5. Similarly, the marginal effect of concentration (HHI) on NPL ratio found in model 4 is presented in Figure 4.6 where HHI is regressed on NPL ratio with positive and significant coefficient of HHI (136.7103), and negative and significant coefficient of quadratic value of HHI (-321.6379). Likewise, the marginal effect of competition measured by H-statistic on equity ratio found in model 5 is presented in Figure.4.7. The H-statistic is regressed on equity ratio with positive and significant coefficient of H (2.3348), and negative and significant coefficient of quadratic value of H (-2.3459). In a similar vein, the marginal effect of concentration measured using HHI on equity ratio found in model 6 is also presented in Figure 4.8. The HHI is regressed on equity ratio with a negative and significant coefficient of HHI (-59.1708), and a positive and significant coefficient of the quadratic value of HHI (150.9356). As an alternative measure, for the all the above-mentioned models 3-6, this study also applied the Sasabuchi-test, and found significant t-value for all the models indicating existence of non-linear relationship between bank competition/concentration and stability.

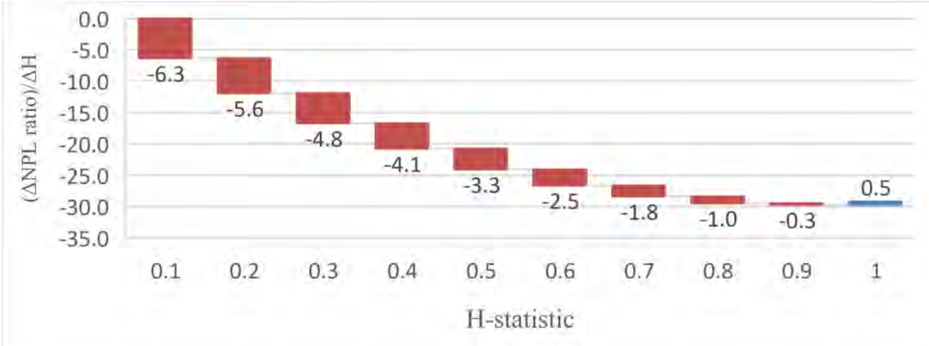

Figure 4.5 Increasing marginal return in *lnZ*-score with increasing the value of HHI

Note: Figure 4.5 shows the coefficient of the regression equation (3.2) presented in model 3 of Table 4.7.

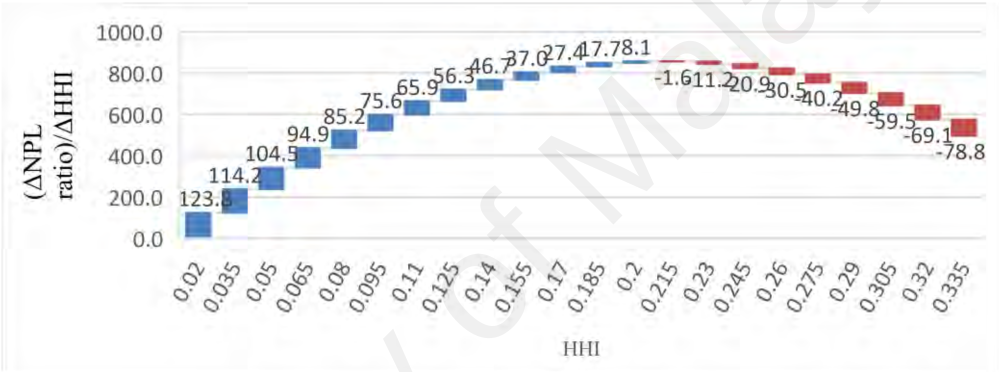

Figure 4.6 Diminishing marginal effect of concentration on NPL ratio in ASEAN-5 during 1990-2014

Note: Figure 4.6 shows the coefficient of the regression equation (3.2) presented in model 4 of Table 4.7.

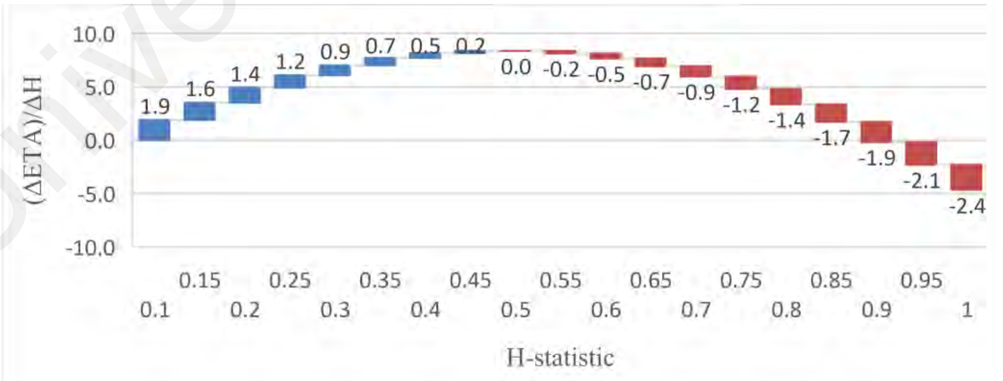

Figure 4.7 Diminishing marginal effect of competition on Equity ratio in ASEAN-5 during 1990 to 2014

Note: Figure 4.7 shows the coefficient of the regression equation (3.2) presented in model 5 of Table 4.7.

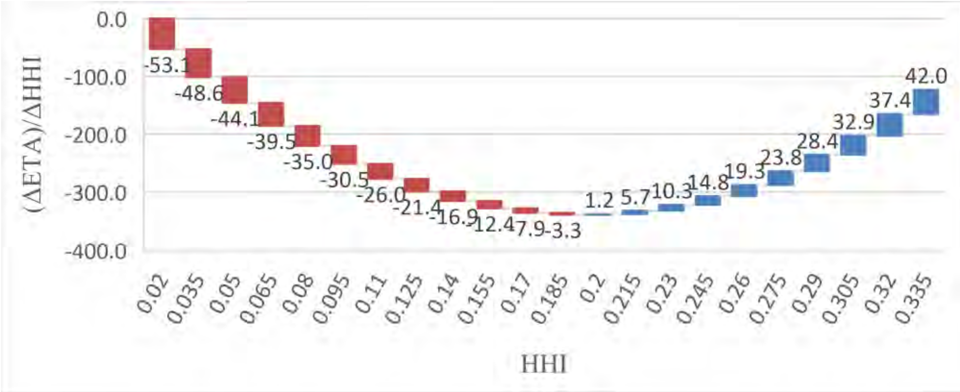

Figure 4.8 Increasing marginal effect of concentration on Equity ratio in ASEAN-5 during 1990 to 2014

Note: Figure 4.8 shows the coefficient of the regression equation (3.2) presented in model 6 of Table 4.7.

The inflection point of models 3, 4, 5 and 6 are 0.9357, 0.2172, 0.4976 and 0.1960 respectively. The inflection point of model 3 is 0.9357 which corresponds to approximately 95th percentile, indicating that 95% of the data distribution of H-statistic is lying below the inflection point, suggesting that greater competition in ASEAN-5 countries reduces credit risk in the bank portfolio. The inflection point of the model 4 is 0.2175 which corresponds to approximately 95th percentile of the data distribution. This also indicates that 95% of the data distribution of HHI is lying left to the inflection point, suggesting that greater concentration in the less competitive market increases credit risk in the banking system of the ASEAN countries.

Likewise, the inflection point of model 5 is 0.4976 which is approximately 50th percentile, indicating that only 50% of the data is lying below the inflection point, suggesting that greater bank competition promote capitalisation of banks in the ASEAN countries. The lower percentage of the data distribution of H-statistic may be due to omitted variable bias (Wooldridge, 2015). In addition, the inflection point of model 6 is 0.1960 which corresponds to approximately 95th percentile, indicating that 95% of the data distribution of HHI is lying left to the inflection point, suggesting that greater concentration or lower competition induces banks to be less capitalised.

Based on the results reported on Table 4.7, it can be concluded that the relationship between bank competition and stability is non-linear. It may be due to the omission of important variables explaining the relationship between bank competition and stability as argued by Wooldridge, (2015). Further, the inflection points of the variables of interest drive the research to conclude that most of the data distribution of the variables of interest H-statistic and/or HHI lying below the inflection point, and a very small percentage of the data distribution of the variable of interest is lying beyond the inflection point, which can be ignored. Therefore, based on the lion's share of the data distribution of H-statistic and HHI ratio, this thesis concludes that greater bank competition and lower concentration increases capitalisation and stability and reduces credit risk of banks in the absence of important variables such as bank regulation which may affect the relationship between bank competition and stability.

4.5.1.1 Robustness checks

This study offers several robustness checks to illustrate that the existence of competition-stability view for the commercial banks of ASEAN-5 is robust. Roodman (2006, 2009) argued that the system GMM improves efficiency of estimates compared to the alternatives dynamic OLS and dynamic fixed effect controlling serial correlation, heteroscedasticity and endogeneity problem. This study firstly test efficiency of the system GMM estimates by comparing the coefficient of lagged dependent variable provided by the system GMM against the same coefficient provided by dynamic OLS and dynamic fixed effect. Roodman (2006) argued that the coefficient of the lagged dependent variable of system GMM estimation must be within the range of the lagged dependent variable of dynamic OLS (provides maximum value due to upward biasness) and dynamic fixed effect (provides minimum value due to downward biasness). The coefficient of the lagged dependent variables of all models in Tables 4.6 and 4.7 are within the range of the same coefficient of lagged dependent variable estimated by using both dynamic OLS and dynamic fixed effect in Appendices E and F. Appendix E replicates Table 4.6 using equation (3.1), and Appendix F replicates Table 4.7 using equation (3.2). In addition to the proofing the efficiency of the system GMM estimates, both dynamic OLS and dynamic fixed effect estimates provide similar direction of the coefficient of both H-statistic and HHI in both Appendices E and F, indicating robustness of the original results that competition promotes bank stability in ASEAN-5 countries.

Secondly, concerning the non-existence long-run equilibrium for H-statistic in Indonesia and the Philippines during 1990-2014, as an alternative non-structural measure of bank competition in addition to the H-statistic, this study uses the Lerner index developed by Lerner (1934) which is used extensively to measure competition in bank literature including Jiménez et al. (2007), Berger et al. (2009), Deniz et al. (2012), Nguyen et al. (2012b), Amidu and Wolfe (2013), Liu and Wilson (2013), Soedarmono et al. (2013) and Fu et al. (2014). The Lerner index measures bank competition by determining market power of bank which is a mark-up of price over the marginal cost or the deviation of price from marginal cost. The value of the Lerner index ranges from 0 to 1, indicating perfect competition to pure monopoly. The details of Lerner index estimation process are provided in Appendix G. As an additional measure of bank competition, the study uses loan concentration ratio of large three banks (CR3) as alternative structural measure of bank competition, details estimation method of CR3 are also provided in Appendix G. Using the system GMM estimators, the regression results of equations (3.1) and (3.2) are reported in Appendix H and Appendix I respectively. Appendix H shows that the coefficient of the Lerner index is negative in model 1 on *lnZ*-score, and model 5 on equity ratio. It is positive in model 3 where the dependent variable is NPL ratio, demonstrating that greater market power induces banks to take more insolvency risk and credit risk, and hold less capital. Likewise, the coefficient of CR3 is negative in model 2 on *lnZ*-score, and model 6 on equity ratio, while it is positive in model 4, also demonstrating that high concentration in loan market increases insolvency and credit risk, and reduces equity ratio of the banks. This is consistent with the competition-stability view of Boyd & Nicolo (2005), and the previous findings from Tables 4.6 and 4.7. It, therefore, robustly supports Hypothesis 1. These results robustly suggest that more competition promotes stability in the banking sector.

To check the robustness of Hypothesis 2, this study incorporates quadratic term of both Lerner index and CR3 in equation (3.2). The GMM estimates of equation (3.2) are reported in Appendix I. With respect to the coefficients of Lerner index, although the sign of the quadratic term of Lerner index is different from that of respective linear term in models 1, 3 and 5, they are insignificant and do not fulfil the condition of non-linearity between bank competition and stability. In addition, the Sasabuchi-test does not provide any value for models 1 and 3, because of the extreme value (inflection point is 3.7627 in model 1, and is 3.6241 in model 3 lying beyond the conditional interval of Lerner index from 0 to 1). In addition, although the extreme value (inflection point) is lying in the conditional interval in Mode 3, the test statistic of Sasabuchi-test is insignificant. Therefore, the null hypothesis of the non-linear relationship between bank competition and stability is not supported if competition is measured using the Lerner index. This implies that the relationship between bank competition, captured by Lerner index, and bank stability is not non-linear, rather it is monotonic. With respect to CR3 as a measure of competition through concentration ratio, the Sasabuchi-test statistic is significant in models 2, 4, and 6, implying that the null hypothesis of the non-linear relationship between bank competition and stability is supported. However, the extreme value or inflection point is considered. It is 0.7016 in model 2, 0.7089 in model 4, and 0.6625 in model 6 while all are lying in the 95th percentile, indicating that 95% of the data distribution of CR3 lying below the inflection point and only 5% of the data of that distribution lying over the inflection point which may be ignored (Wooldrige, 2015). This might be due to the omission of some important variable as argued by Wooldrige (2015). On this basis, this study suggests that the non-linear relationship between bank competition and stability is not robust in ASEAN-5.

Thirdly, the correlation coefficient between NPL ratio (dependent variable) and loan loss reserve to gross loan ratio (independent variable) is 0.658 which is more than the cut-off rate of 0.50, and is considered as very high. The relationship between NPL ratio and bank competition measured by H-statistic and HHI controlling loan loss reserve ratio may be biased due to the possible causality running from NPL to loan loss reserve ratio. Therefore, the study re-estimates basic equation (3.1) dropping loan loss reserve ratio from the list of bank level control variable and the results reported in Appendix J. The estimated coefficient using the system GMM shows that the correlation coefficient of H-statistic is positive for the *lnZ*-score in model 1 and equity ratio in model 3, and negative for NPL ratio in model 5. This is consistent with the previous findings and supports the competition-stability view for the commercial banks of ASEAN-5

Fourthly, among ASEAN-5 countries, the banking market structure in Singapore is different from the other four countries (Indonesia, Malaysia, the Philippines and Thailand) in ASEAN-5. The average size of the bank in term of total assets in Singapore is US$ 37,623.6 million, while it is only US$ 7,396.22 million in the other four countries. The banking market of Singapore is very concentrated (CR3 is 0.930), where banks enjoy more market power (Lerner index is 0.215) and face lowest competition (H- statistic is 0.321). Conversely, the market structures in rest of the ASEAN-5 countries are similar in term of concentration ratio in the loan market measured by CR3 which is within the range of 0.464 to 0.530, and competition is represented by H-statistic which is within the range of 0.500 to 0.696. Therefore, the study decides to re-estimate the basic equation (3.1) considering only Indonesia, Malaysia, the Philippines and Thailand, excluding Singapore to ensure robustness of the main results presented in Table 4.6. The estimated coefficients using two-step system GMM reported in Appendix K. The results demonstrate that the coefficient of H-statistic is positive for the Z-score in model 1 and equity ratio in model 3, and it is negative for NPL ratio in model 5, which is consistent with the previous finding and ensure robustness of the finding that more competition promotes bank stability in ASEAN-5.

Finally, due to the adoption of tremendous financial liberalisation policy in order to foster competition and develop financial market drives the commercial banks in ASEAN countries to bring revenue diversification from traditional banking operations such as deposited funded loan to non-interest income generating operations in the form of securitisation, derivative sectaries, loan origination and standby letter of credit (Lee et al., 2014; Nguyen et al., 2012b). The revenue diversification not only provides the banks a protection against loss of franchise value and cash flows, it may also increase the risk exposure for them due to increase volatility in cash flows (Demirgüç-Kunt and Huizinga, 2010; Soedarmono et al., 2013). Therefore, this study includes the ratio of non-interest income to total revenue to proxy revenue diversification in the list of control variables in examining the relationship between bank competition and stability and the estimates of equation (3.1) using the system GMM are reported in Appendix L. Where the coefficients of H-statistic and HHI as measure of bank competition provide the same sign and significance in all models as presented in Table 4.6. The results of Appendix L also suggest that more competition reduces credit risk and promotes equity capitalisation and bank stability. Thus, the robustness tests the original findings of the study. More competition promotes stability in the banking sector by inducing them to take less credit risk and hold more equity capital and makes them stable in ASEAN-5.

4.5.2 Second Objective: Examine the moderating role of bank regulation on the relationship between bank competition and bank stability.

The results indicate that despite competition promotes bank stability, it may also have a fragility effect due to the presence of non-linear relationship in the banking sector of ASEAN-5. The existence of non-linear relationship may be due to the omission of important regulatory variables in the examination, because OECD (2010), Beck et al. (2013), World bank (2013), and Fu et al. (2014) claimed that the relationship between bank competition and bank stability depends on the regulatory framework. Therefore, to examine the role of bank regulation particularly capital regulation, activity restrictions, deposit insurance and official supervision on the relationship between bank competition and stability in the banking sector, this study developed Hypothesis 3, 'Bank regulation moderates the relationship between bank competition and bank stability. To test Hypothesis 3, this study extends equation (3.2), and designs the following two dynamic regression equations to test Hypothesis 3, which are reproduced below:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.10)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.11)$$

All the variables and subscripts in both equations (3.10) and (3.11) are retained same as in Chapter 3. In order to estimate the above equations (3.10) and (3.11), this study also applies the system GMM considering financial freedom and property right as instrumental variables in order to deal with serial correlation, heteroscedasticity and endogeneity issues. The GMM estimates of equations (3.10) and (3.11) are reported in the Tables 4.8 to 4.11 considering different proxies of bank regulation in a disaggregated manner. For example, in examining the relationship between bank competition and stability, as bank regulation, roles of capital regulation are reported in Table 4.8, and similarly the roles of activity restrictions, deposit insurance and official supervision are also reported in Tables 4.9, 4.10 and 4.11 respectively. In all the mentioned tables, models 1 and 2 present the GMM estimates of the above equations (3.10) and (3.11) considering *lnZ*-score as dependent variable, models 3 and 4 present the GMM estimates considering NPL ratio as dependent variable, and models 5 and 6 present the GMM estimates considering equity ratio as dependent variable to capture bank stability. On the other hand, Panzar-Rosse H-statistic is used as the only measure of bank competition in this part, because in addition to the justification for the H-statistic reported in methodology part, the study finds all significant H-statistic value in the previous analysis part. This means that H-statistic may better explain bank competition to show its effect on the stability in ASEAN-5 compares to the alternative competition measures including HHI, and also Lerner index and CR3 which are used in robustness analysis. Meanwhile, before running the GMM, a Variance Inflection Factor (VIF) is calculated and reported at the bottom of the table showing a value of less than 10 in all models.[33] This implies that the models are free from multicollinearity problem. In addition, the significant value of Wooldridge test, Breush- Pagan/Cook-Weisberg test and Wu-Hausman test indicate that this unbalanced panel is suffering from serial correlation, Heteroscedasticity and endogeneity issues.

Similar to the previous analysis, to handle the above mentioned issues, this study firstly runs first stage F-test using 2SLS regression to check instrumental validity, the significant value of first stage-F statistics indicates that the instruments are weak and invalid in 2SLS regressions. It justifies the use of Two-step system GMM of Arellano and Bover (1995) and Blundell and Bond (1998), as Roodman (2006) argued that system GMM can handle serial correlation, heteroscedasticity and endogeneity issues and provides more efficient estimates.

[33] A VIF value of more than 10 indicates multicollinearity problem (Gujarati, 2009)

In addition, as post-diagnostic test of the system GMM estimates, the insignificant value of Hansen's-J test ensures the validity of overidentifying restrictions indicating that instrumental variables used for handling endogeneity problem are valid, and heteroscedasticity issue is also controlled.[34].In addition, significant value of AR (1) and insignificant value of AR (2) indicate that serial correlation is present in the level (first order), but it is absent in the first difference (second order). Moreover, a significant value of Wald test implies that all models are correctly specified.

Tables 4.8-4.11 report Two-step system GMM estimates of the effect of bank regulation (particularly, capital regulation, activity restrictions, deposit insurance and official supervision) on the relationship between bank competition and stability. Where bank stability is captured with *ln*Z-score, NPL ratio and equity ratio, and bank competition is captured with H-statistic in all models. Tables 4.8-4.11 demonstrate that in presence of a specific bank regulation, despite the coefficient of H-statistic remain positive on *lnZ*-score in models 1 and 2, and equity ratio in models 5 and 6, and negative on NPL ratio in models 3 and 4, the coefficients of the quadratic term of H (H^2) become insignificant in the most of the models. In addition, the t-statistic of Sasabuchi-test in all models are insignificant. These results demonstrate that the bank regulation (especially, capital regulation, activity restrictions, deposit insurance and official supervision) strengthen the positive risk shifting effect of bank competition on stability and weaken the negative franchise value effect of bank competition on stability, and makes the relationship between bank competition and stability monotonic from non-linear, and weaken Hypothesis 2. This suggests that bank regulation plays an important role on the relationship between bank competition and stability by weakening the negative franchise value effect of competition.

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[34] This is because in the presence of heteroscedasticity the overidentification restrictions would not be validated(Baum, et al.,2003).

Table 4.8: The moderating role of capital regulation on the relationship between bank competition and bank stability

Dependent Variable	*lnZ*-score		NPL Ratio		Equity Ratio	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *ln*Z-score, NPL	.6362	.6356	.5666	.5657	.4129	.4122
ratio & equity ratio	(.0304)***	(0312)***	(.0588)***	(.0588)***	(.0770)***	(.0764)***
H-statistic (H)	.5585	.4892	-4.7944	-4.5695	.3578	.7134
	(.2710)**	(.4306)*	(2.0201)**	(1.9290)**	(1.1832)*	(1.9001)**
H^2	-.2898	-.2923	2.9812	2.6094	-.1991	-.4227
	(.2209)	(.2344)	(1.8261)	(1.7914)	(1.0680)	(1.1022)
Inflection Point	0.9636	0.8368	0.8041	0.8755	0.8985	0.8438
Capital Requirements	.0192	.0021	-.5703	-.4907	.3892	.1027
Index (CRI)	(.0233)	(.0333)	(.1223)***	(.1497)***	(.1465)***	(.1868)
H*CRI		.0334		-.1085		.5384
		(.0510)		(.1147)*		(.2421)**
Loan Composition	-.0096	-.0097	.0983	.1018	-.0121	-.0138
	(.0029)***	(.0029)***	(.0162)***	(.0173)***	(.0160)	(.0163)
Loan Quality	-.0296	-.0298	.3725	.3792	.0537	.0549
	(.0116)***	(.0117)***	(.0846)***	(.0855)***	(.0467)	(.0465)
Bank Size	-.0439	-.0412	.3594	.3497	-.6958	-.6493
	(.0264)*	(.0266)	(.2184)*	(.2212)	(.2559)***	(.2441)***
Operational	-.0054	-.0054	.0028	.0016	.0058	.0057
Efficiency	(.0020)***	(.0022)***	(.0135)	(.0134)	(.0105)	(.0107)
Ownership Dummy	.3384	.3386	-1.0065	-1.0407	.5872	.6137
	(.0949)***	(.0959)***	(.5297)*	(.5319)**	(.3689)	(.3736)*
GDP Growth Rate	.0125	.0125	-.0322	-.0285	-.0285	-.0245
	(.0082)	(.0081)	(.0601)	(.0607)	(.0398)	(.0396)
Inflation Rate	-.0194	-.0191	.1711	.1703	-.0853	-.0797
	(.0060)***	(.0060)***	(.0474)***	(.0488)**	(.0379)**	(.0362)**
Constant	2.3588	2.4300	-2.8214	-3.1159	11.3819	12.4118
	(.3432)***	(.3685)***	(2.4732)	(2.4343)	(2.7506)***	(2.898)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observation	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments.	142	142	142	142	142	142
Wald Test	1657.78	1634.80	785.54	774.53	168.29	174.85
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR (1)	-6.79	-6.76	-4.10	-4.07	-3.60	-3.58
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR (2)	1.13	1.10	-0.35	-0.43	-0.80	-0.96
(P-value)	(0.257)	(0.269)	(0.724)	(0.668)	(0.424)	(0.338)
Hansen's J Test	144.74	144.04	140.91	141.10	143.25	140.60
(P-value)	(0.178)	(0.173)	(0.242)	(0.220)	(0.201)	(0.229)
First Stage F-test (P-	3.4872	208.358	3.0177	203.258	3.0177	203.25
value)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Wooldridge Test	242.687	241.403	46.595	47.120	157.81	157.83
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wu-Hausman Test (P-	7.9135	5.697	17.3186	20.9205	6.68718	3.757
value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Breush Pagan/Cook-	249.55	246.59	3554.92	3558.70	1219.89	1217.96
WeisbergTest (P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sasabuchi-test(P-value)	0.71(.238)	0.93(.177)	0.48(.317)	0.56(.288)	0.68(.342)	0.75(.276)
VIF	2.45	5.20	2.44	5.22	2.44	5.22

This table presents the system GMM estimates with robust standard error in the parenthesis of the following equations in order to test hypothesis 3

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.10)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.11)$$

CRI is bank regulation indicating Capital Requirements Index. Details of this table are presented in Appendix C.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

For a deeper understanding of the issue and determine the moderating role of bank regulation on the relationship between bank competition and stability, this study investigates how a particular bank regulation influences stability in competition environment.

At first attempt, this study investigates how capital regulation moderates influences the bank competition- stability relationship. That is, whether capital regulation enhance or weaken the relationship between bank competition and stability. Models 1 and 2 of Table 4.8 demonstrate that the coefficient of capital requirements index on *lnZ*-score is positive, but insignificant.

Models 3 and 4 demonstrate the empirical results of the effect of capital regulation on bank competition-stability relationship when NPL ratio is used as dependent variable. Model 3 shows that the coefficient of capital requirements index is negative on NPL ratio, and significant at 1 percent, suggesting that capital regulation appears an effective regulatory policy to reduce credit risk of the banks. This may be attributed to the fact that high capital regulation stimulates banks to set stricter loan granting criteria for ASEAN banks, and focuses on building a close relationship with borrowers with too-big- to-fail problem based on which bank may grant less loan to them. The finding is consistent with the theoretical model of Zhang, Jun, & Liu (2008), who argued that implementation of Regulation Governing Capital Adequacy ratio effectively reduces banks' the risk-taking behaviour as well as optimum risk assets ratio.

The finding is consistent with Konishi & Yasuda (2004) who adopted time series cross sectional regression model incorporating different variables including franchise value, bank shareholding, value of shares, and dummies to capture acceptance from the Ministry officer. Their findings revealed that capital adequacy minimised risk-taking activities for regional Japanese commercial banks.

An interaction term of capital requirements index and bank competition is included in model 4 to examine whether the risk minimising effect of capital stringency changes depending on the level of competition. As the coefficient of both capital requirements index and the interaction term of capital requirements index and competition proxy (H-statistic) is negative and significant at 1 percent and 10 percent level respectively in model 4, it is inferred that the risk minimising effect of capital regulation does not change in more competitive environment. This supports Hypothesis 3 that bank regulation moderates the relationship between bank competition and stability by promoting bank stability in both less competitive and more competitive environment.

The finding is consistent with Repullo (2004) whose dynamic model based on the model of Hellmann et al. (2000) argued that capital regulation does not erode the franchise value of the banks, because the cost of capital requirements is fully transferable to the depositor, and high capital requirements is effective in reducing the excessive risk-taking behaviour of the banks.

In addition, models 5 and 6 report the results of capital regulation effect on equity ratio. Model 5 exhibits that the coefficient of capital stringency is positive and significant at 1 percent level on equity ratio as proxy of bank stability, suggesting that capital regulation has a positive effect on equity ratio implying that any increase in capital regulation increases equity capital of the banking industry. This finding is consistent with the supervisory power hypothesis that capital regulation increases banks' equity ratio which helps them to strengthen the financial soundness by limiting them from taking excessive risk (Jackson et al., 1999). In respect to risk limiting effect of capital requirements, Berger et al. (2009) argued that high capital adequacy provides franchise value which a bank may enjoy only if it remains active in the market and takes lower lending risk. In addition, a positive and significant coefficient of the interaction term of capital requirements index and H-statistic at 1 percent level on equity ratio in model 6 suggests that stringent capital regulation obliges banks to hold more capital in competitive market which induces them to take less insolvency risk and enhances bank stability of the banking system. This finding is consistent with the previous expectation of capital regulation as utility of capital to avoid moral hazard problem and build market power for the banks. The fundamental reason is that banks need to hold more capital with increasing capital requirements, indicating that shareholders' equity is at risk and face more equity losses if the bank become insolvent. Therefore, capital regulation incentivises banks to take less risk and be more prudent in investment. This finding is consistent with the work of Repullo (2004) who found that risk based capital requirements enhance banks' market power and is an effective tool to restrain banks from risk-taking in perfectly competitive deposit market. The result is consistent with the finding of Berger & Bouwman (2013) who considered capital stringency as banks' incentive to enhance relationship with borrowers which reduce moral hazard and default probability. The overall results of Table 4.8 suggest that capital regulation is positively related to capitalisation and negatively related to credit risk, suggesting that stringent capital regulation promotes bank stability by enhancing capitalisation and reducing both credit risk. The results further demonstrate that the positive effect of capital regulation on bank capitalization and negative effect of capital regulation on credit risk remain even in the more competitive banking market. These findings of capital regulation support hypothesis 3.

After analysing the moderating role of capital regulation, this part examines the role of the activity restrictions index to capture activity restrictions on the relationship between bank competition and stability in ASEAN-5 from 1990 to 2014. Table 4.9 demonstrates that the coefficient of activity restrictions index on *lnZ*-score is negative and significant at 5 and 1 percent level in models 1 and 2 respectively, demonstrating that more restrictions is negatively associated with bank stability in the ASEAN countries.

Table 4.9: The moderating role of activity restrictions on the relationship between bank competition and bank stability

Dependent Variable	***lnZ*-score**		**NPL Ratio**		**Equity Ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *lnZ*-score, NPL ratio and equity ratio	.6525 (.0304)***	.6601 (.0317)***	.4763 (.0592)***	.4754 (.0599)***	.4328 (.0769)***	.4319 (.0762)***
H-statistic(H)	.6420 (.2687)**	0.759 (.7590)	-1.0413 (1.9631)	-.9250 (4.3702)	.3214 (1.2911)	.1713 (1.3063)
H^2	-.3372 (.2224)	-.4263 (.2139)**	.7930 (1.9225)	.8120 (1.9504)	-.5879 1.2021)	-.6117 (1.1965)
Activity Restrictions Index	-.0348 (.0153)**	-.1150 (.0440)***	.8162 (.1166)***	.7019 (.2622)***	-.2244 (.0993)**	-.2688 (.0974)*
H*ARI		.1784 (.0697)**		-.9955 (.3565)*		.4266 (.0391)
Loan Composition	-.0084 (.0026)**	-.0061 (.0024)**	.1265 (.0227)***	.1217 (.0230)***	-.0352 (.0162)**	-.0351 (.0159)**
Loan Quality	-.0198 (.0091)**	-.0177 (.0089)**	.4320 (.0875)***	.4318 (.0873)***	.0451 (.0485)	.0419 (.0489)
Bank Size	-.0193 (.0284)	-.0341 (.0309)	-.3571 (.2306)	-.3361 (.2347)	-.3557 (.2172)	-.3527 (.2202)
Operational Efficiency	-.0052 (.0020)**	-.0052 (.0018)***	.0216 (.0142)	.0215 (.0140)	.0093 (.0105)	.0106 (.0117)
Bank Ownership	.2297 (.0982)**	.2143 (.0939)**	-.8081 (.4960)*	-.7602 (.5011)	.3078 (.3153)	.3196 (.3053)
GDP Growth Rate	.0159 (.0079)**	.0146 (.0076)**	-.0569 (.0625)	-.0512 (.0634)***	-.0198 (.0391)	-.0254 (.0395)
Inflation Rate	-.0249 (.0056)***	-.0273 (.0062)***	.1987 (.0490)***	.2033 (.0504)***	-.1002 (.0400)***	-.0989 (.0410)***
Constant	2.4994 (.3679)***	3.4814 (.6298)***	-12.1325 (3.1083)***	-14.3627 (4.3550)	13.8838 (3.2694)***	13.9145 (3.2393)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	142	142
Wald Test (P-value)	1685.49 (0.000)	1815.47 (0.000)	850.64 (0.00)	877.60 (0.00)	 (0.00)	146.35 (0.00)
AR (1) (P-value)	-6.77 (0.00)	-6.84 (0.00)	-4.10 (0.00)	-4.12 (0.00)	-3.68 (0.00)	-3.68 (0.00)
AR (2) (P-value)	1.13 (0.260)	1.09 (0.276)	-0.56 (0.575)	-0.38 (0.700)	-1.01 (0.312)	-1.02 (0.308)
Hansen's J Test (P-value)	148.00 (0.134)	148.92 (0.111)	148.43 (0.128)	149.13 (0.108)	141.80 (0.226)	141.40 (0.215)
First Stage- F-Test (P-value)	3.2998 (0.00)	3.72158 (0.00)	2.6817 (0.01)	3.7804 (0.050)	3.68179 (0.01)	3.7804 (0.04)
Wooldridge Test (P-value)	238.326 (0.00)	238.350 (0.00)	47.232 (0.00)	47.268 (0.00)	158.170 (0.00)	161.106 (0.00)
Wu- Hausman Test (P-value)	49.6466 (0.00)	53.3892 (0.00)	51.1987 (0.00)	48.9658 (0.00)	36.386 (0.00)	37.341 (0.00)
Breush–Pagan/Cook - Weisberg Test (P-value)	269.29 (0.00)	279.27 (0.00)	3237.50 (0.00)	3157.90 (0.00)	1206.66 (0.00)	1171.24 (0.00)
Sasabuchi-test (P-value)	0.84 (0.20)	0.74 (0.461)	0.12 (.451)	0.20 (0.421)	0.37 (0.355)	0.31 (0.376)
VIF	2.42	2.43	2.49	2.50	2.39	2.43

This table presents the system GMM estimates with robust standard error in the parenthesis of the following equations in order to test Hypothesis 3

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.10)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.11)$$

ARI is bank regulation indicating Activity Restrictions Index. The details of this table are presented in Appendix C

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

This result is consistent with the expectation of this study, suggesting that imposition of restrictions on fees based services and owning from non-bank financial institutions incentivise banks to take more risk which increases their insolvency risk and undermine bank stability. Regarding this issue, Stijn Claessens (2003) argued that financial services integration in emerging counties is a hot debating issue. Theoretically, activity restrictions reduce the scope of risk diversification opportunity. It also reduces the opportunity of risk shifting to other lines of businesses providing fees or profit to compensate potential loss from traditional banking. Rather, it forces banks to remain in the traditional banking activities to earn only interest and reducing the opportunity to earn fees, and franchise value.

Therefore, banks focus on the loan market which stimulates banks to take more insolvency risk to compensate the opportunity costs from fees based business and franchise value erosion. Thus, this study suggests that imposition of activity restrictions incentivises banks to increase their market share by lending to the risky borrowers with low credit worthiness. This study argues that activity restrictions weaken stability of the banking system by increasing credit risk and insolvency risk of banks. This finding is consistent with Barth et al. (2004) who found a negative impact of activity restrictions on the banking sector development of 107 countries, and also greater restrictions increases the possibility of likelihood of major financial crisis. This finding is consistent with Laeven & Levine (2009) who claimed that the risk-taking tendency of the banks is increased, if the activities of banks are concentrated to a particular market, and banks are unable to add a new line of business. The results are consistent with Lin et al. (2013) who found that tighter restrictions on traditional activities of banks decreases their performance in the banking system in 72 countries over the 1999-2007 period.

To examine the moderating role of activity restrictions on bank stability in competitive market, an interaction term of activity restrictions index and H-statistic is used in model 2, where the dependent variable is considered as the *ln*Z-score. Model 2 demonstrates that coefficient of the interaction term becomes positive on *ln*Z-score, suggesting that activity restrictions incentive banks to invests prudently in more competitive market which is consistent with supervisory hypothesis. This may be due to the fact that activity restrictions neutralise the negative 'franchise value effect' of competition for taking extra risk in order to compensate the lost in franchise value. As a result, activity restrictions cause the banks to be careful and prudent in investment decision making and induce them to take less risk. Activity restrictions not only increases risk-taking incentive to the bank due to less scope of risk diversification, it also increases competition on the traditional banking market which induces banks to take less risk due to 'risk shifting effect', where the 'risk shifting effect' argues that banks assumes less risk in the competitive loan market. Greater risk-taken by a bank increases the default risk of its borrowers which ultimately shifted to the bank due to high positive correlation between the bank's insolvency and borrowers' default risk (Boyd & Nicolo, 2005). Regarding the stabilisation effect of activity restrictions in a competitive market, the finding is consistent with the theoretical consideration of Hellmann et al. (2000) who suggested that restrictions on certain assets class reduce moral hazard problem of the banks, especially if they accelerate gambling opportunities which may cause of moral hazard. In a similar vein, Matutes & Vives (2000) suggested that activity restrictions can substitute the role of capital regulation and deposit insurance in reducing the risk-taking behaviour of the banks in a highly competitive market. Similarly, Beck (2008) reported that many industrialised countries imposed restrictions on branching and other activities to banks after financing crisis of 1930s to promote competition and improve bank stability.

The effect of activity restriction on the NPL ratio is reported in models 3 and 4. The coefficient of activity restrictions on NPL ratio is positive in model 3, suggesting that an increase in activity restrictions increases the credit risk of the banks. However, the negative coefficient of the interaction term of activity restrictions index and H-statistic in model 4 suggests the activity restrictions have a positive effect on credit risk-taking of the banks, and that positive effect is weakened with an increase in the level of competition in the banking sector. This result is consistent with the empirical findings of Lepetit, Nys, Rous, & Tarazi (2008) who found from 602 European banks from 1996-2002 that liberalisation of activity restrictions on banking activities for fees banks income increases banks' credit risk. This result is consistent with our findings in model 2. This results can be interpreted that activity restrictions erode the franchise value and profit buffer of the banks if the level of competition in the market is less and banks enjoys more market power with risk diversification opportunities. However, activity restrictions have a positive effect on promoting the level of competition as argued by Barth et al. (2004) and Beck (2008) which erodes franchise value and profit buffer and induces banks to take less credit risk due to risk shifting effect.

The effect of activity restrictions on equity ratio is reported in models 5 and 6. The effect of activity restrictions on equity ratio is reported in model 5. A negative coefficient of activity restrictions on equity ratio suggests that activity restrictions reduce the incentive of banks to hold more equity capital. This finding is consistent with our previous finding in the models with Z-score and NPL ratio. This is due to the fact that activity restrictions reduce the franchise value and profitability of the banks which reduces banks capital buffer and equity ratio. The interaction term of activity restrictions index and H-statistic in model 6 provides a positive coefficient, suggesting that activity restrictions induce banks to hold more capital if they face competition in the traditional loan market. This is because, activity restrictions increase the level of competition in the traditional banking market which makes the banks more prudent in risk management to avoid the fragility effect of competition. As a prudent risk management strategy, banks hold more capital which is considered as a buffer against upcoming unexpected losses and shocks (Berger et al., 2009, 2013). The results suggest that greater activity restrictions in a highly competitive market induces banks to hold more equity capital and renders the banking industry financially stable. The overall result in Table 4.9 suggests that the imposition of activity restrictions in competitive banking market promote bank stability by reducing risk-taking behaviour and increasing capitalisation.

To determine the threshold level on bank in competitive environment able to benefit from activities restrictions, this study determines the partial effect of activity restrictions on competition and stability relationship presented in equation (3.11). It takes the first derivative of absolute value of stability functions with respect to activity restrictions and make it equal to zero in the following way.

$$\left| \frac{\Delta STAB_{ijt}}{\Delta ARI_{jt}} = \alpha_4 + \alpha_5 * H = 0 \right| \quad (4.1)$$

Here, STAB indicates bank stability which is captured with *lnZ*-score, NPL ratio and equity ratio. ARI indicates activity restrictions index and H indicates H-statistic which is the measure of competition. α_4 is the coefficient of regulatory variable to capture activity restrictions, and α_5 is the coefficient of the interaction term of the bank regulation, activity restrictions index, and H-statistic indicating the level of competition.

This study solves equation (4.1) to calculate the value of H-statistic for models 2, 4 and 6 in the following way.

Using the values from model 2, the value of H-statistic is-

$$\left| \frac{\Delta \mathrm{STAB_{ijt}}}{\Delta \mathrm{ARI_{jt}}} = -0.1150 + 0.1784 * \mathrm{H} = 0 \right| \text{ or H= 0.6446}$$

Using the values from model 4, the value of H-statistic is-

$$\left|\frac{\Delta \mathrm{STAB_{ijt}}}{\Delta \mathrm{ARI_{jt}}} = 0.7019 - 0.9955 * \mathrm{H} = 0\right| \text{ or H= 0.7051}$$

Using the values from model 6, the value of H-statistic is-

$$\left|\frac{\Delta \mathrm{STAB_{ijt}}}{\Delta \mathrm{ARI_{jt}}} = -0.2688 + 0.4266 * \mathrm{H} = 0\right| \text{ or H= 0.6301}$$

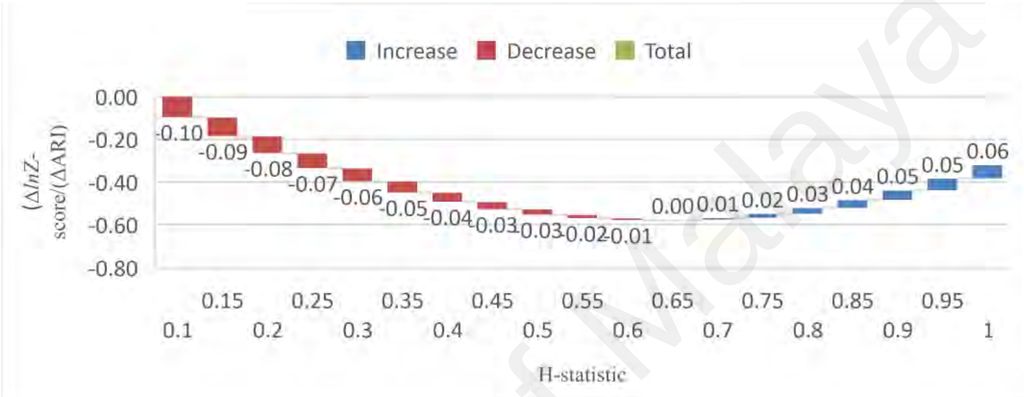

Figure 4.9 The marginal effect of activity restrictions on bank competition-stability relationship

Note: Figure 4.9 shows the coefficients of the regression equation (3.11) presented in model 2 of Table 4.9.

Figure 4.9 demonstrates that the marginal effect of activity restrictions on log of Z-score is negative (-0.10) at lower value of H-statistic (0.1), but the negative marginal effect is reduced (such as -.09, -0.8, -0.7 and so on) by increasing the value of H-statistic (such as 0.15, 0.2, 0.25 and so on). The marginal effect becomes zero if H-statistic is 0.6446. For any value of H-statistic more than 0.6446, the marginal effect of activity restrictions on log of Z-score becomes positive. Figure 4.9 suggests that despite activity restrictions decreases stability of the banks at lower competition level, the marginal effect of activity restrictions on bank stability is increasing in highly competitive market and this happen when competition in the market is more than 0.6446 as measured by the H-statistic which is consistent with the theoretical considerations of Hellmann et al. (2000) and Barth et al. (2004) who argued that restrictions on certain assets class reduce moral hazard problem in a situation where gambling opportunity results in a moral hazard. This is because greater competition makes banks more prudent in loan price determination and investment decision making due to risk shifting effect of Boyd & Necolo (2005).

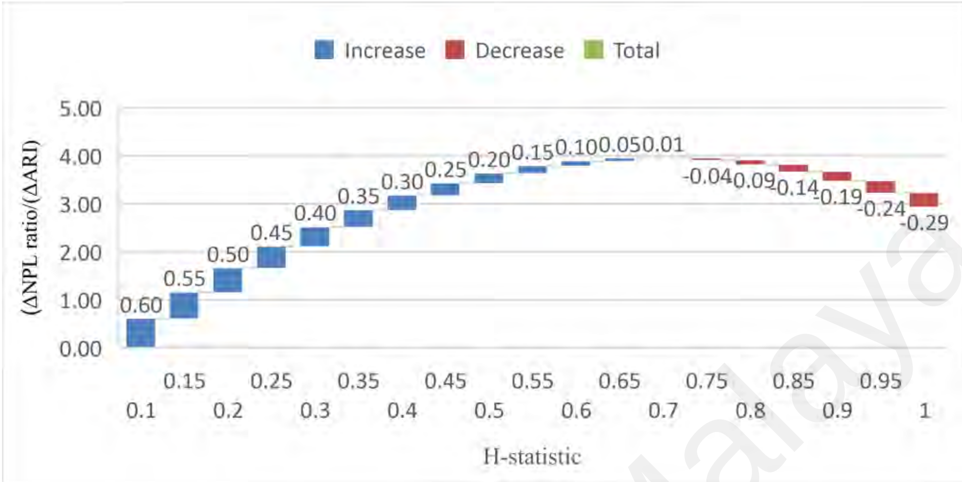

Figure 4.10 The marginal effect of activity restrictions on bank competition-stability relationship.

Note: Figure 4.10 shows the coefficients of the regression equation (3.11) presented in model 4 of Table 4.9.

Figure 4.10 shows a diminishing marginal effect of activity restrictions on NPL ratios when the level of competition increases. The figure shows that imposition of activity restrictions increases NPL ratio when the bank competition is less, but activity restrictions decrease the NPL when competition is more at 0.7051. This may due to law of diminishing marginal effect (Wooldrige, 2015). This is because activity restrictions increase risk-taking behaviour due to narrowing down the scope to operations and risk diversification. Tight restrictions on branching, securities, insurance and owning non-bank financial institution force banks to operate only in the traditional loan market which erodes bank's franchise value and gives rise to moral hazard problem of the bank to compensate the lost franchise value (Barth et al., 2004). On the other hand activity restriction also increases competition which oblige banks to be prudent in investment and risk-taking in order to survive in the competitive market (Matutes & Vives, 2000).

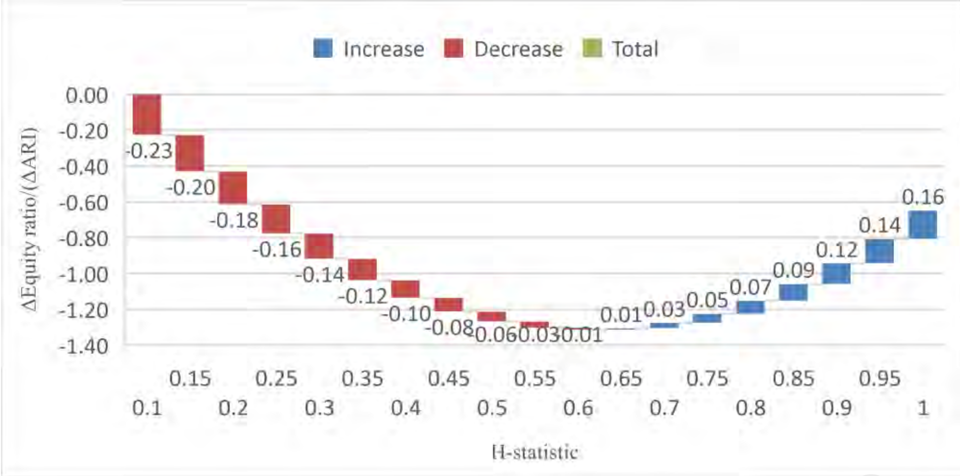

Figure 4.11 The marginal effect of activity restriction on bank competition-stability relationship

Note: Figure 4.11 shows the coefficients of the regression equation (3.11) presented in model 6 of Table 4.9.

The marginal effect of activity restrictions on equity ratio at different levels of competition is calculated and presented in Figure 4.11. Greater equity capitalisation is considered as a credit risk management strategy which increases bank solvency by creating a buffer against upcoming unexpected financial shocks (Berger et al., 2009). As Figure 4.9 shows, Figure 4.11 also shows an increasing marginal effect of activity restrictions on equity ratio with level of competition. The marginal effect of activity restrictions on equity ratio is -0.23 when H-statistic is 0.1, but the marginal effect increases with increasing levels of competition. The marginal effect becomes -0.06 when H is 0.50 and the marginal effect becomes positive 0.01 when H-statistic is 0.65. These results suggest that banks holds less capital with imposition of activity restrictions at less competitive environment, but intensity of capitalisation increases as banks face with more competition.

The results provide interesting implications for policy makers with respect to formation of activity restrictions and bank competition policy. The activity restrictions enhance bank stability depends on the level of competition in the banking market. Activity restrictions render to banks fragile in less competitive environment due to the limited scope of operations and risk diversification. This effect is changed with increasing competitive pressure in the market. Greater activity restrictions in the more competitive environment increases bank stability (higher solvency, reduction in credit risk and increase in equity to capital ratio) The results suggest that greater activity restrictions lead banks to give more risky loan in less competitive market when banks gain significant market power, but the risk taking behaviour of banks is changed in the highly competitive market when the market power of the banks is eroded.

Next, the effect of deposit insurance on bank competition-stability relationship is estimated using equations (3.10) and (3.11). Table 4.10 exhibits the moderating role of deposit insurance on the relationship between bank competition-stability relationship considering *ln*Z-score in models 1 and 2, NPL ratio in models 3 and 4 and equity ratio in models 5 and 6 as dependent variable. The main explanatory variables in the models are competition which is captured with H-statistic and deposit insurance which is captured with a dummy variable.

Table 4.10 demonstrates H-statistic has a positive effect on *ln*Z-score in models 1 and 2, equity ratio in models 5 and 6, and negative effect on NPL ratio in models 3 and 4. It indicates that greater competition promotes stability and capitalisation, and reduces credit risk in the banking sector. This finding suggests that the effect of bank competition on stability remains unaltered by including the deposit insurance.

Table 4.10: The moderating role of deposit insurance on the relationship between bank competition and bank stability

Dependent Variable	*ln*Z-score		NPL Ratio		Equity Ratio	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *ln*Z-score, NPL ratio and equity ratio	.6408 (.0328)***	6526 (.0349)***	.5863 (.0609)***	.5872 (.0622)***	.4316 (.0885)***	.4308 (.0895)**
H-statistic	.6350 (.2639)**	.8475 (.3597)***	-5.3117 (2.1127)***	-8.1239 (2.3517)***	.5770 (1.3741)	.2915 (1.3190)
H-statistic^2	-.3233 (.2167)	-.4492 (.2463)*	2.9705 (1.8561)	4.9492 (1.8975)***	-.9147 (1.2172)	-.8687 (1.1863)
Deposit Insurance (DI)	.0648 (.0787)*	0.0826 (.1199)*	-1.5533 (.5581)***	-1.3632 (.8813)***	.5816 (.4764)	0.5216 (.5235)
H-statistic*DI		-.1223 (.2366)*		2.1527 (1.2861)***		0.7874 (.6079)
Loan Composition	-.0089 (.0034)***	-.0096 (.0034)***	.0904 (.0224)***	.0966 (.0224)***	-.0169 (.0188)	-.0166 (.0185)
Loan Quality	-.0322 (.0115)***	-.0352 (.0130)***	.3752 (.0804)***	.4278 (.0794)***	.0523 (.0657)	.0587 (.0617)
Bank Size	-.0299 (.0301)	-.0391 (.0317)	-.0484 (.2121)	.0218 (.1991)	-.4496 (.2201)**	-.4142 (.2349)*
Operational Efficiency	-.0038 (.0020)*	-.0035 (.0019)*	-.0029 (.0134)	-.0057 (.0138)	.0035 (.0118)	.0048 (.0119)
Foreign Ownership	.2772 (.1007)***	.2875 (.1028)**	-.9939 (.6264)	-1.0241 (.6082)*	.9063 (.3446)***	.8892 (.3630)**
GDP Growth Rate	.01227 (.0088)	.0126 (.0089)	-.0030 (.0651)	-.0062 (.0644)	-.0217 (.0425)	-.0278 (.0445)
Inflation Rate	-.0199 (.0056)***	-.0198 (.0057)***	.1667 (.0483)***	.1658 (.0474)***	-.1103 (.0503)**	-.1073 (.0544)**
Constant	2.1811 (.3779)***	2.1432 (.3820)***	-.5942 (2.8699)	-.0877 (2.8276)	10.8864 (3.7238)***	10.5885 (3.7197)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	1856	1856
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	171	171
Wald Test (P-value)	1505.83(.00)	1460.15(.00)	1024.72(.00)	1015.61(.00)	151.35(.00)	155.41(.00)
AR (1) (P-value)	-6.77(.00)	-6.83(.00)	-4.10(.00)	-4.20(.00)	-3.51(.00)	-3.53(.00)
AR (2) (P-value)	1.10(.27)	1.07(.28)	-0.26(.79)	-0.03(.98)	-1.08(.28)	-1.08(.28)
Hansen's J Test (P-value)	149.77(.11)	148.99(.11)	142.86(.21)	145.10(.16)	142.14(.22)	142.05(.20)
FirstStage F-test (P-value)	28.0826 (0.00)	4.0105 (0.00)	28.4484 (0.00)	5.0155 (0.07)	28.4484 (0.00)	4.0155 (0.00)
Wooldridge Test (P-value)	238.838 (0.00)	238.304 (0.00)	47.429 (0.00)	48.875 (0.00)	156.688 (0.00)	156.192 (0.00)
Wu-HausmanTest (P-value)	22.0782 (0.00)	17.967 (0.00)	85.6336 (0.00)	86.0816 (0.00)	74.5162 (0.00)	70.6357 (0.00)
Breush –Pagan/Cook-Weisberg Test (P-value)	236.30 (0.00)	236.81 (0.00)	3272.95 (0.00)	3268.42 (0.00)	1126.81 (0.00)	1101.18 (0.00)
VIF	2.44	3.32	2.42	3.29	2.42	2.75
Sasabuchi-test (P-value)	0.76 (.22)	0.89 (0.19)	0.71 (0.24)	0.99 (0.16)	0.58 (0.28)	0.47 (0.32)

This table presents the system GMM estimates with robust standard error in the parenthesis of the following equations in order to test Hypothesis 3

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.10)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.11)$$

DI is bank regulation indicating deposit insurance. The details of this table are presented in Appendix C.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

With respect to the role of deposit insurance on bank stability, the results in models 1 and 2 show that the coefficient of deposit insurance on *ln*Z-score is positive and significant at level 10 percent, suggesting that deposit insurance has a positive effect on bank stability. It further suggests that deposit insurance increases solvency and reduces the insolvency risk of the banks. This may be attributed to the fact that deposit insurance promotes the level of intermediation in the banking market and reduces the moral hazard of the bank for taking excessive risk. In the absence of deposit insurance, banks need to offer high deposit rate to the depositors which would increase loan interest rate and moral hazard of the banks. On the other hand, in the presence of deposit insurance, depositors are protected by public safety net which builds their confidence on the banking system and stimulate them to deposit their savings in the banking system. This not only increases banks' market power of loan creations and earn more return, it also increases their stability. This finding is consistent with Diamond & Dybvig (1983), who argued that the deposit insurance system reduces the danger of bank runs and a systematic effect of a run on a bank that could cause spillover to other banks, the banking system and the entire economy of a country. It is also consistent with Demirgüç-Kunt & Detragiache (2002) who argued that deposit insurance brings stability of the banking system in promoting the level financial intermediation. Thus, deposit insurance promotes stability by creating stabilisation of deposits in the banks and assuring depositors that their deposits are protected and safe.

The deposit insurance also regressed on NPL ratio in models 3 and 4. The negative and significant coefficient of deposit insurance at level 1 percent suggest that deposit insurance has a negative effect on the credit risk in the banking system. This finding is consistent with Karels & McClatchey (1999) who investigated the relationship between deposit insurance and risk-taking behaviour of US credit union industry using industry average financial ratios for federal and state credit unions. They found that risk-taking behaviour of the credit unions declined in post-deposit insurance period. This finding is also consistent with Gropp & Vesala (2004) who found that deposit insurance reduces moral hazard and risk-taking behaviour of EU commercial banks. This finding is consistent with the work of Anginer et al. (2014b) who found banks take less insolvency risk in the counties with explicit deposit insurance and remain systematically stable during the 2008-09 credit crunch.

To examine how deposit insurance effect on bank stability and risk-taking with increased levels of competition, an interaction term of deposit insurance and competition is added on *ln*Z-score in model 2 and on NPL ratio in model 4, the coefficient of which is found negative in model 2 and positive in model 4, suggesting that deposit insurance undermines the bank stability and exacerbates risk exposure with increasing of the level of competition in the banking market. This may be due to the fact that deposit insurance creates moral hazard among the banks in competitive markets, because of the franchise value effect of the competition, where greater competition erodes market power and franchise value and induces banks to take more risk in order to offset the lost franchise value. In addition, in the presence of deposit insurance in the banking system, depositors are protected and they are unlikely to monitor the risk-taking activities of the banks. Therefore, banks can borrow funds at lower interest rate issuing deposit insurance, which then lend to risky borrowers at high interest rate in order to compensate their lost franchise value. This finding is consistent with Keeley (1990) and Chernykh & Cole (2011) who found strong evidence that the introduction of deposit insurance increases credit risk of Russian the banking system. However, it contradicts Hellmann et al. (2000) who argued that deposit insurance reduces banks risk-taking behaviour in competitive market, albeit capital stringency boosts their franchise value. It also contradicts Landskroner & Paroush (2008) who showed evidence that banks lose their monopolistic power and charter value, and take more risk with increasing competition in the deposit market if deposits are uninsured. However, in the presence of the deposit insurance, the charter value of the banks increases if competition rises.

The overall results of Table 4.10 suggest that deposit insurance has a positive effect on bank stability. However, the positive effect of deposit insurance on banking stability changed in highly competitive banking environment by increasing the insolvency and credit risks. It would be interesting for the policy makers to determine the level of competition in the ASEAN market where the stability effect of deposit insurance is neutralised and beyond which the moral hazard effect of deposit insurance starts dominating. This study further determine the threshold level of competition (H-statistic) in which deposit insurance changes the bank competition- stability relationship that may have significant policy implication.

To calculate the threshold level of competition or the value of H-statistic, this study determines the partial effect of deposit insurance on bank competition and stability relationship presented in equation (3.11) and take the first derivative of absolute value of bank stability functions with respect to deposit insurance and make it equal to zero in the following way.

$$\left| \frac{\Delta STAB_{ijt}}{\Delta DI_{jt}} = \alpha_4 + \alpha_5 * H = 0 \right| \tag{4.2}$$

Here, STAB indicates bank stability which is captured with *lnZ*-score and NPL ratio of bank *i*, country *j* and time *t*. DI indicates deposit insurance of country *j* and time *t*, and H indicates H-statistic measuring bank competition. α_4 is the coefficient of regulatory variable to capture deposit insurance, and α_5 is the coefficient of the interaction term of the bank deposit insurance and H-statistic indicating the level of bank competition.

This study uses equation (4.2) to calculate the value of H-statistic for models 2 and 4 in the following way.

Using the values from model 2, the value of H-statistic is-

$$\left| \frac{\Delta STAB_{ijt}}{\Delta DI_{jt}} = 0.0826 - 0.1223 * H = 0 \right| \text{ or H= } 0.6754$$

Using the values from model 4, the value of H-statistic is-

$$\left| \frac{\Delta STAB_{ijt}}{\Delta DI_{jt}} = -1.3632 + 2.1527 * H = 0 \right| \text{ or H= } 0.6332$$

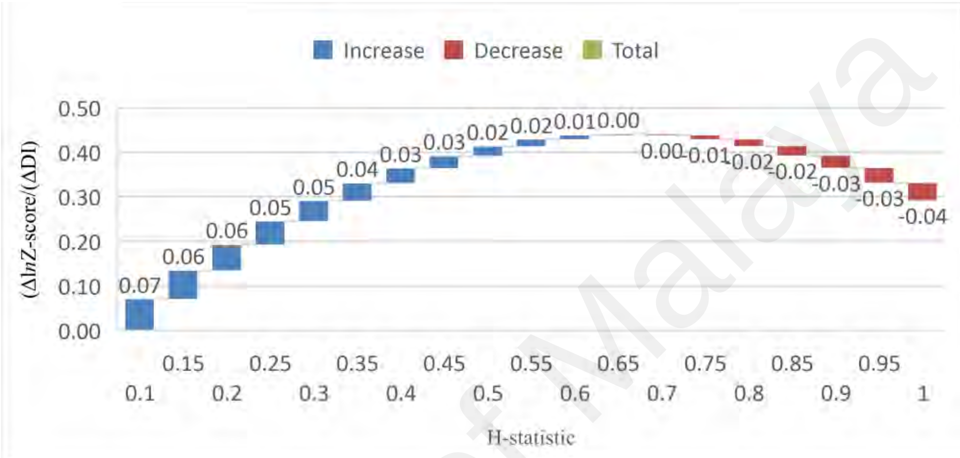

Figure 4.12 The marginal effect of deposit insurance on bank competition-stability relationship

Note: Figure 4.12 shows the coefficients of the regression equation (3.11) presented in model 2 of Table 4.10.

Figure 4.12 demonstrating that a diminishing marginal effect of deposit insurance on *ln*Z-score at the different value of H-statistic. Where, the marginal effect is higher (0.07) at lower value of H-statistic (0.1), but the positive marginal effect declines (such as 0.06, 0.05, 0.04 and so on) with increasing the value of H-statistic (such as 0.15, 0.25, 0.35 and so on). The marginal effect of deposit insurance becomes zero if the value of H-statistic is 0.6754. For any value of H-statistic more than 0.6754, the marginal effect of deposit insurance on *ln*Z-score turns negative. Figure 4.12 suggests that deposit insurance increases stability of the banks in less competitive environment, the marginal effect of deposit insurance on bank stability decreases in a more competitive environment. This may be due to the fact that greater competition in the loan market in the presence of deposit insurance may give rise to moral hazard problem of the banks to collect deposit from depositors at lower rate and create risky credit or investment to cover the lost franchise value resulting from increased competition Keeley (1990). Thus, the stability gain of deposit insurance may be outweighed by the exacerbation of moral hazard due in highly competitive banking system.

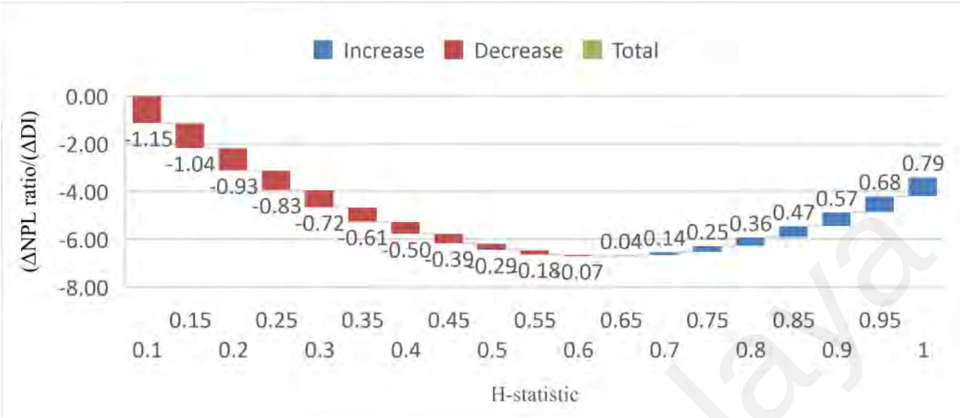

Figure 4.13 The marginal effect of deposit insurance on bank competition-stability relationship

Note: Figure 4.13 shows the coefficient of the regression equation (3.11) presented in model 4 of Table 4.10.

The same explanation of deposit insurance in the presence of competition is also shown in Figure 4.13 which is derived from model 4 of Table 4.10 where marginal effect of deposit insurance on NPL of banks increases with the increase in the level of competition. The threshold level of competition for NPL in model 4 is 0.6332. Below that level deposit insurance brings stability effect on the banking system, but beyond that level the moral hazard effect of deposit insurance starts dominating and may render the banking system fragile.

The study proceeds to investigate the moderating role of supervisory power estimated using equations (3.10) and (3.11) to investigate how does official supervision influence on the relationship between bank competition and stability. Table 4.11 demonstrate the coefficients of H-statistic for *lnZ*-score in models 1 and 2, and equity ratio in models 5 and 6 are positive, and it is negative on NPL ratio in models 3 and 4, and significant in all the cases indicating that greater competition promotes stability and capitalisation, and reduces credit risk in the presence of powerful official supervision in the banking sector.

Table 4.11: The moderating role of powerful official supervision on the relationship between bank competition and bank stability

Dependent Variable	***ln*Z-score**		**NPL Ratio**		**Equity Ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *ln*Z-score, NPL ratio, Equity ratio	.6444 (.0344)***	.6208 (.0378)***	.5875 (.0615)***	.5824 (.0623)***	.4315 (.0709)***	.4310 (.0703)***
H-statistic	.9085 (.3046)***	.8048 (.3003)***	-7.0269 (2.0278)***	-6.1958 (1.9026)***	1.1419 (1.3649)	.6185 (1.3278)
H-statistic^2	-.5113 (.2424)**	-.4631 (.2409)***	3.8956 (1.8704)***	3.81245 (1.7889)**	-1.2167 (1.1890)	-1.2028 (1.1723)
Supervisory Power Index	.0009 (.0372)	.0303 (.0454)	-.4865 (.2545)*	-.4357 (.2548)*	.2493 (.2166)	.2195 (.2191)
H-statistic*SPI		.0091 (.0086)		-.1115 (.0474)**		.0750 (.0412)*
Loan Composition	-.0109 (.0036)***	-.0103 (.0044)**	.0922 (.0211)***	.0967 (.0213)***	-.0249 (.0179)	-.0279 (.0182)
Loan Quality	-.0318 (.0126)**	-.0303 (.0168)*	.3295 (.0861)***	.3360 (.0859)***	.0311 (.0571)	.0277 (.0574)
Bank Size	-.0246 (.0319)	-.0123 (.0327)	-.2051 (.2214)	-.2165 (.2276)	-.4611 (.2232)**	-.45234 (.2260)**
Operational Efficiency	-.0047 (.0024)**	-.0044 (.0021)**	-.0085 (.0140)	-.0107 (.0137)	.0124 (.0103)	.0135 (.0107)
Foreign Ownership	.2979 (.0993)**	.2906 (.0939)***	-.8813 (.6020)	-1.0123 (.5968)*	.4938 (.3335)	.5743 (.3295)*
GDP Growth Rate	.0109 (.0082)	.0116 (.0087)	-.2386 (.0541)***	-.2323 (.0550)***	-.0353 (.0402)	-.0458 (.0408)
Inflation Rate	-.0192 (.0066)***	-.0146 (.0073)**	.0845 (.0501)*	.0876 (.0503)*	-.0914 (.0389)**	-.0934 (.0405)***
Constant	2.2361 (.7417)***	1.7954 (.8977)**	7.4488 (4.9660)	7.1215 (5.0041)	8.3146 (3.8381)**	8.5483 (3.7833)**
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	142	142
Wald Test (P-value)	1510.38(.00)	1329.12(.00)	1117.00(.00)	1099.72(.00)	141.61(.00)	148.25(.00)
AR(1) (P-value)	-6.79(.00)	-6.66(.00)	-4.08(.00)	-4.00(.00)	-3.76(.00)	-3.81(.00)
AR(2) (P-value)	1.15(.25)	0.86(.35)	-0.30(.76)	-0.46(.65)	-1.05(.29)	-1.05(.29)
Hansen's J Test(P-value)	146.26(.15)	136.14(.32)	142.63(.21)	143.22(.18)	143.08(.20)	140.96(.22)
First Stage F-test(P-value)	28.895(.00)	7.9536(.00)	28.4952(.00)	7.77795(.00)	28.4952(.00)	58.553(.00)
Wooldridge Test(P-value)	242.491(.00)	241.394(.00)	46.511(.00)	47.480(.00)	157.340(.00)	157.16(.00)
Wu-Hausman Test (P-value)	7.603 (0.00)	8.6237 (0.00)	35.4065 (0.00)	34.0469 (0.00)	57.797 (0.00)	7.7779 (0.00)
Breush–pagan/Cook-Weisberg Test (P-value)	243.23 (0.00)	242.91 (0.00)	3283.11 (0.00)	3225.10 (0.00)	1123.98 (0.00)	1110.40 (0.00)
Sasabuchi Test (P-value)	1.31(.112)	1.39(.101)	1.24(.108)	1.43(.99)	0.97(.165)	0.77(.222)
VIF	2.43	5.08	2.54	2.55	2.44	2.55

This table presents the system GMM estimates with robust standard error in the parenthesis of the following equations in order to test Hypothesis 3

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.10)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.11)$$

SPI is bank regulation indicating supervisory power index. Details of this table are presented in Appendix C
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly.

This finding suggests that the stability effect of bank competition remains unaltered when including regulatory variables to capture powerful official supervision, and the main finding became more robust with the inclusion of the supervisory power index.

To investigate how official supervision moderates the bank competition-stability relationship, the study regressed supervisory power index in models 1, 3 and 5 using equation (3.10). It also investigated through the channel of bank competition using an interaction term of supervisory power index and H-statistic in models 2, 4, and 6 using equation (3.11) to determine how powerful supervisor influences of bank stability in more competitive banking market.

With respect to the effect of powerful official supervision, Table 4.11 demonstrates that official supervisory index regressed on NPL ratio in models 3 and 4. The negative and significant coefficient of official supervisory index at 10 percent level suggests that powerful supervision of the bank regulation has positive effect on reducing credit risk. The results indicate that presence of powerful supervision reduces banks' tendency to take excess credit risk and promote bank stability, which is consistent with the public interest view of Beck et al. (2006). A possible explanation of this finding is that strong official supervision brings disciple in the banks by monitoring their risk-taking behaviour which promotes corporate governance and incentivises banks to maintain close relationship with the borrowers. It not only solves the information problem of the banks but also mitigate moral hazard problem through close lending relationship. The results are consistent with the findings of Anginer et al. (2014a), Lee & Hsieh (2014), and Tabak, Fazio, Karine, & Cajueiro, (2016) who suggested that official supervision enables banks to take diversified risk and makes them stable. The results also consistent with Laeven & Levine (2009) who argued that powerful official supervision enhances governance and promote disciple in the banking system, and restricts banks from the systematic risk-taking which may make the banking system fragile.

In investigating the effect of official supervision on bank stability through the channel of competition, an interaction term of supervisory power index and H-statistic is regressed on NPL ratio in model 4. The coefficient of the interaction on NPL ratio is negative and significant at 5 percent level, suggesting that stringent official supervision has a positive effect on reducing credit risk in the more competitive market. These result is consistent with public interest view of supervision suggesting that supervisors strengthen the official supervision upon the banks to ensure compliance of bank regulation and bring discipline in the banking system. It may promote bank stability by reducing risk-taking behaviour.

The overall results of Table 4.11 suggest that official supervision has a negative effect on credit risk. The results further suggest that the credit risk minimizing effect of the official supervision does not change in more competitive banking environment.

With respect to the bank specific control variable, loan composition, measured by the ratio of net loan to total assets, is negatively and significantly related to the *lnZ*-score and positively related to NPL ratio. It suggests that higher the level of intermediation or loan composition increases the scope of risk-taking which weaken bank stability. In terms of loan quality measured by the ratio of loan loss reserve to gross loan, loan quality has a negative effect on bank stability and positive effect on credit risk, suggesting that the lower the level of default risk or increasing the level of loan quality increases bank stability and decreases credit risk. The results further demonstrate that large banks are less capitalised which may exacerbate their insolvency risk in the presence of bank regulation compared to the small banks in the region. Next, operational efficiency, as captured by the ratio of cost to income ratio, is positively related to the banks' soundness, suggesting that efficient banks are found to be more financially sound and less prone to both insolvency risk and overall risk, though they hold less capital than inefficient banks in ASEAN-5 nations. As expected, foreign banks, as captured with a dummy variable with 1 if the bank is a foreign bank, otherwise, 0, are found as more financially sound as they hold more equity and are less prone to credit risk. In terms of macroeconomic control variables, GDP positively influences on enhancing bank stability and reducing both insolvency risk and credit risk, despite motivating banks to hold less capital. On the other hand, inflation weakens the soundness of the banking system by increasing the moral hazard of taking more credit risk and eroding the capability to hold more capital.

4.5.2.1 Robustness checks

To ensure accuracy of the GMM estimates reported in Tables 4.8 to 4.11 and validate the findings of the role of bank regulation on the relationship between bank competition and stability, this study undertook several robustness checks. It checked the efficiency of GMM estimates by comparing the lagged dependent variable of the system GMM estimates reported in Tables 4.8-4.11 against the same lagged dependent variable calculated using dynamic OLS and dynamic fixed effect. Roodman (2006) argued that lagged dependent variable of GMM estimation must be within the lagged dependent values of dynamic OLS (suffering from upward biasness and provides maximum value) and dynamic fixed effect estimation (suffering from downward biasness and provides minimum value). Therefore, the study re-estimates equations (3.10) and (3.11) and replicates estimation of Tables 4.8 to 4.11 using both dynamic OLS and dynamic fixed effect. This is reported in Appendix M to P, where Appendix M replicates Table 4.8, Appendix N replicates Table 4.9, Appendix O replicates Table 10, and Appendix P replicates Table 4.11. All models reported in Tables 4.8, 4.9, 4.10 and 4.11 show that the coefficient of lagged dependent variable of the system GMM estimates is in between the range of the coefficients of lagged dependent variables calculated using dynamic OLS and dynamic fixed effect reported in Appendix M, N, O and P which ensures efficiency of the system GMM estimates. In addition, Appendix M demonstrates that capital regulation promotes bank stability without, and also with interaction of level of competition in both dynamic OLS and dynamic fixed effect. Appendix N demonstrates that despites activity restrictions increase fragility. These restrictions promote bank stability through the channel of competition. Appendix O demonstrates that despite deposit insurance promotes bank stability in less competitive environment, it increases fragility in more competitive environment. Appendix P demonstrates that official supervision promotes bank stability without and also interacting with competition. That is, the original findings from Tables 4.8 to 4.11 using the system GMM are robust in Appendices M-P using dynamic OLS and dynamic fixed effect.

Secondly, this study removes the quadratic term of the H-statistic (H^2) measuring competition from all models, the results are reported in Appendix Q. Appendix Q shows that the sign of the coefficient of the variable of interest H-statistic and bank regulation captured with capital requirements index, activity restrictions index, and deposit insurance remain same as the original estimation reported in Tables 4.8-4.11. The findings of the role of bank regulation on the relationship between bank competition and stability are robust while removing the quadratic term of H-statistic from the models. Thus, the robustness tests robustly indicates that capital requirements effective risk minimising tool for the bank both less competitive and more competitive environment. In addition, deposit insurance robustly promotes bank stability in less competitive environment, while activity restrictions promote bank stability in more competitive environment.

Thirdly, the banking sector of ASEAN-5 has gone through tremendous bank restructuring, and regulatory and supervisory changes in the aftermath of the 1997-1998 AFC in order to strengthen financial institutions, rebuild public trust and restore stability in the banking system. This started in early 1999 and continued until 2002 (Laeven, 2005;

Williams & Nguyen, 2005). Bank restructuring efforts included the closure of failed banks, consolidation in the form of merger and acquisition, privatisation, regional and international bank integration which resulted to decrease the number of banks in ASEAN-5 from 453 in 1997 to 264 in 2001 (Kishi, 2001). Initiatives to upgrade bank regulation and supervision as per international best practices included capital regulation, activity restrictions, deposit insurance and official supervision (Teo et al., 2000;; Kishi & Okuda, 2001). This study makes a sub-sample analysis of the role of bank regulation on the relationship between bank competition and stability during the 2000-2014 period. This study considers the year 2000 as the starting of sub-sample since a new regulation does not influence on bank stability immediately, particularly through the channel of competition. It considers the succeeding year of 1999 when regulatory reform strategies are adopted in ASEAN-5 countries.

Appendix R presents the system GMM estimates of equation (3.11) determining the effect of bank regulation on the bank competition-stability relationship during the period from 2000-2014, where dependent variable is *ln*Z-score in models 1-4, NPL ratio in models 5-8 and equity ratio in models 9-12. The positive and significant sign of the coefficient of capital requirements index and the interaction term of H-statistic and capital requirements index on *ln*Z-score and equity ratio, and opposite on NPL ratio make the role of capital regulation on the relationship between bank competition and stability robust. These results robustly demonstrate that capital regulation promote bank stability, and also through the channel of competition in ASEAN-5 in the post-bank restructuring period. The coefficients of activity restrictions index and the interaction term of H-statistic and activity restrictions index in Appendix R further demonstrate that activity restrictions promote bank stability through the channel of competition, despite these restrictions rendering the banking sector fragile independent of competition. The results also suggest that deposit insurance renders the banking sector fragile in competitive market, despite having a positive effect on bank stability independence competition.

Fourthly, the study also uses static models both OLS and fixed effect following the work of Lee & Hsieh (2014) who examined banking reform effect on the relationship between foreign ownership and bank's risk-taking instead of two-step System GMM. The empirical results of OLS and fixed effect are reported in Appendices S and T respectively. Appendices S and T also demonstrate that the basic empirical results are robust in both static and dynamic formulations. Finally, this study uses Lerner index in Appendix U as a measure of market power which is reciprocal of competition. Appendix U exhibits that regulatory effect on the bank competition-stability nexus is not altered when using alternative measures of competition. Capital regulation promotes bank stability irrespective of the level of market power of the banks. Deposit insurance promotes the stability of the banks enjoying high market power, while weakening stability of the bank enjoying low market power. On the other hand, activity restrictions weakened bank stability when banks enjoy more market power, but promote bank stability when banks' market power is eroded and competition is increased in the market.

4.5.3 Third Objective: Examine the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank stability.

The results so far indicate that competition promotes bank stability, and bank regulation, particularly capital regulation, activity restrictions, deposit insurance and official supervision, strengthen that relationship by weakening the non-linear relationship between bank competition and stability. The results find bank regulation affects bank stability in both less competitive environment and more competitive environment. More particularly, capital regulation is important in promoting bank stability by reducing risk-taking behaviour and capitalization in both less competitive and more competitive banking market. Further, deposit insurance promotes bank stability in less competition, while activity restrictions promotes bank stability in more competition.

This section examines whether the aforementioned moderating effects of bank regulation on the relationship between bank competition and stability change as a result of financial crisis. This is estimated using Equation 3.12, 3.13 and 3.14 as stated in Chapter 3. The equations is restated as follows:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.12)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.13)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.14)$$

To estimate the above equations, this study applies two-step system GMM considering financial freedom and property right as instrumental variables in order to deal serial correlation, heteroscedasticity and endogeneity issues. The GMM estimates of equations (3.12) to (3.14) are reported in Tables 4.12 to 4.15 considering different proxies as bank regulation. The roles of capital regulation are reported in Table 4.12, and roles of activity restrictions, deposit insurance and official supervision are also reported in Table 4.13, Table 4.14 and Table 4.15 respectively. In all the mentioned tables, models 1 and 2 present the GMM estimates of the above equations considering *ln*Z-score as dependent variable, models 3 and 4 present the estimate considering NPL ratio as dependent variable, and models 5 and 6 present the estimates considering equity ratio as dependent variable to capture bank stability. On the other hand, Panzar-Rosse H-statistic is used as the only measure of competition in this part. Before running the GMM, a Variance Inflection Factor (VIF) is calculated and reported at the bottom of the table showing a value of less than 10 in all models.[35] This implies that the models are free from multicollinearity problem. In addition, the significant value of Wooldridge test, Breus-Pagan/Cook-Weisberg test and Wu-Hausman test indicate that this unbalanced panel suffers from serial correlation, heteroscedasticity and endogeneity issues. Similar to the previous analysis, in order to handle the issues, this study firstly runs First stage F-test using 2SLS regression in order to check instrumental validity, the significant value of First stage-F statistics indicates that the instruments are weak and invalid in 2SLS regressions. This justifies the use of two-step system GMM of Arellano and Bover (1995) and Blundell and Bond (1998). Roodman (2006) argued that this GMM can handle serial correlation, heteroscedasticity and endogeneity issues and provides more efficient estimates.

In addition, as a post-diagnostic test of GMM, the insignificant value of Hansen's J test ensures the validity of overidentifying restrictions indicating that instrumental variables used for handling endogeneity problem are valid. In addition, significant value of AR (1) and insignificant value of AR (2) indicates that serial correlation is present in the level, but it is absent in the first difference. Moreover, a significant value of Wald test implies that all models are correctly specified.

Table 4.12 demonstrates that the coefficient of the crisis dummy is negatively related with the *lnZ*-score and equity ratio in models 1 and model 7 respectively, and positively related with NPL ratio in model 4. The results indicate that financial crisis undermines bank stability and renders the banking institutions fragile by increasing both insolvency risk and credit risk and eroding equity capitalisation. These results may be due to the fact that ASEAN banks were directly affected by the 1997-1998 AFC when commercial banks

[35] A VIF value of more than 10 indicates multicollinearity problem (Gujarati, 2009).

suffered from huge nonperforming loan and capital erosion resulting from credit boom and high risk-taking appetite of the banks (Soedarmono et al., 2013). Regarding this issue, Corsetti et al. (1999) claimed that lending boom and risk-taking appetite of the Southeast Asian commercial banks was exacerbated by the structural distortion in the banking sector including weak regulation and lax supervision, limited expertise in regulatory institutions, low capital adequacy ratio, absence of incentive compatible deposit insurance scheme and corrupt bank lending. This finding is consistent with the business cycle theory which suggests that business cycle fluctuation is the origin of financial instability and risk-taking behaviour, where risk is declined during expansion phase and increased only during near to peak or contraction phase (Borio, Furfine, and Lowe, 2001). This may be attributed to the counter cycle movement of credit expansion and loan provisioning. During boom, banks expand credit rapidly which inflates the values of loan collateral and leads banks to hold comparatively low capital and provisions, however, during recession when banks face more risk exposures and loan defaults, a reverse trend is observed (Borio et al., 2001). The business cycle theory suggests that banks adopts different conservative approaches such as limit credit expansion, increase safely net subsidies during crisis period and give more focus on building capital buffer and loan provisioning to reduce moral hazard and regain bank stability (Jokipii and Milne, 2008; Soedarmono et al., 2013).

To examine effect of financial crisis on capital regulation on bank competition-stability relationship, the study incorporated an interaction term of capital requirements index and crisis dummy on the bank stability model in equations (3.13) and (3.14), and the GMM estimates of the equations are reported in models 2-3, 5-6, and 8-9. The coefficient of the interaction term of capital requirements index and crisis dummy is positive on *ln*Z-score and equity ratio, and negative for NPL ratio. The results suggest that during financial crisis capital stringency promotes bank stability by increasing capitalisation and decreasing insolvency risk and default risk.

Table 4.12: The influence of financial crisis on the moderating role of capital regulation on the relationship between bank competition and bank stability.

Dependent Variable		***lnZ*-score**			**NPL Ratio**			**Equity Ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lagged *lnZ*-score,	.6422	.6415	.6402	.6107	.6065	.5947	.4267	.4249	.425
NPL Ratio, & Equity	(.0318)***	(.0307)***	(.0304)***	(.0613)***	(.0591)***	(.0613)***	(.0737)***	(.0731)***	(.071)***
Ratio									
H-statistic(H)	.5547	.3738	.3749	-6.5608	-5.5731	-5.2749	1.4766	1.0886	.957
	(.2485)**	(.2502)	(.2561)	(2.123)***	(2.075)***	(2.0708)**	(1.3233)	(1.2906)	(1.291)
H^2	-.2939	-.2257	-.2426	3.0884	2.5709	2.4042	-1.4961	-1.3041	-1.267
	(.2066)	(.2056)	(.2114)	(1.8502)*	(1.8187)	(1.770)	(1.1560)	(1.1279)	(1.124)
Crisis	-.3199	-1.2243	-1.1911	.8532	5.0919	5.0297	-.3372	-2.0932	-2.011
	(.0763)***	(.2688)***	(.2883)***	(.3117)***	(1.309)***	(1.482)***	(.3438)	(1.2005)*	(1.192)*
CRI*Crisis		.1654	.1438		-.7599	-.7768		.3165	.285
		(.0455)***	(.0679)**		(.2054)***	(.2434)***		(.2026)	(.194)
H*CRI*Crisis			.0245			-.0161			.085
			(.0504)*			(.0821)*			(.068)
Loan	-.0092	-.0065	-.0064	.1169	.1039	.1006	-.0296	-.0252	-.026
Composition	(.0027)***	(.0029)**	(.0029)***	(.0187)***	(.0182)***	(.0189)***	(.0163)*	(.0166)	(.017)
Loan Quality	-.0361	-.0331	-.0333	.3642	.3692	.3963	.0199	.0186	.017
	(.0116)***	(.0111)***	(.0113)**	(.0841)***	(.0810)***	(.0744)***	(.0514)	(.0522)	(.058)
Bank Size	-.0227	-.0373	-.0347	-.4381	-.3322	-.1884	-.5967	-.6341	-.639
	(.0324)	(.0321)	(.0317)	(.3674)	(.3501)	(.4062)	(.2661)**	(.2742)**	(.291)**
Operational	-.0059	-.0075	-.0076	-.0168	-.0112	-.0128	.0074	.0060	.006
Efficiency	(.0020)***	(.0023)***	(.0023)***	(.0158)	(.0150)	(.0147)	(.0109)	(.0111)	(.021)
Bank Ownership	.2573	.2044	.2074	-.5425	-.2445	-.3587	.8492	.7523	.721
	(.0961)***	(.0897)**	(.0910)**	(.5992)	(.5884)	(.5331)	(.3291)***	(.3251)**	(.356)**
GDP Growth	.0240	.0180	.0172	-.1729	-.1319	-.1598	-.0436	-.0570	-.051
Rate	(.0110)**	(.0110)*	(.0107)*	(.0687)**	(.0655)**	(.0697)**	(.0388)	(.0412)	(.047)
Inflation Rate	-.0038	-.0033	-.0030	.0744	.0688	.1334	-.0752	-.0743	-.073
	(.0060)	(.0059)	(.0058)	(.0516)	(.0524)	(.0615)**	(.0393)*	(.0378)**	(.072)**
Constant	2.1837	2.2701	2.2594	-1.1418	-1.8578	-3.4602	11.91023	12.1986	12.14
	(.3681)***	(.3673)***	(.3674)***	(2.8477)	(2.7364)	(2.9724)	(2.995)***	(3.075)***	(3.101)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1927	1927	1927	2001	2001	2001	2001	2001	2001
No. of Banks	174	174	174	176	176	176	176	176	176
Instruments	142	142	142	142	142	142	142	142	142
Wald Test	1655.98	1858.64	1810.37	980.08	1065.24	1038.66	147.05	151.30	158.09
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
AR(1)(P-value)	-6.80(.00)	-6.75(.00)	-6.75(.00)	-4.12(.00)	-4.11(.00)	-3.74(.00)	-3.72(.00)	-3.69(.00)	-3.70(.00)
AR(2)(P-value)	1.09(.27)	1.02(.318)	1.01(.31)	-0.19(.85)	-0.32(.75)	-0.31(.76)	-0.95(.34)	-0.93(.35)	-0.90(.37)
Hansen's J Test (P-	147.23	144.31	144.10	138.45	132.80	137.85	142.49	142.42	143.47
value)	(0.13)	(0.15)	(0.142)	(0.269)	(0.368)	(0.241)	(0.197)	(0.181)	(0.151)
First Stage F-test (P-	8.0958	6.9160	20.6963	8.8374	7.6963	22.0535	8.8374	7.6963	22.053
value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wooldridge Test(P-	254.547	254.383	244.246	59.818	59.720	59.678	178.278	177.723	178.41
value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wu-Hausman Test	43.704	42.512	40.1708	90.5348	76.2889	68.8742	52.526	46.0504	41.764
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Breush–Pagan/	282.05	282.88	279.80	3524.63	3681.80	3348.50	978.80	987.24	988.36
Cook-Weisberg	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Test (P-value)									
VIF	2.39	4.25	6.36	2.41	4.29	6.40	2.41	4.29	6.40

This tables presents the system GMM estimates with robust standard error in parenthesis using the follow equation (3.12) to (3.14) to test Hypothesis 4:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.12)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.13)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.14)$$

CRI is bank regulation indicating capital requirements index. Details of this table are provided in Appendix C

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

This means that the effect of capital regulation on bank stability is stronger during the crisis period. This result supports the hypothesis that capital regulation promotes bank stability of the banking system.

The stabilisation effect of capital during financial crisis is due to the fact that capital provides safety net or buffer and survival capacity (Berger and Bouwman, 2013). During the crisis, banking risks are increased and the risk absorption capacity of the capital becomes vital. The banks with higher capital are better sheltered against the shock of the financial crisis and survive in the market. In addition, high capital motivates banks to behave more prudently and also incentivises them to monitor the relationship with borrowers, due to capital-at-risk effect, in order to reduce the default probability of the borrowers. This finding is consistent with Berger and Bouwman (2013) who empirically found for the US banking sector that capital increases both bank performance in terms of market share and survival during both normal times and crisis period from 1984 to 2010.

This finding brings practical interpretation for the banking sector. Capital is served as the main line of defence or buffer for the banks against the adverse shocks. Capital is highly needed for banking institutions, especially for small banks in both boom and bluest, as they are more vulnerable to the crisis and their access to the financial market is comparatively limited due to high borrowing cost, albeit the number of small banks in ASEAN-5 has been dwindling especially after the adaptation of consolidation strategy as Asian financial crisis banking reform in late 1990s. However, financial crisis shakes all banks irrespective of their size, because access to finance may fail to protect them against the adverse shock of the crisis. Therefore, capital is the pivotal for ensuring the stability of the banks. This finding is consistent with the theoretical papers that explain capital promotes stability in the banking sector (Repullo, 2004; Repullo and Suarez, 2013).

To examine the effect of financial crisis on the moderating role of capital stringency on bank competition-stability relationship, an interaction term of capital requirements index, H-statistic and crisis dummy is added to equation (3.14), and the GMM estimates are reported in models 3, 6 and 9. The coefficient of the interaction term is positive on *lnZ*-score and equity ratio in models 3 and 9 respectively, and it is negative on NPL ratio in model 6. This suggests that high capital stringency further enhances the bank stability in highly competitive market during financial crisis. These findings may be due to the fact that high capital requirements reduce the adverse consequences of financial crisis, such as moral hazard problem and degree of risk taking. Stricter capital requirements during crisis reduces the supply of loanable fund which obliges banks to dwindling lending activities and incentivises them to extend credit to those firms with which they can maintain a good lending relationship. Thus, high capital stringency mitigates moral hazard with prudent lending decision in highly competitive market during financial crisis.

The overall results suggest that financial crisis exacerbates fragility in the banking sector by eroding capitalisation and increasing insolvency risk and default risk. However, stringent capital regulation has a strong stabilisation effect on bank stability during financial crisis, especially in competitive banking industry, by obliging banks to increase capital buffer and incentivising them to take less credit risk and make prudent lending decision.

Next, this study examines the effect of financial crisis on activity restrictions on the bank competition-stability relationship using GMM estimation . The results are presented in Table 4.13.. Firstly, this study examines how financial crisis moderate the effect of activity restrictions on bank stability by incorporating an interaction term of crisis dummy and activity restrictions index with equation (3.13).

Table 4.13: The influence of financial crisis on the moderating role of activity restrictions on the relationship between bank competition and bank stability

Dependent Variable	*ln*Z-score		NPL ratio		Equity ratio	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *ln*Z-score, NPL	.6383	.6317	.6283	.6302	.4693	.4696
Ratio, & Equity Ratio	(.0353)***	(.0365)***	(.0590)***	(.0595)***	(.0770)***	(.0769)***
H-statistic(H)	.7015	.6806	-5.9247	-5.7315	1.6261	1.6239
	(.2630)***	(.2616)***	(2.2372)***	(2.2341)****	(1.2485)	(1.2550)
H ^2	-.4327	-.4919	3.1297	3.3843	-1.6331	-1.6578
	(.2121)**	(.2055)***	(1.9218)*	(1.9270)*	(1.1322)	(1.1274)
Crisis	-.8355	-.6427	.6365	2.1704	-2.3041	-2.2364
	(.3165)***	(.3286)**	(.3530)*	(.8713)**	(1.3805)*	(1.3967)
ARI*Crisis	-.1078	-.1147	.0815	.0797	-.2566	-.2531
	(.0283)***	(.0302)***	(.0384)**	(.0391)**	(.1149)**	(.1169)**
H*ARI*Crisis		.0405		-.2346		.0231
		(.0204)**		(.1135)**		(.0393)
Loan Composition	-.0075	-.0063	.1086	.1032	-.0386	-.0376
	(.0027)***	(.0028)**	(.0202)***	(.0204)***	(.0153)**	(.0154)**
Loan Quality	-.0329	-.0321	.3348	.3321	-.0119	-.0119
	(.0114)***	(.0119)***	(.0794)***	(.0809)***	(.0455)	(.0457)
Bank Size	-.0441	-.0373	-.5419	-.5972	-.8276	-.8418
	(.0359)	(.0357)	(.4128)	(.4175)	(.2553)***	(.2618)***
Operational Efficiency	-.0067	-.0073	-.0240	-.0232	.0048	.0049
	(.0021)***	(.0020)***	(.0166)	(.0167)	(.0070)	(.0070)
Foreign Ownership	.1449	.1513	-.7197	-.7117	.5213	.5109
	(.0990)	(.1001)	(.6198)	(.6185)	(.3094)*	(.3122)*
GDP Growth Rate	.0068	.0023	-.1524	-.1301	-.0814	-.0757
	(.0105)	(.0104)	(.0709)**	(.0672)*	(.0334)**	(.0330)**
Inflation Rate	-.0138	-.0127	.0823	.0739 (.0491)	-.1014	-.1028
	(.0055)***	(.0057)**	(.0493)*		(.0379)***	(.0381)***
Constant	2.2336	2.2088	-.2591	-.0275	13.4204	13.4591
	(.4076)***	(.4014)***	(3.0736)	(3.0923)	(3.0133)***	(2.9937)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	142	142
Wald Test (P-value)	1754.92(.00)	1882.26(.00)	895.22(.00)	963.75(.00)	157.48(.00)	158.84(.00)
AR(1) (P-value)	-6.77(.00)	-6.70(.00)	-4.11(.00)	-4.07(.00)	-3.78(.00)	-3.78(.00)
AR(2) (P-value)	1.02(.31)	0.95(.34)	-0.09(.93)	-0.14(.89)	-0.99(.11)	-0.99(.32)
Hansen's J Test(P-value)	144.58(.15)	143.06(.16)	143.29(.16)	144.27(.14)	138.44(.25)	138.31(.23)
First Stage F-test	9.218	15.294	10.086	16.456	10.086	16.456
(P-value)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Wooldridge Test	252.992	246.670	59.847	59.616	180.280	180.665
(P-value)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Wu-Hausman Test	42.5671	42.4739	92.2731	88.8792	48.6912	48.3276
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.000	(0.00)
Breush–Pagan/Cook-	268.30	258.04	3506.87	3505.42	1035.82	1035.94
WeisbergTest(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
VIF	5.97	6.16	6.03	6.21	6.47	6.63

This tables presents the system GMM estimates with robust standard error in parenthesis using the follow equations (3.12) to (3.14) to test Hypothesis 4:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.12)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.13)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt} \qquad (3.14)$$

ARI is bank regulation indicating activity restrictions index. Details of this table is provided in Appendix C
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Table 4.13 demonstrates that the coefficient of the interaction term of activity restrictions index and crisis dummy is negative on *lnZ*-score and equity ratio in models 1 and 2, and models 5 and 6 respectively, and positive on NPL ratio in models 3 and 4. These results suggest that activity restrictions on non-traditional banking activities and ownership control of non-bank financial institutions increase fragility during crisis period by increasing insolvency risk and credit risk and reducing equity ratio. This finding is consistent with the previous finding on overall period. The negative effect of activity restrictions on bank stability during crisis period may be the consequence of erosion of franchise value and increase of moral hazard problem. Banks should be allowed to increase risk diversification opportunity during crisis in order to decrease risk exposure and moral hazard problem, but the imposition of activity restrictions limit that scope of risk diversification opportunities to the other line of business which may erode banks' market power and increase moral hazard of the bank to take more risk in traditional business line especially in lending operations.

Next, the effect of financial crisis on moderating role of activity restrictions on bank competition-stability relationship is examined using a triple terms interaction of activity restrictions index, H-statistic and crisis dummy in equation (3.14), the GMM estimates of which are reposted in models 2, 4 and 6. The coefficient of the interaction term turned to positive on *lnZ*-score, and equity ratio in models 2 and 6 respectively, and negative on NPL ratio in model 4. These results suggest that the activity restrictions further enhance the effect on bank competition-stability during financial crisis. This finding is similar to the finding on the overall period discussed in our preceding section. This finding can be interpreted in the way that more competition on non-traditional banking activities may arise gambling opportunity for the banking industry during crisis which may increase moral hazard problem.

Table 4.14: The influence of financial crisis on the moderating role of deposit insurance on the relationship between bank competition and bank stability

Dependent Variable	*lnZ*-score		NPL ratio		Equity ratio	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged L*lnZ*-score, NPL Ratio, & Equity Ratio	.6346	.6398	.6146	.6147	.4836	.4832
	(.0373)***	(.0366)***	(.0611)***	(.0603)***	(.0685)***	(.0689)***
H-statistic(H)	.5378	.5510	-6.6649	-6.7461	1.8927	1.8569
	(.2346)**	(.2368)**	(2.1648)***	(2.1410)***	(1.3457)	(1.3672)
H^2	-.3378	-.3082	3.2609	3.0825	-1.9331	-1.9321
	(.2006)*	(.2036)	(1.8407)*	(1.8818)*	(1.0946)*	(1.1066)*
Crisis	-.5508	-.5245	1.4232	1.3048	-.6482	-.6365
	(.1099)***	(.1110)***	(.6036)**	(.5814)**	(.3542)*	(.3560)*
DI*Crisis	.3214	.6008	-.9668	-2.5139	.5042	.4371
	(.1302)**	(.2233)***	(.6942)	(1.3486)*	(.4562)	(.4427)
H*DI*Crisis		-.4449		2.4436		.2632
		(.2925)		(1.7070)		(.4787)
Loan Composition	-.0072	-.0074	.1118	.1130	-.0381	-.0369
	(.0031)**	(.0032)**	(.0209)***	(.0206)***	(.0178)**	(.0179)**
Loan Quality	-.0416	-.0411	.3687	.3697	-.0189	-.0183
	(.0129)***	(.0127)***	(.0828)***	(.0825)***	(.0474)	(.0472)
Bank Size	-.0483	-.0525	-.3345	-.2851	-.7172	-.7336
	(.0371)	(.0366)	(.3721)	(.3656)	(.2794)***	(.2830)***
Operational	-.0048	-.0044	-.0170	-.0192	.0102	.0101
Efficiency	(.0021)**	(.0021)**	(.0157)	(.0159)	(.0097)	(.0095)
Bank Ownership	.2034	.1996	-.5345	-.4974	.6864	.6773
	(.1017)**	(.1041)**	(.6535)	(.6596)	(.3381)**	(.3379)**
GDP Growth Rate	.0164	.0189	-.1500	-.1621	-.0449	-.0418
	(.0107)	(.0108)*	(.0649)**	(.0650)**	(.0331)	(.0326)
Inflation Rate	-.0097	-.0117	.1018	.1106	-.0802	-.0819
	(.0053)*	(.0054)**	(.0502)**	(.0487)**	(.0371)**	(.0373)**
Constant	2.2310	2.2293	-1.4724	-1.6920	12.1237	12.1527
	(.4100)**	(.4020)***	(2.6994)	(2.6683)	(2.8681)***	(2.8920)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	142	142
Wald Test (P-value)	1655.38(.00)	1626.21(.00)	1090.00(.00)	1116.58(.00)	156.27(.00)	155.36(.00)
AR(1) (P-value)	-6.72(0.00)	-6.75(0.00)	-4.11(0.00)	-4.13(0.00)	-3.94(0.00)	-3.94(.00)
AR(2) (P-value)	0.91(.36)	0.96(0.34)	-0.17(.87)	-0.12(.91)	-1.02(.31)	-1.01(.31)
Hansen's J Test (P-value)	143.36(.17)	144.76(.13)	136.78(.28)	134.80(.30)	138.37(.25)	138.83(.22)
First Stage F-test	6.6404	16.3218	7.4023	17.5212	7.4023	17.5212
(P-value)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wooldridge Test	270.947	257.094	59.880	60.480	181.028	183.508
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wu- Hausman Test	44.0459	39.381	92.8124	88.1766	52.7442	45.8724
(P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Breush –Pagan/Cook -	267.41	265.83	3486.59	3452.56	1003.20	1014.00
Weisberg Test (P-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
VIF	2.76	4.14	2.79	4.17	2.79	4.17

This tables presents the system GMM estimates with robust standard error in parenthesis using the follow equations (3.12) to (3.14) to test Hypothesis 4:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.12)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.13)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.14)$$

DI is bank regulation indicating deposit insurance. The details of this table are provided in Appendix C

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

However, the imposition of restrictions on non-traditional banking activity neutralises the negative consequence of activity restrictions (resulting moral hazard from gambling opportunity) when competition is more in the market, and provides stimulus to the banks to reduce risk taking intensity and promote their bank stability

With respect to the deposit insurance impact on the bank competition-stability relationship during financial crisis , like the preceding section, this study examines the effect of deposit insurance on bank stability during financial crisis incorporating an interaction term of deposit insurance dummy and crisis dummy in equation (3.13). The same effect of financial crisis on the moderating effect of deposit insurance on bank competition-stability relationship is estimated using the interaction term of deposit insurance dummy, crisis dummy and H-statistic in equation (3.14). The GMM estimates of deposit insurance's effect on the relationship between bank competition and stability during financial crisis are reported in Table 4.14, where bank stability is captured with *lnZ*-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in models 5 and 6.

Table 4.14 demonstrates that the coefficient of the interaction term of crisis dummy and deposit insurance is positive on Z-score and equity ratio in models 1 and 2, and models 5 and 6 respectively, and negative on NPL ratio in models 3 and 4. These results demonstrate that despite crisis having a fragility effect on the banks, deposit insurance helps restore bank stability during financial crisis by reducing insolvency risk and credit risk and increasing capitalisation. This positive effect of deposit insurance on bank stability may be due to the fact that bank may face capital shortfall and limited lending opportunity and moral hazard of risk exacerbation during financial crisis. However, deposit insurance promotes the depositor confidence with government safely net and brings them back to the banking system which helps not only in avoiding bank runs during the crisis period and welfare cost of crisis, but also greater level of intermediation with the deposits. Consequently, deposit insurance may lead to higher capitalisation promoting the level of intermediation and reduce moral hazard of risk taking which bring back bank stability in the banking system during the crisis period. This finding is consistent with Anginer et al. (2014b) who found a stabilisation effect of deposit insurance on systematic stability of banks during the 2008-2009 GFC using a sample of 4109 listed banks from 96 countries from 2004 to 2009.

With respect to the deposit insurance effect on bank stability in highly competitive market during financial crisis, the coefficient of the triple terms interaction factor is negative on log of Z-score in model 2, positive on NPL ratio and equity ratio in models 4 and 6 respectively, but insignificant in all the cases. The results suggest that the positive and stabilisation effect of deposit insurance on bank stability may also prevail in highly competitive environment during financial crisis. The implication of this finding is that the stabilization effect of deposit insurance in crisis period is not depend on the market structure. Though during normal period in more competitive market deposit insurance exposes to bank's risk taking behaviour due to its moral hazard effect, it is changed in the crisis period even in more competitive environment. This is because, deposit insurance system is implemented in a banking system to prevent bank runs, prevent banking crisis and reduce the social cost of the banking crisis (Demirgüç-kunt & Detragiache, 2002). Even during the crisis irrespective of the level of competition, deposit insurance system works as a risk minimiser by protecting deposits of major depositors as they anticipate their deposits are under an insurance system which is backed by government safety net. As a result, depositors without an immediate consumption do not rush to the bank to withdraw funds which protects a contagious bank run and minimises the social cost of the bank crisis. Thus, deposit insurance not only prevents a bank run, contagious run and reduces the social cost to bank crisis, it also restores depositors' confidence in the banking system which encourages individuals to deposit their saving to the banks and supports banks to increase their level of intermediation and bank stability.

Table 4.15: The influence of financial crisis on the moderating role of official supervision on the relationship between bank competition and bank stability

Dependent Variable	***lnZ*-score**		**NPL ratio**		**Equity ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged *lnZ*-score, NPL Ratio, & Equity Ratio	.6192	.6099	.6092	.6097	.4042	.4022
	(.0349)***	(.0356)***	(.0619)***	(.0617)***	(.0719)***	(.0719)***
H-statistic(H)	.7865	.7340	-7.3062	-6.9068	1.6678	1.5145
	(.2835)***	(.2785)***	(1.9832)***	(1.9634)***	(1.3927)	(1.3871)
H^2	-.5816	-.6131	4.0102	3.8749	-1.7710	-1.7285
	(.2222)***	(.2144)***	(1.6896)**	(1.6559)**	(1.2086)	(1.2009)
Crisis	-3.6353	-3.3956	7.4469	6.3975	-6.5815	-6.2354
	(.7422)***	(.7419)***	(3.5554)**	(3.5284)*	(3.1838)**	(3.1299)**
SPI*Crisis	.2778	.2287	-.5523	-.3508	.5330	.4946
	(.0608)***	(.0626)***	(.2870)**	(.2913)	(.2658)**	(.2610)**
H*SPI*Crisis		.0465		-.1801		.0525
		(.0213)**		(.1140)		(.0326)*
Loan Composition	-.0062	-.0057	.1181	.1177	-.0336	-.0319
	(.0034)*	(.0035)	(.0205)***	(.0211)***	(.0179)*	(.0176)*
Loan Quality	-.0370	-.0375	.3561	.3600	-.0052	-.0073
	(.0126)**	(.0126)***	(.0821)***	(.0810)***	(.0563)	(.0553)
Bank Size	-.0365	-.0275	-.5481	-.5879	-.6808	-.6949
	(.0375)	(.0380)	(.3926)	(.3870)	(.2746)**	(.2714)***
Operational Efficiency	-.0065	-.0075	-.0155	-.0143	.0107	.0110
	(.0025)**	(.0028)***	(.0152)	(.0152)	(.0102)	(.0104)
Foreign Ownership	.1948	.1955	-.6899	-.6589	.6421	.6027
	(.0898)	(.0944)**	(.5971)	(.6057)	(.3085)**	(.3146)**
GDP Growth Rate	.0148	.0087	-.1447	-.1197	-.0488	-.0373
	(.0110)	(.0113)	(.0656)**	(.0636)*	(.0375)	(.0375)
Inflation Rate	-.0073	-.0053	.0896	.0815	-.1045	-.1062
	(.0062)	(.0064)**	(.0498)*	(.0498)*	(.0383)***	(.0381)***
Constant	2.0004	2.0348	-.4285	-.6368	12.6514	12.6888
	(.4290)***	(.4247)***	(3.0177)	(2.9537)	(3.0870)***	(3.0219)****
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	142	142
Wald Test (P-value)	1751.27(.00)	1701.31(.00)	1013.69 (.00)	1052.22(.00)	151.05 (.00)	154.15 (.00)
AR (1) (P-value)	-6.71 (.00)	-6.65 (0.00)	-4.11 (.00)	-4.08 (.00)	-3.63 (.00)	-3.63 (.00)
AR (2) (P-value)	0.94 (.35)	0.84 (.39)	-0.19 (.85)	-0.23 (.82)	-1.16 (.25)	-1.14 (.26)
Hansen's J Test(P-value)	146.43 (.13)	145.41 (.13)	144.14 (.16)	142.25 (.17)	140.01 (.22)	140.90 (.19)
First Stage F-test (P-value)	7.94 (.00)	16.75 (.00)	8.78 (.00)	18.01 (.00)	8.7828 (0.00)	18.01 (.00)
Wooldridge Test (P-value)	276.95 (.00)	269.36 (.00)	59.84 (.00)	59.85 (.00)	180.46 (.00)	181.59 (.00)
Wu-Hausman Test (P-value)	41.29 (.00)	40.62 (.00)	88.24 (.00)	82.85 (.00)	51.35 (.00)	50.13 (.00)
Breush –Pagan/Cook-Weisberg Test (P-value)	266.86 (0.00)	259.93 (0.00)	3493.91 (0.00)	3489.82 (0.00)	1000.39 (0.00)	1000.10 (0.00)
VIF	2.50	3.63	2.52	3.64	2.52	3.64

This tables presents the system GMM estimates with robust standard error in parenthesis using the follow equations (3.12)-(3.14) to test hypothesis 4:

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.12)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.13)$$

$$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.14)$$

SPI indicates supervisory power index. The details of this table are provided in Appendix C

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly.

Table 4.15 shows the system GMM estimates of effect of financial crisis on official supervision on the relationship between bank competition and stability. In terms of the effect of official supervision on bank stability during financial crisis , the coefficient of the interaction term of supervisory power index and crisis dummy is positive on *ln*Z-score and equity ratio in models 1 and 2, and models 5 and 6 respectively, and negative on NPL ratio in models 3 and 4. The results demonstrate that stringent official supervision is highly warranted in the banking market especially in the crisis to restore bank stability in the banking system by obliging banks to increase capitalisation and behave prudently in risk-taking. This finding is consistent with the public interest view of Beck et al. (2006), because the powerful supervisors are highly concerned with market failure, and driven by public interest to ensure smooth functioning of intermediation process through bring market disciple and bank governance. These results suggest that powerful official supervision is highly required to restore stability in the banks in financial crisis . This is because official supervisors could effectively control and reduce the risk taking attitude of the banks by monitoring their activities and obliging them to comply with the regulator's policy with respect to capitalisation and governance. This finding is consistent with Shehzad & Haan (2015) who found that supervisory power to change organisational set up and hire and fire of bank managers effectively reduces moral hazard of excessive risk taking problem during and post-GFC period of commercial and savings banks in OECD countries. It is also consistent with Doumposa, Gaganis, & Pasiouras (2015) who found that supervisors' independence effectively promotes bank stability of 1700 commercial banks from 90 countries during the 2008-2009 GFC period.

The study further examines the effect of financial crisis on moderating role of powerful official supervision on bank competition-stability relationship using interaction term of H-statistic, supervisory power index and crisis dummy using equation (3.14). The coefficient of the triple terms interaction factor is positive and significant on *lnZ*-score and equity ratio in models 2 and 4 respectively, suggesting that official supervision enhances bank competition-stability relationship during financial crisis by promoting capitalisation and reducing insolvency risk. This finding suggests that strong supervision obliges banks to hold more equity and take risk prudently even though competition is more in the market during financial crisis. This may be attributed to the fact that strong supervision driven by public interest monitors and controls risk taking attitude of the banks, and ensure their compliance with respect to bank regulation particularly minimum capital requirements during crisis period. These helps bring the market in disciple which promotes franchise value of the banks and reduces negative consequences of the competition that provides banks with lower incentive to take more risk and make investment decision more prudently during financial crisis.

4.5.3.1 Robustness checks

To check robustness of the empirical results with respect to the role of capital regulation, activity restrictions, deposit insurance and official supervision on the relationship between bank competition and stability during financial crisis, this study has undergone a number of robustness tests.

Firstly, to ensure efficiency of the system GMM estimates presented in Tables 4.12-4.15, this study checks whether the coefficient of lagged dependent variable lying in between the respective coefficient of lagged dependent variable estimated by dynamic OLS and dynamic fixed effect. For the system GMM estimates to be efficient, Roodman (2006) argued that lagged dependent variable of the system GMM estimation must be within the lagged dependent values of dynamic OLS (suffers from upward biasness and provides maximum value) and dynamic fixed effect estimation (suffers from downward biasness and provides minimum value). Therefore, the study replicates the estimation of equations (3.13) and (3.14) using both dynamic OLS and dynamic fixed effect and reported in Appendix V to Y, where Appendix V replicates Table 4.12, Appendix W replicates Table 4.13, Appendix X replicates Table 4.14, and Appendix Y replicates Table 4.15. All models reported in Tables 4.12, 4.13, 4.114 and 4.15 show that the coefficient of lagged dependent variable of the system GMM estimates is in between the range of the coefficients of lagged dependent variables calculated using dynamic OLS and dynamic fixed effect reported in Appendices V, W, X and Y which ensure the efficiency of GMM estimates. In addition, Appendix V demonstrates that capital regulation promotes bank stability and also through the channel of competition during crisis period in both dynamic OLS and dynamic fixed effect. Appendix W demonstrates that despites activity restrictions increase fragility during crisis period, but they promote bank stability through the channel of competition during crisis period. Appendix X demonstrates that although deposit insurance promotes bank stability in less competition during crisis period, its fragility effect on bank stability is changed in competitive environment in financial crisis. Appendix Y demonstrates that official supervision promotes bank stability and also interacting with competition during crisis period. That is, the original findings from Tables 4.12 to 4.15 using the system GMM are robust in Appendices V-Y using dynamic OLS and dynamic fixed effect.

Secondly, the study removes the quadrative term of competition measure (H-statistic) from all models. The results are reported in Appendices Z, AA, AB and AC. Appendices Z to AC showing that the basic results remain unaltered, and similar impact of bank regulation on the relationship between bank competition and stability during financial crisis.

Third, the study examines the static models using OLS and fixed effect model following the work of Lee and Hsieh (2014), who examined banking reform effect on the relationship between foreign ownership and banks' risk taking using static models instead of two step system GMM. The empirical results of OLS and fixed effect are reported in Appendices AD to AG. The appendices demonstrate that the basic empirical results are robust in both static and dynamic formulations.

The robustness checks are robust with respect to the findings of the effect of bank regulation on the relationship between bank competition and stability during financial crisis. The results demonstrate that despite financial crisis has fragility effect in ASEAN-5 during the 1990-2014 period by increasing insolvency risk and credit risk and eroding capitalisation, crisis does weaken the relationship between bank competition and stability in ASEAN-5 banking sector. The results further report that both capital stringency and official supervision have positive effect on bank stability and equity capitalisation, and negative effect on NPL ratio independence of the level of competition and, through the channel of competition during the financial crisis. Further, activity restrictions render the banking institutions fragile independent of the level of competition during financial crisis, while deposit insurance renders the banking institutions financial strong in that circumstance. The results also find the negative effect of activity restrictions and positive effect of deposit insurance are changed in the presence of competition during the financial crisis. That is, activity restrictions promote bank stability and capitalisation, and reduce credit risk through the channel of competition in financial crisis. On the other hand, deposit insurance weakens bank stability through the channel of competition during financial crisis.

4.6 Chapter Summary

This chapter tested all the four hypotheses developed based on the three objectives concerning relationship between bank regulation, competition and bank stability. The data consists of all commercial banks in ASEAN-5 countries including Indonesia, Malaysia, the Philippines, Singapore and Thailand for the 1990-2014 period, which are subject to certain criteria to eliminate the influence of outliers. This study uses the dynamic panel regression model, particularly two-step system GMM to estimate the parameters as the dynamic model is less biased and more efficient estimator in solving serial correlation, heteroscedasticity and endogeneity problems in a panel data model (Baltagi, 2005, Roodman,2006). Several pre-diagnostic tests including Wooldridge test, Breush-Pagan/Cook-Weisberg test and Wu-Hausman test are conducted to test serial correlation, heteroscedasticity and endogeneity problem of the unbalanced panel as justification of using the two-step system GMM. Several post-diagnostic tests including Arrelano-Bond test, Hensen's-J test and Wald test are also performed to satisfy the GMM requirements.

With respect to Objective 1, this thesis tested Hypothesis 1, *Bank competition promotes bank stability in the banking sector,* in section 4.5.1. Bank stability is measured with *lnZ*-score, NPL ratio and equity ratio, and competition is measured with H-statistic and HHI. After controlling for bank level variables to capture loan composition, loan quality, operational efficiency, bank size and foreign ownership of bank, and macroeconomic variables in order to capture macroeconomic instability through annual real GDP growth and inflation rate, the two-step system GMM estimates shown that H-statistic is positively related with *ln*Z-score and equity ratio, and negatively related with NPL ratio, and HHI is negatively related with *ln*Z-score and equity ratio and positively related with NPL ratio. These results suggest that competition reduces credit risk and promotes capitalisation and financial solvency of the banking institutions in ASEAN-5.

To ensure robustness of this finding, this thesis re-estimated equation (3.1) using dynamic OLS and dynamic fixed effect, secondly considers Lerner index and CR3 instead of H-statistic and HHI respectively as measures of competition. Thirdly, it removed the ratio measuring loan quality from the model. Fourthly, it removed the banks from Singapore from the panel data. Finally, additional control variable revenue diversification ratio was added to the model. All the cases reported similar results. Thus, these results robustly support Hypothesis 1, bank competition promotes bank stability in the banking sector.

This thesis then tested Hypothesis 2, *The relationship between bank competition and bank stability is non-linear.* To test the non-linear relationship between bank competition and stability, this study considers the Sasabuchi-test, in addition to the opposite and significant sign of the coefficient of competition proxy in linear and quadratic terms. This thesis found an existence of non-linear relationship between bank competition and stability in main results considering H-statistic and HHI as measure of competition due to the omission of important variable (Wooldridge, 2015). It found that in the presence of bank regulation (capital regulation, activity restrictions, deposit insurance and official supervision) the non-linear relationship weakens by neutralising the negative franchise value effect of the competition, and the relationship between bank competition and stability becomes monotonic. In addition, the inflection points shown that more than 90% of the data distribution are lying below the inflection point in most of the models. Therefore, this thesis conforms the bank stability enhancing effect of bank competition.

With respect to Objective 2, this thesis tested Hypothesis 3, *Bank regulation moderates the relationship between bank competition and bank stability,* in section 4.5.2. On the basis of theoretical literature, the thesis considered four bank regulation including capital regulation, activity restrictions, deposit insurance and official supervision, and adopted three indices for capital requirements index, activity restrictions index and supervisory power index, and a dummy variable for deposit insurance following earlier literature. The findings for Hypothesis 3 are reported in Table 4.16.

Table 4.16: Summary of the findings of the moderating role of bank regulation on the relationship between bank competition and stability

Variables	*ln*Z-score	NPL ratio	Equity ratio
Capital Requirements Index	+	-***	+***
Capital Requirements Index *H-statistic	+	-*	+**
Activity restrictions Index	-***	+***	-**
Activity restrictions Index *H-statistic	+**	-*	+
Deposit Insurance	+*	-***	+
Deposit Insurance *H-statistic	-*	+***	+
Supervisory Power Index	+	-*	+
Supervisory Power Index*H-statistic	+	-**	+*

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

The results suggest that capital regulation, deposit insurance and official supervision have a positive effect on bank stability in independent of the level of competition. These regulatory policies found to promote bank stability by increasing capitalization and reducing credit risk taking tendency of the banks in less competitive environment. If competition increases in the market, capital stringency and official supervision promote bank stability, while the role of deposit insurance is changed and found weakening bank stability by increasing insolvency risk and credit risk. On the other hand, activity restrictions decrease bank stability and increase risk-taking behaviour of the bank in less competitive environment. Activity restrictions work well in promoting bank stability in competitive environment by promoting financial solvency and decreasing both insolvency risk and credit risk.

To ensure robustness of these results, this thesis re-estimated equations (3.10) and (3.11). First, it uses dynamic OLS and dynamic fixed effect. Second, it removes the quadratic term of competition measure (H-statistic^2) from the equations. Third, it uses a sub-sample analysis of 2000-2014 period aftermath of post-AFC banking sector restructure. Fourth, it uses static OLS and fixed effect, and finally, instead of H-statistic using Lerner index as a measure of competition. In all the cases, this thesis finds consistent results. Thus, this study robustly supports hypothesis 3 and suggests that bank regulation especially capital regulation, deposit insurance and official supervision promote bank stability in less competitive environment, and capital requirements, activity restrictions and official supervision promote bank stability in more competitive environment.

With respect to Objective 3, this study tests Hypothesis 4, *Financial crisis influences on the moderating role of bank regulation on the relationship between bank competition and bank stability,* in section 4.5.3. Here, financial crisis is captured with a dummy variable which takes a value of 1 for the years 1997, 1998, 2008 and 2009 as crisis years, and 0 otherwise. The findings of Hypothesis 4 are reported in Table 4.17.

Table 4.17: Summary of the findings of the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and stability

Variables	*lnZ*-score	NPL ratio	Equity ratio
Crisis	-***	+***	-*
Capital Requirements Index*Crisis	+***	-***	+
Capital Requirements index*Crisis*H	+*	-*	+
Activity restrictions Index*Crisis	-***	+**	-**
Activity restrictions Index*Crisis *H	+**	-**	+
Deposit Insurance*Crisis	+***	-*	+
Deposit Insurance*Crisis *H	-	+	+
Supervisory Power Index*Crisis	+***	-**	+**
Supervisory Power Index*Crisis*H	+**	-	+*

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

The results suggest that the banks become fragile during financial crisis, where banks found suffering from insolvencies, high nonperforming loans and low capitalisation. The results further suggest that during financial crisis capital regulation, deposit insurance and official supervision have a positive effect on restoring stability of banking institutions. These regulatory policies work well during financial crisis to restore bank stability by increasing financial solvency and also reducing both credit risk and insolvency risk taking appetites of the banks. As regulatory tools the deposit insurance found insignificant in raising moral hazard problem in competitive market during financial crisis. On the other hand, activity restrictions render the banking system fragile by increasing insolvency risk and credit risk. But, the fragility effect of activity restrictions is reversed in more competitive market during financial crisis. To ensure the robustness of these results, this study re-estimated equations (3.12)-(3.14) firstly using dynamic OLS and dynamic fixed effect. It then removes the quadratic term of competition measure (H-statistic^2) from the equations using static OLS and fixed effect methods. In all the cases, the original findings of this thesis with respect to regulation effect on bank stability during crisis remain unaltered. Thus, this study supports Hypothesis 4 and suggests that bank regulation, especially capital requirements, deposit insurance and official supervision, promotes bank stability in less competitive environment, and capital requirements, activity restrictions, and official supervision promotes bank stability in more competitive environment in financial crisis.

CHAPTER 5: CONCLUSION, POLICY IMPLICATION AND FUTURE RESEARCH

5.1 Introduction

Although competition is a precondition of an efficient, innovative and develop financial system, there has been no academic consensus for bank policy makers as to whether high bank competition leads to bank stability or fragility in the banking system. The theoretical literature on the relationship between bank competition and stability is conflicting and ambiguous. The traditional competition-fragility theory of Keeley (1990) argued that competition erodes the franchise value of banks which leads to decrease their profit margin. Consequently, banks like to invest in risky portfolio in order to recover their lost profit margin. As a result, risk-taking tendency of the banks in more competition undermines their stability and makes them fragile institutions. Conversely, the alternative competition-stability theory argues that competition rather promotes stability of the banking institutions. The advocate of this theory, Boyd & Nicolo (2005) claimed less competition in the bank loan market induces banks to charge high interest rate to the borrowers, which increases borrowers' loan default risk, as the borrowers' risk and bank risk are perfectly correlated, the borrowers risk shifted to the bank through risk shifting effect and increases banks probability of default and makes them fragile. On the other hand, Martinez-Miera & Repullo (2010) partially supported the risk shifting effect of Boyd & Nicolo (2005) where higher loan interest rate charged by the banks on less competitive loan market increases the probability of bank's default. However, Martinez-Miera and Repullo (2010) additionally argued that high interest rate in less competitive market also increases banks' profit rate due to margin effect, and claims that both the competition-fragility view and competition-stability view could coexist, and the relationship between bank competition and stability is non-linear or inverted U-shaped.

The mixed empirical evidence on the relationship between bank competition and stability makes the issue more puzzling for bank policy makers.

The theoretical literature suggests that the relationship between bank competition and stability depends on bank regulation such as capital regulation, activity restrictions, deposit insurance and official supervision. With respect to the capital regulation, more capital requirements may have franchise value effect of excessive risk-taking (Hellmann et al., 2000), and equity-at-risk effect of making banks more responsive and prudent in risk-taking (Hellmann et al., 2000; Repullo, 2004). Similarly, activity restrictions have a franchise value effect of excessive risk taking (Claessens and Laeven, 2004) and risk shifting effect of more calculative risk-taking on the banking system (Boyd and Nicolo, 2005). Likewise, deposit insurance has stabilisation effect by increasing depositors' confidence by protecting bank runs (Diamond and Dybvig, 1983). Also, moral hazard affects excessive risk-taking due to agency relationship between depositors and bank (Jensen and Meckling, 1976). In a similar vein, powerful bank supervision may affect risk-taking by banks due to public interest view and private interest view of the supervisor (Beck et al., 2006). However, the literature has not examined empirically does the bank regulations, particularly capital regulation, activity restrictions, deposit insurance and official supervision, influence on the relationship between bank competition and stability. Moreover, literature (Anginer et al., 2014b; Beck et al., 2006; Repullo and Suarez, 2013) suggests that the stabilisation or risk-taking effect of bank regulation may depend on the economic conditions. It has not yet examined empirically does financial crisis influence on the moderating role of bank regulation, especially capital regulation, activity restrictions, deposit insurance and official supervision, on the relationship between bank competition and stability especially in developing countries. These are the gaps in the banking literature which are addressed in this study. It offers significant policy implications with respect to bank consolidation, bank regulation and supervision based on the ASEAN banking sector which has undergone financial liberalisation, deregulation, and restructuring through tremendous consolidation and bank reform based on the experience of the AFC to promote bank stability in the banking sector.

To address the research gaps, this thesis examined whether bank competition promotes bank stability in the banking sector. Secondly, it examined whether the relationship between bank competition and stability is non-linear in the absence of bank regulation. It includes bank regulations and supervision such as capital regulation, activity restrictions, deposit insurance and official supervision in examining the relationship between bank competition and stability to make the aforementioned relationship robust and extend the literature regarding regulatory impact on bank stability through the channel of competition. Here, this thesis investigates does bank regulation moderate the relationship between bank competition and bank stability in both less and more competitive environment. Finally, as theories suggest that stability effect of bank regulation depends on the level of economic condition, the influence of financial crisis on the moderating role of the bank regulation on the relationship between bank competition and bank stability in both less and more competitive environment.

The rest of the chapter is structured as follows. The summary of the findings of the study is highlighted in section 5.2 and the implications of overall findings are addressed in section 5.3. The limitations and direction for future research are presented in section 5.4 and 5.5 respectively.

5.2 Summary of Findings

This section summarises the findings of the three objectives of this thesis. The first objective is to evaluate the influence of bank competition on bank stability in the banking sector. The second objective is to examine the moderating role of bank regulation on the relationship between bank competition and stability in the banking sector. The final objective is to examine the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector.

To meet the first objective, two testable hypotheses were developed in Chapter 1 where, Hypothesis 1 is 'bank competition promotes bank stability in the banking sector', and Hypothesis 2 is 'the relationship between bank competition and bank stability is non-linear'. Here, this study tests competition-fragility theory of Keeley (1990), competition-stability theory of Boyd & Necolo (2005), and Martinez-Miera & Repullo's (2010) theory of non-linear relationship between bank competition and stability.

To satisfy the second objective, the study develops and tests the Hypothesis 3 which is 'Bank regulation moderates the relationship between bank competition and bank stability'. Here, the study considers four bank regulations including capital regulation, activity restrictions, deposit insurance and official supervision, and tests the franchise value effect and equity-at-risk effect for capital regulation, franchise value effect and risk shifting effect for activity restrictions, stabilisation effect and moral hazard effect for deposit insurance and public interest view and private interest view for official supervision. To fulfil the third objective, this study develops and tests Hypothesis 4 which is 'Financial crisis influences on the moderating role of bank regulation on the relationship between bank competition and bank stability'. Here, the study considers capital regulation, activity restrictions, deposit insurance and official supervision and tests their aforementioned respective effects for respective regulation in examining the relationship between bank competition and stability during financial crisis period. The development of research hypotheses and research design are discussed in Chapter 1.

To satisfy the research objectives and test the respective hypothesis, this study constructs an unbalanced panel data with 2527 bank-year observations from 180 commercial banks in ASEAN-5 (including Indonesia, Malaysia, the Philippines, Singapore and Thailand) over the period from 1990 to 2014, which covers both the 1997-98 AFC and 2008-09 GFC, also early 1990s financial liberalisation, post-AFC deregulation and bank restructuring efforts in ASEAN-5. The estimation is carried out in a dynamic panel framework to deal with the dynamic nature of bank level data arising from serial correlation of dependent variable, heteroscedasticity and endogeneity of problem of the main explanatory variables, competition and bank regulation.

Two-step System GMM is used in the estimation process, as it can more efficiently deal with misspecification errors arising from the existence of serial correlation, heteroscedasticity and endogeneity problem in bank level data, and also it is least biased estimator among other alternatives (Baltagi, 2008; Roodman, 2006, 2009). In the investigation process, this study uses three alternative accounting based measures of stability for individual banks such as natural logarithm of Z-score, NPL ratio and equity ratio, based on both theoretical consideration and also factor analysis. Meanwhile, both traditional industrial organisational measures such as HHI (CR3 for robustness testing), and new empirical industrial organisational measure such as Panzar-Rosse-H-statistic (Lerner index for robustness testing) are used to capture the level of competition for the ASEAN banks. Controlling the bank characteristics including loan composition, loan quality, operational efficiency, bank size and foreign ownership of bank, and macroeconomic characteristics including annual GDP growth rate and inflation rate, and also taking accounts for endogeneity of competition and bank regulation with stability by employing financial freedom and property right as instrumental variables, this study concludes with the following findings which are also summarised in Table 5.1.

With respect to the first objective, this thesis found that H-statistic is positively related with *lnZ*-score and equity ratio, and negatively related with NPL ratio, and HHI is negatively related with *lnZ*-score and equity ratio and positively related with NPL ratio. These results suggest that competition increases financial soundness and capitalisation, and reduces credit risk in the ASEAN banking market. In the other words, concentration has a fragility effect in ASEAN region which decreases financial solvency and capitalisation and increases credit risk. Thus, this thesis suggests that bank competition promotes stability which supports the Hypothesis 1 of this thesis. This thesis further suggests that an individual bank may promote stability through lowering credit risk and increasing capitalisation. In investigating the non-linear relationship between bank competition and stability in the absence of bank regulation, this thesis found an existence of non-linear relationship between bank competition and stability. The coefficient of H-statistic is positive and significant in linear terms, and negative and significant in quadratic terms on *ln*Z-score and equity ratio. The opposite effect of H-statistic is found on NPL ratio. On the other hand, the coefficient of HHI is negative and significant in linear terms, and positive and significant in quadratic terms on both *ln*Z-score and equity ratio. The opposite effect of HHI is found on NPL ratio. In addition, the Sasabuchi-test is significant in all the cases in the absence of bank regulation in stability models.

Table 5.1 Summary of findings of the study

Objective	Hypothesis	Theory	Hypothesis (Supported/ not supported)
1) Examine influence of bank competition on bank stability in banking sector	Bank Competition promotes bank stability	*Competition-fragility *Competition-stability	Supported
	The relationship between bank competition and bank stability is non-linear	Mixed view of Martinez-Miera & Repullo (2010)	Supported
2) Examine the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector	Bank regulation moderates the relationship between bank competition and bank stability.	***Capital Regulation** Franchise value effect/ Equity-at-risk-effect	Supported
		***Activity Restrictions** Franchise value effect/ Risk shifting effect	Supported
		***Deposit Insurance** Stabilisation effect/ Moral hazard effect	Supported
		***Official Supervision** Public interest view/ Private interest view	Supported
3) Examine the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank stability in the banking sector.	Financial crisis influences on the moderating role on the relationship between bank competition and bank stability.	***Capital Regulation** Franchise value effect/ Equity-at-risk-effect	Supported
		***Activity Restrictions** Franchise value effect/ Risk shifting effect	Supported
		***Deposit Insurance** Stabilisation effect/ Moral hazard effect	Supported
		***Official Supervision** Public interest view/ Private interest view	Supported

With respect to the second objective, the moderating role of bank regulation on the relationship between bank competition and stability, using three indices to capture capital regulation, activity restrictions, official supervision, and a dummy variable for deposit insurance, this thesis found that bank regulation makes the positive relationship between bank competition and stability more robust. The results suggest that bank regulation strengthens the positive stability effect of bank competition and weaken the negative fragility effect of bank competition, and weaken the non-linear relationship between bank competition and stability. Further, this thesis found evidence that bank regulation affects the relationship between bank competition and stability in both less competitive environment and more competitive environment in the region. This thesis found the most important bank regulations in promoting bank stability are activity restrictions and deposit insurance. This thesis found the coefficient to deposit insurance on *lnZ*-score is positive and significant, and it is negative and significant on NPL ratio, suggesting that deposit insurance promotes bank stability by reducing risk taking appetite and increasing bank solvency in less competitive market. However, the bank stabilization effect of deposit insurance found weaken in the competitive environment as the coefficient of the interaction term of deposit insurance and H-statistic is negative and significant on *ln*Z-score, and it is positive and significant on NPL ratio.

On the other hand, the coefficient of the activity restrictions index on *ln*Z-score and equity ratio found positive and, it is found negative on NPL ratio indicating that activity restrictions weaken bank stability by reducing bank solvency and capitalization, and increasing risk taking appetite in less competitive market. However, the fragility effect of the activity restrictions found changed in the competitive environment. It is found that the the coefficient of the interaction term of the activity restrictions index and H-statistic is positive and significant on lnZ-score and , the same coefficient is found negative and significant on NPL ratio.

These results support to accept Hypothesis 3 of this thesis. This is because, in both less and more competitive environment, capital regulation and official supervision promote bank stability by reducing risk-taking behaviour of the banks. On the other hand, deposit insurance promotes bank stability in less competitive environment, and activities restrictions promote bank stability in more competitive environment.

These results suggest that bank regulation alone is insufficient for investigating its effect on stability or fragility. Rather a complete investigation of bank regulation along with the level of competition is required in disaggregated manner. Activity restrictions has a risk-taking effect in the banking system in less competitive environment due to franchise value effect of competition, while that effect is reversed in competitive environment due to the risk-shifting effect of competition. Similarly, although deposit insurance promotes bank stability in the less competitive market, the rise in the level of competition in the market the moral hazard effect of deposit insurance dominates its stabilisation effect, and renders the banking system fragile. Thus, this thesis found the most prominent bank regulation to promote bank stability is deposit insurance in less competitive market. On the other hand, activity restrictions is found as most prominent bank regulation to promote bank stability in more competitive environment.

With respect to the final objective, this thesis examined the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and stability. This thesis, firstly, found that despite financial crisis renders the banking system insolvent by eroding capitalisation and increasing nonperforming loan, the bank stability effects of competition is not changed during financial crisis. This thesis, further, found that that financial crisis influence on the moderating role of the bank regulation on the relationship between bank competition and stability. It found that capital regulation, deposit insurance and official supervision restore bank stability by building capital buffer and reducing nonperforming loan in both less competitive and more competitive environment during financial crisis. Regarding activity restrictions, this thesis found that activity restrictions renders the banking system more fragile during crisis period by increasing nonperforming loan and decreasing solvencies in the less competitive environment. The fragility effect of the activity restrictions were reversed during the crisis period if competition is more in the banking market. These results accept Hypothesis 4 as well. From the above findings, this thesis suggests that the moderating roles of the bank regulation on the relationship between bank stability and competition are not changed in financial crisis, accept deposit insurance.

5.3 The Implications of the Overall Findings

Although the ASEAN banking sector has undergone tremendous consolidation process and become more concentrated in the last three decades, the findings of this study do not confirm that such attempts improved the bank stability in this region. It is reflected in the findings that greater concentration does not induce banks to take less risk, hold more capital and become financially solvent. Rather, greater competition encourages banks to improve the risk management process, hold more capital and become financially sound. Further, this study suggests that bank regulation plays a vital role in promoting bank competition and stability. The findings further suggest that stability effect of bank regulation depends on the level of competition in the banking market. Deposit insurance is found as the best bank regulation to promote bank stability in less competitive environment. While, activity restrictions is found as the best bank regulation to promote bank stability in more competitive environment. The findings further suggest that the effectiveness of the bank regulation on stability does not change even in financial crisis except deposit insurance in high competitive environment.

The findings of this thesis could enable the policy makers of the ASEAN banks to evaluate whether the consolidation policy is appropriate in promoting bank stability in the region. These findings further enable the policy makers to determine which particular regulation among capital regulation, activity restrictions, deposit insurance and official supervision is/are more effective in improving banks' risk management capacity and improving bank stability considering the level of competition. The contributions of this thesis towards the literature, methodology and policy formulations are outlined in section 1.6 of chapter 1. This section outlines the implications of the study for literature, methodology and policy formulations by regulators in ASEAN such as the ministry of finance, central bank, bank supervisors, deposit insurance organisations, as well as commercial banks.

5.3.1 Implications for literature

5.3.1.1 Bank competition promotes bank stability

This thesis contributes to the bank competitive-stability puzzle in ASEAN-5 banking market by incorporating the moderating role of the bank regulation to identify the most effective bank regulation for promoting bank stability in competitive environment. Unlike earlier literature Liu et al., 2012 and Fu et al. (2014), this thesis contributes to the literature by showing that more competition promote banks stability by reducing risk taking behaviour and increasing capitalization. Further, it contributes the puzzle by showing that bank regulations such as capital regulation, activity restrictions, deposit insurance and powerful official supervision strengthen the positive risk-shifting effect of competition and reduces the negative franchise value effect of competition.

5.3.1.2 Determination of the threshold level of bank competition

In addition, this thesis contributes to the competition-stability puzzle by determining inflection point of competition to show the threshold level of competition beyond which franchise value effect of competition starts dominating over its risk shifting effect. By determining the marginal effect competition on bank stability, this thesis found the threshold level of competition proxied by H statistic is 0.7631, against the regional average of 0.55. This thesis, further, contributes to the literature by showing the role of bank regulation to move forward the threshold level of competition to get benefits of competition to promote bank stability in ASEAN-5 countries. By determining the marginal effect of bank regulation on the relationship between bank competition and stability, this thesis shown that the threshold level of competition may be shifted to the right to reduce the fragility effect of the competition and increase the stability effect of competition in the banking market.

5.3.1.3 The moderating role of bank regulation on the relationship between bank competition and bank stability

This thesis further contributes competition-stability puzzle by investigating the moderating role of the bank regulation (particularly, capital regulation, activity restrictions, deposit insurance and official supervision) on competition stability relationship in disaggregated manner by identifying the most relevant bank regulation to promote bank stability in the competitive environment. This thesis reports that more important bank regulations that moderate the relationship between bank competition and bank stability are deposit insurance and activity restrictions. Existing literature of activity restrictions [such as Barth et al. (2001, 2004, 2008), Claessens and Laeven (2004), Beck et al. (2006, 2013), Berger et al. (2009), Liu, et al. (2012) and Fu et al. (2014)] describe that the restrictions increase moral hazard of banks and weaken bank stability by exacerbating the risk taking tendency of the banks. However, this thesis for the first time shown activity restrictions work well in reducing risk taking behavior and promoting bank stability in high competitive environment due to the risk-shifting effect of the activity restrictions. Further, this study shown that deposit insurance works well in promoting bank stability by increasing capitalization and reducing risk taking behavior in less competitive market due to the stabilization effect of deposit insurance. However, the aforementioned effect of deposit insurance is reversed in competitive market as banks face moral hazard in the competitive market as they believe that they are protected by public safety net subsidy and depositors are not monitoring their risk taking behavior in the competitive market.

5.3.1.4 The influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and bank stability

This thesis further contributes to the literature by investigating the influence of financial crisis on the moderating role of bank regulation on the relationship between bank competition and stability by identifying the most relevant regulation to promote financial stability in competitive market in financial crisis. The results suggest that the effects of bank regulation on the relationship between bank competition and stability do not change during financial crisis except deposit insurance in high competitive environment. This thesis contributes to the literature in the context of ASEAN-5 showing that deposit insurance works well even in the competitive environment during financial crisis.

5.3.2 Implication for methodology

It also contributes to the methodology to determine more suitable proxies to capture bank stability by using factor analysis in ASEAN-5 to identify the best measures for banks stability, which are Z-score, NPL ratio and equity ratio. This thesis found an evidence that high Z-score is associated to high equity ratio and low NPL ratio, suggesting that high bank stability is a result of high capitalization and low risk-taking behaviour of the banks in the region.

5.3.3 Implications for policy makers

5.3.3.1 Competition policy

As the results suggest that increased competition is associated with more capitalisation, more solvency and less risk-taking, the policy makers of the ASEAN economies should prevent anticompetitive policies such as excessive concentration to promote bank stability. With respect to the evaluation and approval of merger and acquisition at the national level, the regulators should undertake a more careful approach. As foreign ownership is associated with higher capitalisation and financial solvency, and lower risk-taking, the proposed ASEAN banking integration framework, which allows banks from any of ASEAN-5 economies to move to other ASEAN-5 economies with the status of home country, expects to promote competition in the region, and also too-big-to-fail phenomena will worsen in a competitive environment. The ASEAN banks should focus on improving efficiencies in operations and resources allocation in the economy. Regulators should motivate banks to engage in financial innovation for efficient risk management, which may help banks be financially stable through product innovation.

As the bank regulation moderates the relationship between bank competition and stability, regulators should cautiously design the right combination of bank regulation in order to optimise the competition gains from bank regulation to promote bank stability in the banking market.

5.3.3.2 Capital regulation

Stringent capital regulation was effective in motivating banks to hold more capital, reduce bank intensity to make risky assets portfolio in both high and less competitive environment even in financial crisis, due to the equity-at-risk effect of capital. The Basel III framework which is adopted during 2013 to 2014 by all ASEAN-5 economies to improve the risk management capacity and bring discipline in the market would be beneficial for the region to ensure bank stability.

5.3.3.3 Activity restrictions

Although restrictions on branching, insurance, real states and own non-bank financial firms have a moral hazard effect in less competitive environment, it may be implemented on the banks to increase competition and bank stability after securitisation of its risk impact. This thesis found evidence that negative franchise value effect of activity restrictions is replaced slowly by the positive risk-shifting effect of activity restrictions as the restrictions rise competition in the market by eroding banks franchise value.

5.3.3.4 Deposit insurance

Explicit deposit insurance was implemented in 2004-2005 in every ASEAN-5 except Thailand, where it was implemented in 2011 to provide a public safety net to the depositors and increase their confidence in banking system and ensure bank stability. Explicit deposit insurance system promotes bank stability in less competitive environment by reducing risk-taking in the region. Also, the banking system of this region showed resilient during the recent 2008-09 global financial crisis, which may be attributed to the depositors' confidence in the banking system in the presence of deposit insurance. However, as deposit insurance exacerbates moral hard effect of high risk-taking and worsening bank solvency in high competition, it is inferred that deposit insurance is not credibly designed. Therefore, regulators should focus on the design feature of deposit insurance to protect against bank runs. In addition, as the fragility effect of deposit insurance is altered in competitive market during financial crisis, deposit insurance scheme could be designed flexibly. More deposit insurance could be offered to the banks during financial crisis, and it could be reduced during normal time.

5.3.3.5 Official supervision

The official supervisors of the banks promote bank stability by reducing risk-taking behaviour in the overall period, and also financial crisis period by improving capitalisation regardless of the level of competition. This results may be due to the fact that official supervisors are driven by the public interest and are much more concerned about the market failure rather than political connectivity or private interest. Therefore, powerful official supervision could be another efficient tool in bringing governance and market discipline and promoting bank stability in the region.

5.4 Limitations of the Study

5.4.1 Generalisation

One possible limitation of the result is pertaining to the dataset of the cross-border operations of the banks. If banks operate overseas, they are involved in competition domestically and internationally, which reflects on their market power and risk-taking attitude. As this study uses consolidated data from Bankscope database of Bureau Van Dijik, there may be a gap between measurement of competition, market power and bank stability between international and domestic banks. Unfortunately, the disaggregated bank level data of assets and liabilities for domestic and cross-border origin are not available in any database.

5.4.2 Market based bank stability measures

This thesis employs only the accounting based bank stability and risk-taking measures instead of market based measures. The market based measures would greatly restrict the sample size of this thesis. Out of 180 commercial banks, only 38 are listed in the respective country's stock exchanges (15 in Indonesia, 3 in Malaysia, 10 in Philippines, 2 in Singapore and 8 in Thailand). The limited number of banks justifies only to use the accounting based measures. Therefore, the market based bank stability risk measures are not considered in this study.

5.4.3 Context

The thesis is limited to examining the relationship between bank regulation, competition and bank stability in ASEAN-5 (including Indonesia, Malaysia, Philippines, Singapore and Thailand). In examining bank regulation effect on the relationship between bank competition and stability, it is required to have deregulation and bank restructuring efforts in the banking system which are more prominent in ASEAN-5 based on the experience of the early 1990s financial liberalisation, both the 1997-1998 AFC and the 2008-2009 GFC, post-AFC bank restructuring drives and adoption the ASEAN Banking Integration Framework (ABIF)

5.5 Future Research

5.5.1 Replication in other countries or regions

The model used in this thesis, namely 'bank regulation effect on bank stability, and also through the channel of competition in banking market' can also be used in single countries like the US, UK or Germany and geographical areas such as European Union, Latin America or Middle East and North Asia to determine the most suitable bank regulation that improves stability through competition channels. This may have significant policy implications for the respective country or geographical area.

5.5.2 Country-specific institutional factor

It would be interesting to determine how different country-specific institutional factors affect bank stability and how these institutional factors carry influence through the channel of competition in the banking sector, or other sectors that also experienced financial crisis, such as the insurance industry.

5.5.3 Market based risk measure

Future research can be carried out to find the link between bank competition and risk-taking measured with market based risk measures. This requires the information of listed banks. The investigation requires including a large number of countries given only a few banks are listed in ASEAN.

5.5.4 Determine the banks' failure just before they failed

The results of this study further stimulate to determine the banks that failed just before they failed in a future study. This can be determined by performing a trend analysis of failed banks' stability by determining their distance to default, risk taking and capitalisation in a banking market. This may provide interesting findings to the policy makers for significant policy implication.

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LIST OF PUBLICATIONS AND PAPERS PRESENTED

Journal Articles published

1. Noman, AHM, Gee, C.S., Isa, C.R. (2017). Does Competition Improve Financial Stability of the Banking Sector in ASEAN? An Empirical Analysis. *PloS one*, *12*(5), e0176546.

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Journal Articles under review

1. "Does Bank Regulation matter in the relationship between Competition and Financial stability? Evidence from South-East Asian countries" with Gee, C.S., Isa, C.R. under review in *Pacific-Basin Finance Journal*

2. "The relationship between Bank Activity Restrictions and Risk-taking: Does competition matter?" with Gee, C.S., Isa, C.R. under review

3. "Does Market Power exacerbate Risk-taking behaviour of Banks? Evidence from South-East Asian Countries" with Gee, C.S., Isa, C.R. under review

Conference Presentation

1. Noman, A.H.M, Gee, C.S., Isa, C.R. (2016). Does market power increase risk taking behavior of Banks? Evidence from South-east Asian Countries. *China Financial Market Conference.* December 15-16, 2016, Faculty of Business & Accountancy, University of Malaya, Malaysia.

2. Noman, A.H.M, Gee, C.S., Isa, C.R. (2016). Does Competition improve Financial Stability in ASEAN-5? An Empirical Analysis. *24th conference on Securities and Financial Market*. December 9-10, 2016, National Sun Yat-sen University, Kaohsiung, Taiwan.

3. Noman, A.H.M, Gee, C.S., Isa, C.R. (2016). Bank Regulation, Competition and Financial Stability in ASEAN-5. *Bank Performance in ASEAN-5 workshop*. November 10, 2016, Equitable Society Research Cluster (ESRC), Faculty of Business and Accountancy, University of Malaya, Malaysia.

4. Noman, A.H.M, Gee, C.S., Isa, C.R. (2015). The effect of Competition on Financial Stability of ASESN-5 Commercial Banks. *LPEM Conference on Economics and Finance Indonesia 2015*, November 30-December 01, 2015, Faculty of Economics and Business, Universitas Indonesia, Depok, Indonesia.

APPENDIX

Appendix A: Construction of bank regulation index

Regulation	Description
Capital Requirements Index	In constructing the index, this study considers the following 8 questions of Barth et. al., (2001, 2006, 2008, 2013a), where 1 is assigned to the 'yes' answer to the question from 1 to 6 and 'no' answer to the questions 7 and 8, otherwise, 0. The questions are 1) is the minimum required capital ratio risk weighted in the line with Basel guidelines? 2) Does the minimum ratio change with market risk? 3) Are market values of loan losses not realized in accounting books deducted from capital? 4) Are unrealized losses in securities portfolios deducted? 5) Are unrealized foreign exchange losses deducted? 6) Are the sources of funds to be used as capital verified by the regulatory or supervisory authorities? 7) Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities? 8) Can initial disbursement of capital be done with borrowed funds?
Activity Restrictions Index	The index uses to decide whether the commercial banks are (1) unrestricted, (2) permitted, (3) restricted or (4) prohibited in the country in involving in insurance, securities, real estate financing and ownership of non-bank financial firms. In constructing the index, the value 1 is considered for unrestricted, 2 is considered for permitted, 3 is considered for restricted and 4 is considered for prohibited in insurance, securities, real estate activities and owning non-bank financial institutions.
Supervisory Power Index	The index is calculated by incorporating the following 14 questions of Barth et al. (2001, 2006, 2008, 2013a) following Anginer et al., (2014a). The question takes the value of 1, if answer is found as yes, otherwise, it takes the value of zero. The questions are: 1) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? 2) Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud, or insider abuse? 3) Can supervisors take legal action against external auditors for negligence? 4) Can the supervisory authority force a bank to change its internal organizational structure? 5) Are off-balance sheet items disclosed to supervisors? 6) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? 7) Can the supervisory agency suspend the directors' decision to distribute dividends? 8) Can the supervisory agency suspend the directors' decision to distribute bonus? 9) Can the supervisory agency suspend the directors' decision to distribute management fees? 10) Can the supervisory agency legally declare-such that this declaration supersedes the rights of bank shareholders-that a bank is insolvent? 11). Does the banking law give authority to the supervisory agency to intervene that is, suspend some or all ownership rights-a problem bank? 12-14). Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency do the following: (12) supersede shareholder rights? (13) Remove and replace management? (14) Remove and replace directors?

Appendix B: Definition of the variables, and their expected sign and data sources

VARIABLE	DEFINITION	Ex. sign[a]	SOURCES
Dependent Variable			
Z-score	Z-score is a measure of bank's soundness. Higher value indicates high distance from probability of default and lower risk and higher stability. We take the natural logarithm of Z-score to normalize the data(Anginer et al.,2014)		Bankscope database
NPL Ratio	A ratio of Non-performing loan to Gross loan, high value indicates more risky loan portfolio or high credit risk(Berger et al.,2009)		Bankscope database
Equity Ratio	A ratio of Equity to Total assets. Large value indicates lower loan portfolio risk and high risk management capacity (Fang et al., 2014)		Bankscope database
Explanatory variable: Measures of Competition			
H-Statistic	It is a sum of revenue elasticity with respect to input prices. High value indicates more competition(Moch, 2013).	+	Bankscope database
HHI	A concentration measure which is a sum of square of market share of loan of commercial banks. Higher value indicates high concentration and less competition (Berger et al. 2009)	-	Bankscope database
Explanatory variable: Measures of Banking regulation			
Activity Restrictions Index	This index takes a maximum value from 4 to 16. Higher value shows greater regulatory restrictions on bank activities to involve in insurance, securities, real estate financing and ownership of non-bank financial firms(Beck et al. 2013).	-	Barth et.al. (2001,2006, 2008, 2013a)
Capital Requirements Index	This index indicates both initial capital stringency and overall capital stringency. It takes a value from 0 to 8 indicating low to high capital stringency (Agoraki et al, 2011).	+	Barth et.al. (2001,2006, 2008, 2013a)
Supervisory power Index	An index that takes the value from 0-14 indicating low to high power of regulatory authority (Anginer et al. 2014).	+	Barth et.al. (2001,2006, 2008, 2013a)
Deposit Insurance	A dummy variable is used takes value of 1 if deposit insurance is present, otherwise 0. (Fu et al., 2013)	+	Barth et.al. (2001,2006, 2008, 2013a)
Bank level control variables			
Bank Size	Natural logarithm of total assets in million US$.(Tabak et al., 2012)	+/-	Bankscope database
Loan Composition	Loan Ratio, ratio of net loan to total assets indicating size of loan composition or level of intermediation (Liu &Wilson 2013).	-	Bankscope database
Loan Quality	Loan Loss reserve ratio, ratio of loan loss reserve to gross loan to indicate poor loan quality (Fang et al., 2014)	-	Bankscope database
Operational Efficiency	Cost to income ratio, the ratio of cost to income indicating managers' operational inefficiency(Lee & Hsieh 2014)	-	Bankscope database
Foreign Ownership	Foreign Bank Dummy, it takes the value 1, if more than 50 percent of bank share owned by foreigner bank, other wise zero (Berger et al.2009)	+	Bankscope, and bank's website.
Macro-economic control variable			
Inflation Rate	Annual Inflation rate based on consumer price index (Amidu & Wilson, 2013)	-	Worldbank's Development indicator database
GDP Growth Rate	Annual real GDP growth rate (Lee & Hsieh, 2014)	+	Worldbank's Development indicator database
Instrumental variables for GMM specification			
Financial Freedom	An index that takes value from 0-100 indicating the level of regulatory restrictions on financial freedom of the firms. Higher value indicates more freedom and less restrictions (Berger et al., 2009)		Heritage Foundation's database
Property Right	An index that takes a value from 0 -100 indicating the level to which private property right is protected by the laws. A higher score indicates more economic freedom and strong protection of property right of the individuals(Fu et al., 2013)		Heritage Foundation's database

[a] Expected sign is assigned if dependent variable is either Z-score or equity ratio. A reverse sign is expected if dependent variable is NPL ratio

Appendix C: The details of Tables 4.6 to 4.15

Table 4.5	The following equation is used for testing equilibrium condition of H-statistic $$ln(1 + ROA_i) = \alpha + \beta_1 lnW1_i + \beta_2 lnW2_i + \beta_3 lnW3_i + \gamma_1 lnX1_i + \gamma_2 lnX2_i + \gamma_3 lnX3_i + \varepsilon_i \quad (3.9)$$ Where, ROA_i is the bank's return on assets, $W1_i$ is the ratio of interest expenses to total assets as a ratio of price of borrowed funds, $W2_i$ is the ratio of personnel expenses to total assets as a measure of the price of labor, and $W3_i$ is the ratio of administrative and other operating expense to total assets as a measure of the price of fixed capital. Three bank-specific control variables, $X1_i$, $X2_i$, and $X3_i$, are added as the ratio of customer loan to total assets, ratio of equity to total assets, and total assets in millions of USD, respectively. In a long run equilibrium condition, $\beta_1 + \beta_2 + \beta_3 = 0$, indicating that input prices do not affect the bank's return on assets. Significant value of F test implies that all models are correctly specified. The standard errors are reported in the parenthesis.
Table 4.6	This table exhibits two-step system GMM regression estimates of the following equation (3.1) to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error presented in the parenthesis to correct heteroscedasticity among the banks. $$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.1)$$ The dependent variable is *ln*Z-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in models 5 and 6 as proxy of bank stability. The variable of interest, H-statistic and HHI as the measure of competition instrumented with property right and financial freedom are used in alternative model 1,3 and 5; and in model 2, 4 and 6 respectively. The relationship between competition and bank stability is controlled by a number of bank specific factors such as loan composition measured by the ratio of net loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign bank ownership is a dummy variable with 1 for the foreign banks, otherwise zero and operational efficiency of bank managers measured by the ratio to cost to income; and also macroeconomic control variables including annual real GDP growth rate and inflation rate. The presence of serial correlation, heteroscedasticity and endogeneity are examined with pre-diagnostic test Wooldridge test, Breush – Pagan/Cook-Weisberg test and Wu- Hausman test respectively. Significant value of Wooldridge test, Breush – Pagan/Cook-Weisberg test and Wu- Hausman test evident presence of serial correlation, Heteroscedasticity and endogeneity problem respectively and justify the use of two step system GMM specification. Significant value of first stage regression and insignificant value of Hansen's J-test ensure that instrumental variable are both relevant and valid. Further, significant value of AR(1) and insignificant value of AR(2) implies that serial correlation is present at first order but it is absent at second order. Besides, significant value of Wald test implies that all models are correctly specified.
Table 4.7	This table exhibits two-step system GMM regression estimates of the following equation (3.2) to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error presented in the parenthesis to correct heteroscedasticity among the banks: $$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt} \quad (3.2)$$ The dependent variable is *ln*Z-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in models 5 and 6 as proxy of bank stability. The variable of interest, H-statistic and HHI

	as the measure of competition instrumented with property right and financial freedom are used in alternative model 1,3 and 5; and in model 2, 4 and 6 respectively. The relationship between competition and bank stability is control by a number of bank specific factors such as loan composition measured by the ratio of loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign bank ownership is a dummy variable with 1 for the foreign banks, otherwise zero and operational efficiency of bank managers measured by the ratio to cost to income; and also macro-economic control variables such as annual real GDP growth rate and inflation rate. The presence of serial correlation, heteroscedasticity and endogeneity are examined with pre-diagnostic test Wooldridge test, Breush–Pagan/Cook-Weisberg test and Wu- Hausman test respectively. Significant value of Wooldridge test, Breush – Pagan/Cook-Weisberg test and Wu- Hausman test evident presence of serial correlation, Heteroscedasticity and endogeneity problem respectively and justify the use of two step system GMM specification. Significant value of first stage regression and insignificant value Hansen's J-test ensures that instrumental variable are relevant and valid. Further, significant value of AR(1) and insignificant value of AR(2) implies that serial correlation is present at first order but it is absent at second. In addition, significant of Sasabuchi-test implies that there is a non-liner relationship between competition and bank stability. Besides, significant value of Wald test implies that all models are correctly specified.
Table 4.8	This table exhibits two step system GMM regression output of the following the two equations showing the effect of capital regulation on the relationship between competition and bank stability: $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.10)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.11)* The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4 and equity ratio in models 5-6, as bank stability measure. The effect of capital regulation on competition-stability nexus is presented in models 1,3, and 5, where competition is measured by H-statistic. An interaction term of capital requirements index and H statistic is used in models 2,4 and 6 to show the mediating effect of capital regulation through the channel of competition on bank stability. It controls a number of bank level variables such as ratio of net loan to total assets to capture assets composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency of bank managers and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macro-economic instability. Small value of VIF indicates the models are free from multicollinearity problem. Significant value of first stage regression and insignificant value of Hansen's J test ensures that instrumental variables are both relevant and valid. Significant value of Wooldridge test, Breush –pagan/Cook-Weisberg test and Wu- Hausman test indicate that the unbalanced panel is suffering from serial correlation, Heteroscedasticity and endogeneity, which justify the use of system GMM specification. Moreover, insignificance of Sasabuchi-test in all models indicate that the relationship between competition and bank stability in the presence of capital requirement is monotonic and not non-linear. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.
Table 4.9	This table exhibits two step system GMM regression outputs of the following the two equations demonstrating the effect of activity restrictions on the relationship between competition and bank stability:

	$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.10)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.11)* The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4 and equity ratio in models 5-6 as bank stability measure. It shows an effect of activity restrictions on competition-bank stability nexus in model 1, 3 and 5, where competition is measured by H-statistic. An interaction term of activity restrictions index and H statistic is used in models 2,4 and 6 to show the mediating effect of activity restrictions on bank stability through the channel of competition. We control a number of bank level variables such as ratio of net loan to total assets to capture assets composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . We also control GDP growth rate and inflation rate to capture macro-economic instability. Small value of VIF indicates the models are free from multicollinearity problem. Significant value of first stage regression and insignificant value of Hansen's J test ensures that instrumental variable are relevant and valid. Significant value of Wooldridge test, Breush –pagan/Cook-Weisberg test and Wu- Hausman test show there involves serial correlation, Heteroscedasticity and endogeneity and justify the use of GMM specification. insignificance of Sasabuchi-test in all models indicate that the relationship between competition and bank stability in the presence of capital requirement is monotonic and not non linear. Besides, significant value of Wald test implies that all models are correctly specified. Standard deviations are reposted in parenthesis.
Table 4.10	This table exhibits two step system GMM regression outputs of the following the two equations showing the effect of deposit insurance on the relationship between competition and bank stability: $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.10)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.11)* The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6 as bank stability measure. The effect of deposit insurance on stability and competition nexus is presented in models 1, 3 and 5, where competition is measured by H-statistic. An interaction term of deposit insurance and H statistic is used in models 2,4 and 6 to show the mediating effect of deposit insurance on bank stability through the channel of competition. It controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency of managers, and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . We also control GDP growth rate and inflation rate to capture macroeconomic instability. Small value of VIF indicates the models are free from multicollinearity problem. Significant value of first stage regression and insignificant value of Hansen's J-test ensures that instrumental variable are relevant and valid. Significant value of Wooldridge test, Breush –pagan/Cook-Weisberg test and Wu- Hausman test show there involves serial correlation, Heteroscedasticity and endogeneity and justify the use of system GMM specification. In addition, insignificant value of Sasabuchi-test indicates that the relationship between competition and bank stability is not non-linear, rather monotonic. Besides, significant value of Wald test implies that all models are correctly specified. Robust Standard deviations are reposted in parenthesis.
Table 4.11	This table exhibits two step system GMM regression outputs of the following two equations showing the effect of stringent official supervision on the relationship between competition and bank stability: $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4 REG_{jt-1} + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.10)*

	$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 REG_{jt-1} + \alpha_5 (REG_{jt-1} \times COM_{ijt}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.11)* The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4 and equity ratio in models 5-6 as bank stability measure. It shows the effect of official supervision on competition-bank stability nexus in models 1,3 and 5, where competition is measured by H-statistic. On the other hand, the mediating effect of official supervision through the channel of competition is presented in models 2,4 and 6 using an interaction term of supervisory power index and H-statistic. It controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, logarithm of total assets to capture banks size, cost to income ratio to measure operational efficiency of managers, and a dummy variable, with value 0 and 1, to capture foreign ownership of banks, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Small value of VIF indicates the models are free from multicollinearity problem. Significant value of first stage F-test and insignificant value of Hansen's J-test ensure that instrumental variables are relevant and valid. Further, significant value of Wooldridge test, Breush –pagan/Cook-Weisberg test and Wu-Hausman test show there involves serial correlation, Heteroscedasticity and endogeneity and justify the use of GMM specification. In addition, insignificant value of Sasabuchi-test indicates that the relationship between competition and bank stability is not non-linear, rather monotonic in the presence of bank supervision. Besides, significant value of Wald test implies that all models are correctly specified. Standard deviations are reposted in parenthesis.
Table 4.12	This table exhibits two-step system GMM regression estimates of the following equations showing the effect of capital regulation on the relationship between competition and bank stability during financial crisis: $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.12)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.13)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4 Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.14)* The dependent variable is natural logarithm of Z-score in models 1-3, NPL ratio in models 4-6 and equity ratio in models 7-9 as bank stability measures. The effect of financial crisis on bank stability is presented in models 1, 4, and 7, where crisis is captured with a dummy variable which takes the value of 1 if the year is crisis year, otherwise zero. The effect of capital regulation on competition-bank stability nexus during financial crisis are presented in models 2, 5 and 8, where competition is measured by H-statistic. It uses a triple terms interaction of capital requirement index, H-statistic and crisis in order to show the mediating effect of capital regulation on competition-stability nexus during crisis period in models 3, 6, and 9. It controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, logarithm of total assets to capture banks size, cost to income ratio to measure operational efficiency of managers, and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Small value of VIF indicates the models are free from multicollinearity problem. Significant value of first stage F-test and insignificant value of Hansen's J-test ensure that instrumental variables are relevant and valid. Further, significant value of Wooldridge test, Breush –pagan/Cook-Weisberg test and Wu-Hausman test show there involves serial correlation, Heteroscedasticity and endogeneity and justify the use of the system GMM specification. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.
Table 4.13	This table exhibits two step system GMM regression output of the following equations showing the effect of activity restrictions on the relationship between competition and bank stability during financial crisis:

	$STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.12)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.13)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.14)* The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4 and equity ratio in models 5-6 as bank stability measures. The effects of activity restrictions on the competition-stability nexus during crisis are presented in models 1, 3 and 5, where competition is measured by H-statistic. This study uses a triple terms interaction vector of activity restrictions index, H-statistic and crisis in order to show the mediating effect of activity restrictions on the competition-stability nexus during crisis period in models 2, 4, and 6. It controls a number of bank level variables such as ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, logarithm of total assets to capture bank size, cost to income ratio to measure operational efficiency of manager, and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Small value of VIF indicates the models are free from multicollinearity problem. Significant value of first stage F-test and insignificant value of Hansen's J-test ensure that instrumental variables used in the models are relevant and valid. Further, significant value of Wooldridge test, Breush – pagan/Cook-Weisberg test and Wu-Hausman test indicate that there involves serial correlation, Heteroscedasticity and endogeneity in the unbalanced panel which justify the use of the system GMM specification. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.
Table 4.14	This table exhibits two step system GMM regression output of the following equations showing the effect of deposit insurance on the relationship between competition and bank stability during financial crisis: $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.12)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.13)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 \left(COM_{ijt}\right)^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma (YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.14)* The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4 and equity ratio in models 5-6 as bank stability measures. The effects of deposit insurance on the competition-stability nexus during crisis are presented in models 1, 3 and 5, where competition is measured by H-statistic. This study also uses triple terms interaction vector of deposit insurance, H-statistic and crisis in order to show the mediating effect of deposit insurance on competition-stability nexus during crisis period in models 2, 4, and 6. It controls a number of bank level variables such as ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, logarithm of total assets to capture bank size, cost to income ratio to measure managerial operational efficiency, and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . We also control GDP growth rate and inflation rate to capture macroeconomic instability. Small value of VIF indicates that the models are free from multicollinearity problem. Significant value of first stage F-test and insignificant value of Hansen's J-test ensure that instrumental variable are relevant and valid. Further, significant value of Wooldridge test, Breush –pagan/Cook-Weisberg test and Wu- Hausman test indicate that there involves serial correlation, Heteroscedasticity and endogeneity problem in unbalanced panel which justify the use of system GMM specification. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

Table 4.15	This table exhibits two-step system GMM regression output of the following equations showing the effect of official supervision on the relationship between competition and bank stability during financial crisis: $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.12)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (Crisis_t \times REG_{jt-1}) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.13)* $STAB_{ijt} = \alpha_0 + \alpha_1 STAB_{ijt-1} + \alpha_2 COM_{ijt} + \alpha_3 (COM_{ijt})^2 + \alpha_4\, Crisis_t + \alpha_5 (REG_{jt-1} \times Crisis_t) + \alpha_6 (REG_{jt-1} \times COM_{ijt} \times Crisis_t) + \beta BANK_{ijt} + \theta MACRO_{jt} + \gamma(YEAR)_t + \lambda_i + \varepsilon_{ijt}$ *(3.14)* The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4 and equity ratio in models 5-6 as bank stability measures. An independent effect of official supervision on competition-stability nexus during crisis are presented in models 1, 3 and 5, where competition is measured by H-statistic. This study uses a triple terms interaction vector of supervisory power index, H-statistic and crisis in order to determine the mediating effect of official supervision on competition-stability nexus during crisis period in models 2, 4, and 6. It controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, logarithm of total assets to capture bank size, cost to income ratio to measure managers' operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Small value of VIF indicates the models are free from multicollinearity problem. Significant value of first stage F-test and insignificant value of Hansen's J-test indicate that instrumental variables used in the models are relevant and valid. Further, significant value of Wooldridge test, Breush – pagan/Cook-Weisberg test and Wu-Hausman test indicate that there involves serial correlation, Heteroscedasticity and endogeneity in the unbalanced panel which justify the use of system GMM specification. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

Appendix D: Summary of the literatures using Panzar-Rosse H-statistic

Authors	Period	Country	Results	Equilibrium state
Phil Molyneux, Lloyd-Williams, and Thornton (1994)	1986-1989	France, Germany, Italy, Spain and UK,	For Italy, Monopoly and for rest, Monopolistic	No
Philip Molyneux, Thornton, and Llyod-Williams (1996)	1986 and 1988	Japan	Monopoly in 1986 and Monopolistic in 1888	Yes
Bikker and Haaf (2002)	1988-1998	23 developed countries	Monopolistic	Yes, not reported
Claessens and Laeven (2004)	1994-2001	50 counties	Monopolistic	Yes, most counties but not reported
CASU and Girardone (2006)	1997-2003	15 EU counties	Monopolistic except two countries	Yes, most counties
Yildirim and Philippatos (2007)	1993-2000	13 Latin American countries	Monopolistic	No, for four countries
Park (2009)	1992-2004	Korea	Monopolistic	Yes, (1992-96, and 2001-04)
Delis (2010)	1999-2006	CEE	Monopolistic	Yes, but not reported
Liu et al. (2012)	1998-2008	Indonesia, Malaysia, Philippines, Vietnam	Monopolistic	Yes, but not Indonesia and Philippines
Bikker et al. (2012)	1986-2004	67 countries	Monopolistic	No, in some countries
Xu, Rixtel , and Leuvensteijn (2013)	2002-2008	China	Monopolistic	No.
Sufian and Habibullah (2013)	1996-2008	Malaysia	Monopolistic	Yes.
Moch (2013)	2001-2009	Germany	Monopolistic	Yes
Kadir, Habibullah, Law, and Mohamed (2014)	1996-2009	Malaysia	Monopolistic	Yes
Andrieş and Căpraru (2014)	2004-2010	27 EU countries	Monopolistic	Yes
Apergis (2015)	2000-2012	21 developing countries	Monopolistic	Not reported
Apergis, Fafaliou, and Polemis (2016)	1996-2011	26 EU countries	Monopolistic	No

Appendix E: Dynamic OLS and Dynamic FE estimates in measuring the effect of bank competition on bank stability in ASEAN-5 from 1990 to 2014 in linear term.

Dependent Variable(DV)	***ln*Z-score**				**NPL ratio**				**Equity ratio**			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.691 (.02)***	.4854 (.02)***	.6892 (.02)***	.4805 (.02)***	.6516 (.04)***	.5585 (.04)***	.6589 (.04)***	.5645 (.04)***	.5958 (.05)***	.4246 (.05)***	.5952 (.05)***	.4047 (.05)***
H-statistic	.1703 (.08)*	.1529 (.09)*			-1.8959 (.53)***	-1.5851 (.73)***			.2753 (.36)	.0390 (.44)		
HHI			-.2882 (.36)	-2.6309 (1.49)			7.7125 (1.50)***	4.7283 (8.59)			-1.1070 (2.00)	-1.1151 (7.47)
Loan Composition	-.0028 (.00)**	.0037 (.00)	-.0025 (.00)**	.0039 (.00)	.0499 (.017)***	.0822 (.01)**	.0465 (.01)***	.0812 (.02)***	-.0149 (.01)*	-.0033 (.02)	-.0154 (.01)**	-.0033 (.02)
Loan Quality	-.0080 (.00)**	-.0166 (.00)**	-.0083 (.00)**	-.0172 (.01)***	.3056 (.05)***	.3997 (.07)***	.3017 (.05)***	.4002 (.07)***	.0559 (.03)*	-.0321 (.04)	.0561 (.03)*	-.0320 (.03)
Bank Size	.0002 (.01)	.1582 (.05)***	.0038 (.01)	.1579 (.06)**	.0909 (.08)	.9527 (.46)***	.0239 (.08)	.8902 (.48)*	-.7781 (.10)***	-3.5706 (.56)***	-.7893 (.11)***	-3.5751 (.56)***
Operational Efficiency	-.0061 (.00)***	-.0089 (.00)***	-.0062 (.00)***	-.0090 (.00)***	.0008 (.01)	.0053 (.01)**	.0006 (.01)	.0056 (.01)	-.0106 (.01)**	-.0036 (.01)	-.0106 (.01)**	-.0036 (.01)
Foreign Ownership	.0396 (.04)	-.0043 (.04)	.0376 (.04)	-.0024 (.05)	-.3959 (.25)	-.0275 (.26)	-.3838 (.26)	-.0299 (.26)	.4107 (.21)**	.0964 (.22)	.4134 (.20)**	.0983 (.22)
GDP Growth Rate	.0477 (.01)***	.0524 (.01)***	.0512 (.01)***	.0529 (.01)***	-.2589 (.05)***	-.2512 (.05)***	-.2963 (.06)***	-.2798 (.06)***	.0028 (.03)	.0395 (.03)	-.0028 (.03)	.0376 (.03)
Inflation Rate	-.0056 (.00)	-.0007 (.00)	-.0052 (.00)	-.0028 (.01)	.1028 (.04)**	.1272 (.05)***	.0997 (.04)**	.1269 (.05)**	-.1441 (.03)***	-.1286 (.04)***	-.1448 (.03)***	-.1298 (.04)***
Constant	1.7369 (.17) ***	-55.374 (8.69) ***	1.8094 (.17) ***	-63.483 (13.59) ***	-.8011 (1.09)	256.683 (66.96) ***	-1.8589 (1.06)*	276.172 (71.72) ***	12.852 (1.77) ***	-426.435 (76.67) ***	12.7238 (1.75) ***	-429.046 (84.15) ***
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	2121	2121	2121	2121
F- test (P-value)	128.65 (0.00)	156.95 (0.00)	125.90 (0.00)	118.17 (0.00)	112.03 (0.00)	66.38 (0.00)	110.89 (0.00)	74.46 (0.00)	108.11 (0.00)	27.85 (0.00)	106.16 (0.00)	27.03 (0.00)
R^2	0.5313	0.4572	0.5303	0.4574	0.7423	0.6686	0.7414	0.6672	0.6702	0.4878	0.6702	0.4878

This table exhibits the estimation results of regression equation (3.1) using both dynamic OLS in models 1,3,5,7,9 and 11 and dynamic fixed effect in models 2, 4,6,8,10 and 12 to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error in order to correct heteroscedasticity among the banks. The dependent variable is *ln*Z-score in models 1 to 4, NPL ratio in models 5 to 8, and equity ratio in models 9 to 12 as proxy of bank stability. H statistic is used in models 1,2, 5,6, 9, and 10; and HHI is used in models 3,4,7,8, 11 and 12 as measure of competition. The relationship between competition and bank stability is controlled by a number of bank specific factors such as loan composition measured by the ratio of net loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership of bank is a dummy variable with 1 for the foreign banks, otherwise zero, and managers' operational efficiency measured by the ratio to cost to income, and also macro-economic control variables such as annual real GDP growth rate and inflation rate. R square value indicates the independent variables reasonably explain the variations in dependent variable in all models. Besides, significant value of F test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix F: Dynamic OLS and Dynamic FE estimates in measuring the effect of bank competition on bank stability in ASEAN-5 from 1990 to 2014 incorporating both linear and quadratic term.

Dependent Variable(DV)	*ln*Z-score				NPL ratio				Equity ratio			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.6743 (.02)***	.4694 (.02)***	.6873 (.02)***	.4808 (.02)***	.6451 (.04)***	.5514 (.04)	.6478 (.04)***	.5633 (.04)***	.5959 (.05)***	.4242 (.05)***	.5916 (.05)***	.4229 (.05)***
H-statistic	.7106 (.23)***	1.0547 (.30)***			-5.0863 (1.57)***	-5.0089 (1.94)			.1767 (.88)	.9904 (.93)		
H^2	-.5113 (.19)***	-.8209 (.21)***			2.9191 (1.38)**	3.0135 (1.71)			-.4167 (.74)	-.9149 (.87)		
HHI			-5.9623 (1.94)***	-1.1089 (4.23)			96.5125 (10.12)***	54.72 (33.59)*			-40.1673 (8.85)***	-32.993 (29.04)
HHI^2			15.0215 (4.92)***	5.1033 (13.19)			-235.4635 (25.35)***	-200.75 (10.32)**			109.449 (23.61)***	114.929 (89.69)
Loan Composition	-.0026 (.00)**	.0037 (.00)	-.0026 (.00)**	.0038 (.00)	.0488 (.01)***	.0828 (.02)	.0479 (.01)***	.0858 (.01)***	-.0147 (.01)*	-.0035 (.02)	-.01625 (.01)**	-.0059 (.02)
Loan Quality	-.0075 (.00)**	-.0159 (.01)***	-.0076 (.00)**	-.0172 (.01)***	.3048 (.05)***	.3982 (.07)	.2994 (.05)***	.4004 (.07)***	.0567 (.03)*	-.0305 (.04)	.0609 (.03)**	-.0321 (.04)
Bank Size	.0039 (.01)	-.1586 (.06)	.0055 (.01)	-.1571 (.06)	.0683 (.08)	.9357 (.47)	-.0086 (.08)	.8610 (.48)*	-.7748 (.10)***	-3.5725 (.56)***	-.7839 (.10)***	-3.5703 (.56)***
Operational Efficiency	-.0060 (.00)***	-.0087 (.00)***	-.0063 (.00)***	-.0090 (.00)***	0.0001 (.01)	.0043 (.02)	.0016 (.01)	.0055 (.01)	-.0105 (.01)*	-.0032 (.01)	-.0109 (.01)**	-.0035 (.01)
Foreign Ownership	.0426 (.04)	-.0009 (.05)	.0283 (.04)	-.0027 (.05)	-.4032 (.26)	-.0379 (.26)	-.2290 (.26)	-.0164 (.26)	.4126 (.20)**	.1017 (.22)	.3461 (.20)*	.0905 (.22)
GDP Growth Rate	.0451 (.01)***	.0493 (.01)***	.0507 (.01)***	.0532 (.01)***	-.2419 (.05)***	-.2370 (.06)	-.2874 (.05)***	-.2921 (.06)***	.0004 (.03)	.0353 (.03)	-.0079 (.03)	.0448 (.03)*
Inflation Rate	-.0073 (.01)	-.0025 (.006)	-.0052 (.01)	-.0024 (.01)	.1128 (.04)***	.1348 (.05)	.0965 (.04)***	.1125 (.05)**	-.1456 (.03)***	-.1312 (.04)***	-.1444 (.03)***	-.1216 (.04)***
Constant	1.628 (.18)***	-53.836 (11.92)***	2.2404 (.23)***	-62.9213 (13.47)***	.0856 (1.17)	243.586 (67.03)	-8.3531 (1.25)***	256.752 (1.69)***	12.728 (1.83)***	-422.51 (76.36)***	15.8916 (2.13)***	-418.872 (83.81)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	2121	2121	2121	2121
F-Test (P-value)	119.43 (0.00)	130.52 (0.00)	115.21 (0.00)	108.72 (0.00)	107.38 (0.00)	60.07 (0.00)	136.97 (0.00)	68.97 (0.00)	100.05 (0.00)	25.50 (0.00)	99.12 (0.00)	24.49 (0.00)
R^2	0.5331	0.4624	0.5321	0.4574	0.7433	0.6699	0.7474	0.6679	0.6703	0.4882	0.6729	0.4885

This table exhibits the estimation results of regression equation (3.2) using both dynamic OLS in models 1,3,5,7,9 and 11; and dynamic fixed effect in models 2, 4,6,8,10 and 12 to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error in order to correct heteroscedasticity among the banks. The dependent variable is *ln*Z-score in models 1 to 4, NPL ratio in models 5 to 8, and equity ratio in models 9 to 12 as proxy of bank stability. H statistic is used in models 1,2, 5,6, 9, and 10; and HHI is used in models 3,4,7,8, 11 and 12 as measure of competition. The relationship between competition and bank stability is controlled by a number of bank specific factors such as loan composition measured by the ratio of net loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership is a dummy variable with 1 for the foreign banks, otherwise zero and operational efficiency measured by the ratio to cost to income; and also macroeconomic control variables such as annual real GDP growth rate and inflation rate. R square value indicates the independent variables reasonably explain the variations in dependent variable in all models. Besides, significant value of F test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix G: Estimation Method of Lerner Index and large n Bank concentration ratio (CRn)

Lerner Index:

Lerner index value indicates market power of a bank in setting loan price over marginal cost, which is inversely related to competition (Lerner, 1934). High market power indicates less competition and vice versa. In a perfectly competitive market, the Lerner index takes a value of zero, Lerner =0, indicating that both product price and marginal cost are equal for the bank. In less a competitive market, the market price and marginal cost would be different, and the bank may enjoy high mark-up. Thus, unity of Lerner index indicates, Lerner index = 1, pure monopoly market; and a value of Lerner index between unit and zero, 0<Lerner index<1, indicates monopolistic market. Non-optimal behaviour of the market participant in setting product price is represented by the Lerner Index < 0, where the bank loan is priced below the marginal cost. Banks may behave non-optimally and incur more marginal cost than market price due to less profit, cost and operational efficiency (Soedarmono, et al., 2013). The Lerner index is measured in the following manner:

$$Lerner\ index = \frac{P_{TA_{it}} - MC_{TA_{it}}}{P_{TA_{it}}} \qquad (I)$$

where $P_{TA_{it}}$ is the price of total assets, indicating the ratio of total revenue to total assets for bank i at time t. Total revenue is the sum of interest income, non-interest operating income and other operating income following the work of Anginer et al. (2014a). $MC_{TA_{it}}$ is the marginal cost of the total assets of bank i at time t. The following translog cost function is estimated for each ASEAN-5 country, using the methodology of Demirguc-Kunt and Pería (2010) and Anginer et al. (2014a), to estimate $MC_{TA_{it}}$:

$$\begin{aligned} lnCost_{it} = {} & \alpha + \beta_1 ln(Q_{it}) + \beta_2 (lnQ_{it})^2 + \beta_3 ln(W1_{it}) + \beta_4 ln(W2_{it}) + \beta_5 ln(W3_{it}) + \\ & \beta_6 ln(Q_{it}) ln(W1_{it}) + \beta_7 ln(Q_{it}) ln(W2_{it}) + \beta_8 ln(Q_{it}) ln(W3_{it}) + \beta_9 (lnW1_{it})^2 + \\ & \beta_{10} (lnW2_{it})^2 + \beta_{11} (lnW3_{it})^2 + \beta_{12} ln(W1_{it}) ln(W2_{it}) + \beta_{13} ln(W2_{it}) ln(W3_{it}) + \\ & \beta_{14} ln(W1_{it}) ln(W3_{it}) + \theta Year\ Dummies + \varepsilon_{it} \end{aligned} \qquad (II)$$

The subscript *ln* in equation (II) indicates the natural logarithm, *i* indicates banks, and *t* indicates year. Cost is the sum of interest expenses, non-interest operating expense, personnel expenses, other administrative expenses, and other operating expenses, expressed in millions of USD (Anginer et al., 2014a). $\mathrm{Q_{it}}$ is total assets in millions of USD, representing output quality. Three input prices are then used to capture the price of borrowed funds ($\mathrm{W1_{it}}$), the price of labor ($\mathrm{W2_{it}}$), and fixed capital ($\mathrm{W3_{it}}$). Where, $\mathrm{W1_{it}}$ is the ratio of interest expenses to total assets, $\mathrm{W2_{it}}$ is the ratio of personnel expenses to total assets, and $\mathrm{W3_{it}}$ is the ratio of administrative and other operating expenses to total assets. The cost function is estimated separately for each country to account for potential technological differences among the countries, following the work of Berger et al. (2009). A year dummy is included to handle technological progress and changes to the business cycle's condition. Additionally, the following five restrictions are imposed to ensure homogeneity of degree one in the input prices:

$$\beta_3 + \beta_4 + \beta_5 = 1;\ \beta_6 + \beta_7 + \beta_8 = 0;\ \beta_9 + \beta_{12} + \beta_{13} = 0;\ \beta_{10} + \beta_{12} + \beta_{14} = 0;\ \beta_{11} + \beta_{13} + \beta_{14} = 0$$

The coefficient of Equation II is used to estimate the marginal cost for bank *i* at time *t*, using the following equation:

$$MC_{it} = \frac{\partial lC_{it}}{\partial lQ_{it}} = \frac{C_{it}}{Q_{it}}[\beta_1 + 2\beta_2 lnQ_{it} + \beta_6 lnW1_{it} + \beta_7 lnW2_{it} + \beta_8 lnW3_{it}] \qquad (III)$$

Here, $\mathrm{MC_{it}}$ is the marginal cost of bank *i* at time *t*, $\frac{\partial \mathrm{lC_{it}}}{\partial \mathrm{lQ_{it}}}$ indicates changes in log of cost with respect to change in log of quantity. The remaining variables are defined along with the Equation II above.

Largest n Bank Concentration Ratio (CRn)

It is the sum of only largest n banks' market share in a market. CRn is a widely-used concentration measure due to limited data requirement and simplicity in its calculation (Bikker and Haaf, 2002). It takes the following form:

$$CR_n = \sum_{i=1}^{n} S_i \qquad (IV)$$

Where, S_i is the market share of the *i* banks. CR_n assigns equal weight to the n large banks ignoring the many small banks in the market. The selection of large 'n' banks is an arbitrary decision of the researchers, there is no particular principle for determining it. CR_n takes value ranging from zero to unity indicating perfect competition to monopoly. The value will be zero if there are many small banks and the number of n is comparatively very small in compare to the total number of banks in the market, and it will be unit if the number of 'n' banks makes up the whole market. Despite, the determination of 'n' is an arbitrary choice, this study considers large three banks in loan market following the work of Fu et al. (2014). The study considers the market share in the loan market, because banks faces more competition in the loan market as credit creating institutions.

Appendix H: Two-step System GMM results for the effect of bank competition on bank stability in ASEAN-5 from 1990 to 2014 in Linear term.

Dependent Variable (DV)	lnZ-score		NPL ratio		Equity ratio	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged DV	.6602 (.0356)***	.6616744 (.0248)***	.5653 (.0552)***	.6106 (.0553)***	.4408 (.0710)***	.4147 (.0744)***
Lerner Index	-.0472 (.1168)		3.4931 (.8840)		-.0467 (.6636)	
CR3		-.1525 (.2047)		4.2303 (1.8717)**		-1.5456 2.020
Loan Composition	-.0121 (.0035)***	-.0069 (.0026)***	.0772 (.0214)***	.1071 (.0176)***	-.0375 (.0184)**	-.0338 (.0151)**
Loan Quality	-.0263 (.0114)**	-.0212 (.0083)***	.4264 (.0880)***	.3671 (.0814)***	.0006 (.0580)	.0064 (.0496)
Bank Size	.0324 (.0325)	.0299 (.0275)	.1055 (.4002)	-.6336 (.2858)**	-.7050 (.2385)***	-.8691815 (.2392)***
Operational Efficiency	-.0049 (.0025)***	-.0049 (.0022)**	-.0227 (.0177)	-.0102 (.0133)	.0002 (.0097)	-.0046 (.0087)
Foreign Ownership	.2157 (.0966)***	.2055 (.0901)**	-.6599 (.6073)	-.6627 (.5981)	.7647 (.2992)**	.8334 (.3574)**
GDP Growth	.0476 (.0097)***	.0516 (.009)***	-.2703 (.0652)***	-.2751 (.0604)***	-.0020 (.0345)	.0103 (.0356)
Inflation Rate	-.0068 (.0053)	-.0021 (.0063)	.0398 (.0523)	.0752 (.0490)	-.0799 (.0382)**	-.0927 (.0378)**
Constant	2.0277 (.4080)***	1.6729 (.296)***	-2.0417 (2.2829)	-3.3056 (2.1695)	13.8367 (2.7434)***	14.6325 (2.7803)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	176	176	176	176	176
No. of Instruments	121	160	160	160	160	160
Wald Test (P-value)	981.18 (0.00)	1579.19 (0.00)	982.67 (0.00)	963.79 (0.00)	160.68 (0.00)	176.98 (0.00)
AR(1) (P-value)	-6.79 (.00)	-6.81(.00)	-4.09(.00)	-4.1 (.00)	-3.78 (.00)	-3.60 (.00)
AR(2) (P-value)	1.33 (.19)	1.41 (.00)	-0.30(.67)	-0.36(.72)	-0.99 (.32)	-1.01 (.31)
First Stage F-test (P-value)	658.03(.00)	174.77(.00)	641.85(.00)	180.36(.00)	641.86(.00)	180.36(.00)
Hansen's J Test (P-value)	128.51 (.11)	158.64(.28)	159.91(.64)	157.75(.29)	152.87(.39)	157.11(.31)
Wu-Hausman Test (P-value)	83.13 (.00)	24.47 (.00)	27.02 (.00)	78.16 (.00)	48.21 (.00)	49.60 (.00)
Breush–Pagan/Cook-Weisberg Test (P-value)	78.66 (0.00)	78.92 (0.00)	3151.49 (0.00)	3088.82 (0.00)	20.88 (0.00)	22.16 (0.00)
Wooldridge Test (P-value)	266.02(.00)	265.78(.00)	59.13(.00)	60.32(.00)	173.71(.00)	174.71(.00)

This table exhibits two-step system GMM regression estimates to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error to correct heteroscedasticity among the banks. The dependent variable is *lnZ*-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in models 5 and 6, as proxy of bank stability. Lerner index is used in models 1,3 and 5 and CR3 is used in models 2, 4 and 6 as the measure of competition instrumented with property right and financial freedom. The relationship between competition and bank stability is controlled by a number of bank specific factors including loan composition measured by the ratio of loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership is a dummy variable with 1 for the foreign banks, otherwise zero and managers' operational efficiency measured by the ratio to cost to income, and also macroeconomic control variables including annual real GDP growth rate and inflation rate. The presence of serial correlation, heteroscedasticity and endogeneity are examined with pre-diagnostic test Wooldridge test, Breush – Pagan/Cook-Weisberg test and Wu- Hausman test respectively. Significant value of Wooldridge test, Breush – Pagan/Cook-Weisberg test and Wu- Hausman test evident presence of serial correlation, Heteroscedasticity and endogeneity problem respectively and justify the use of two-step system GMM specification. Significant value of first stage regression and insignificant value of post diagnostic test, Hansen's J-test ensures that instrumental variable are relevant and valid. Significant value of AR(1) and insignificant value of AR(2) implies that serial correlation is present at first order but it is absent at second. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix I: Two step System GMM results for the effect of bank competition on bank stability in ASEAN-5 from 1990 to 2014 in both linear and quadratic term.

Dependent Variable(DV)	***ln*Z-score**		**NPL ratio**		**Equity ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged DV	.6583 (.0284)***	.6581 (.0255)***	.5769 (.0538)***	.6005 (.0553)***	.4191 (.0750)***	.4068 (.0747)***
Lerner Index	-.1332 (.1135)		3.9786 (.8439)		-1.1693 (.6363)	
Lerner Index^2	.0177 (.2894)		-.5489 (2.1873)		1.8679 (1.3505)	
CR3		-4.3681 (1.4738)***		78.0695 (12.3267)***		-45.3141 (12.4771)***
CR3^2		3.1131 (1.0921)***		-55.0878 (9.0444)***		34.1984 (9.2910)***
Inflection Point	3.7627	0.7016	3.6241	0.7089	0.3130	0.6625
Loan Composition	-.0090 (.0034)***	-.0094 (.0027)***	.0582 (.0251)**	.1204 (.0173)***	-.0359 (.0198)*	-.0503 (.0202)**
Loan Quality	-.0272 (.0105)***	-.0227 (.0088)***	.4096 (.0776)***	.3190 (.0868)***	.0076 (.0568)	.0327 (.0458)
Bank Size	.0274 (.0289)	.0022 (.0297)	.04517 (.3882)	-.5102 (.3194)	-.7160 (.2436)***	-.9622 (.2947)***
Operational Efficiency	-.0045 (.0021)**	-.0051 (.0022)**	-.0207 (.0169)	-.0132 (.0147)	.0029 (.0110)	-.0031 (.0107)
Foreign Ownership	.2061 (.0886)**	.2097 (.0892)**	-.3922 (.5975)	-.2300 (.6047)	.5340 (.3526)	.1994 (.3488)
GDP Growth	.0492 (.0097)***	.0519 (.0097)***	-.2846 (.0664)***	-.2863 (.0642)***	-.0162 (.0345)	.0119 (.0312)
Inflation Rate	-.0039 (.0060)	-.0019 (.0060)	.0156 (.0495)	.0745 (.0503)	-.1198 (.0418)***	-.0895 (.0400)**
Constant	1.8326 (.3265)***	3.1866 (.4898)***	-.8855 (2.1137)	-25.8092 (4.4117)***	14.4787 (3.1706)***	29.5164 (6.0005)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1972	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	160	160	160	160	160	160
Wald Test (P-value)	1714.41(.00)	1756.07(.00)	1157.30(.00)	1010.52 (.00)	156.54 (.00)	226.57 (.00)
AR(1) (P-value)	-6.77 (.00)	-6.82 (.00)	-4.11 (.00)	-4.05 (.00)	-3.66 (.00)	-3.62 (.00)
AR(2) (P-value)	1.35 (.18)	1.43 (.15)	-0.33 (.74)	-0.26 (.79)	-1.05 (.29)	-1.05 (.29)
First Stage F-test (P-value)	282.14 (.00)	266.15 (.00)	292.59 (.00)	272.68 (.00)	292.59 (.00)	272.685 (.00)
Hansen's J Test(P-value)	153.52 (.36)	153.96 (.35)	159.91 (.64)	162.50 (.19)	152.87 (.04)	153.72 (.00)
Wu-Hausman-Test(P-value)	11.24(.00)	22.23(.00)	113.52(.00)	69.42(.00)	47.53(.00)	45.78 (.00)
Breush – Pagan/Cook-Weisberg Test (P-value)	78.42 (.00)	81.94 (.00)	3161.56(.00)	3165.52 (.00)	19.98 (0.00)	24.88 (.00)
Wooldridge Test (P-value)	242.64 (.00)	246.34 (.00)	59.37 (.00)	59.98 (.00)	177.06 (.00)	174.39 (.00)
Sasabuchi Test (P-value)		2.44(0.01)		5.25(0.00)	1.18(0.12)	3.41(0.00)

This table exhibits system GMM regression estimates to examine the competition-bank stability nexus in ASEAN-5 banking with robust standard error to correct heteroscedasticity among the banks. The dependent variable is *ln*Z-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in models 5 and 6 as proxy of bank stability. As measure of competition instrumented with property right and financial freedom, Lerner index is used in models 1,3 and 5, and CR3 is used in models 2, 4 and 6. The nexus is controlled by a number of bank specific factors including loan composition measured by the ratio of net loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership of bank is a dummy variable with 1 for the foreign banks, otherwise zero and mangers' operational efficiency measured by the ratio to cost to income; and also macro-economic control variables such as annual real GDP growth rate and inflation rate. Significant value of Wooldridge test, Breush – Pagan/Cook-Weisberg test and Wu- Hausman test evident presence of serial correlation, Heteroscedasticity and endogeneity problem respectively in the unbalanced panel which justify the use of two-step system GMM specification. Significant value of first stage regression and insignificant value of post diagnostic test, Hansen's J-test ensure that instrumental variable are relevant and valid. Significant value of AR(1) and insignificant value of AR(2) implies that serial correlation is present at first order but it is absent at second. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis. Insignificant value of Sasabuchi-test indicates that the relationship competition and bank stability is monotonic. Further, Sasabuchi-test statistic is not found in models 1 and 3, as extreme point lying outside the interval. ***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix J: Two-step System GMM results of the effect of bank competition on bank stability in ASEAN-5 from 1990 to 2014 without considering the ratio of loan loss reserve to gross loan.

Dependent Variable(DV)	***lnZ*-score**		**NPL ratio**		**Equity ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged DV	.7049 (.0230)***	.7024 (.0232)***	.7383 (.0458)***	.7405 (.0445)***	.4586 (.0636)***	.4565 (.0638)***
H-statistic	.3062 (.1143)***		-2.2949 (.7232)**		.4822 (.9310)	
HHI		-.3338 (.4161)		9.4521 (3.7292)**		-11.8063 (6.5810)
Loan Composition	-.0060 (.0024)**	-.0046 (.0020)**	.0613 (.0203)***	.0576 (.0181)***	-.0097 (.0190)	-.0183 (.0184)
Bank Size	.0171 (.0303)	.0251 (.0255)	-.5530 (.3037)*	-.8204 (.2824)***	-.5496 (.2285)**	-1.1425 (.2537)***
Operational Efficiency	-.0063 (.0021)***	-.0065 (.0022)***	-.0125 (.0130)	-.0085 (.0124)	-.0037 (.0131)	.0004 (.0090)
Foreign Ownership	.2290 (.0884)***	.2262 (.0859)***	-.5869 (.6584)	-.6851 (.6308)	.6704 (.3322)**	1.3976 (.4552)***
GDP Growth rate	.0485 (.0083)***	.0537 (.0093)***	-.2722 (.0619)***	-.3048 (.0636)***	.0051 (.0458)	-.0122 (.0340)
Inflation Rate	-.0043 (.0054)	-.0058 (.0056)	.1559 (.0516)***	.1349 (.0471)***	-.0632 (.0505)	-.0991 (.0380)***
Constant	1.2492 (.2367)***	1.4467 (.2500)***	1.3006 (2.4426)	1.6481 (2.3072)	11.9076 (2.7159)***	14.2754 (2.3754)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1986	1986	2059	2059	2060	2060
No. of Banks	177	177	179	179	179	179
No. of Instruments	160	160	160	160	120	160
Wald Test (P-value)	1526.30 (0.00)	1427.30 (0.00)	714.18 (0.00)	742.04 (0.00)	116.36 (0.00)	230.94 (0.00)
AR(1) (P-value)	-6.92 (0.00)	-6.84 (0.00)	-4.00 (0.00)	-4.05 (0.00)	-3.90 (0.00)	-3.93 (0.00)
AR(2) (P-value)	1.43 (0.153)	1.39 (0.163)	0.18 (0.939)	-0.08 (0.936)	-0.59 (0.557)	-0.72 (0.469)
Hansen's J Test (P-value)	158.69 (0.293)	162.37 (0.232)	160.49 (0.264)	162.44 (0.230)	124.02 (0.170)	160.22 (0.269)

This table exhibits two-step system GMM regression estimates to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error in order to correct heteroscedasticity among the banks. The dependent variable is *lnZ*-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in models 5 and 6 as proxy of bank stability. As measure of competition instrumented with property right and financial freedom, H-statistic is used in models 1,3 and 5, HHI is used in models 2, 4 and 6. The relationship between competition and bank stability is controlled by a number of bank specific factors including loan composition measured by the ratio of loan to total assets, bank size measured by natural logarithm of total assets, foreign ownership of banks is a dummy variable with 1 for the foreign banks, otherwise zero and managers' operational efficiency measured by the ratio to cost to income; and also macroeconomic control variables including annual real GDP growth rate and inflation rate. Insignificant value of post diagnostic test, Hansen's J-test ensures that instrumental variable are relevant. Significant value of AR(1) and insignificant value of AR(2) implies that serial correlation is present at first order but it is absent at second. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix K: Two-step System GMM results for the effect of bank competition on bank stability in ASEAN-5 excluding Singapore from 1990 to 2014

Dependent Variable(DV)	***ln*Z-score**		**NPL ratio**		**Equity ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged DV	.6807 (.0272)***	.6647 (.0248)***	.6028 (.0528)***	.6069 (.0508)***	.4428 (.0701)***	.4221 (.0701)***
H-statistic	.2471 (.1415)*		-3.4669 (.8798)***		.1017 (.5034)	
HHI		-3.6953 (1.0506)***		59.7515 (8.4727)***		-26.9464 (7.9696)***
Loan Composition	-.0084 (.0025)***	-.0089 (.0025)***	.0987 (.0188)***	.1021 (.0153)***	-.0270 (.0151)*	-.0404 (.0165)**
Loan Quality	-.0176 (.0075)**	-.0182 (.0081)**	.3662 (.0747)***	.3021 (.0759)***	.0039 (.0457)	.0219 (.0442)
Bank Size	-.0056 (.0309)	.0346 (.0290)	-.1849 (.2747)	-.7447 (.2944)**	-.9326 (.2584)***	-.7867 (.2490)***
Operational Efficiency	-.0055 (.0021)***	-.0054 (.0021)**	-.0109 (.0117)	.0005 (.0107)	.0023 (.0087)	-.0032 (.0080)
Foreign Ownership	.2077 (.0895)**	.1353 (.0953)	-.7449 (.6464)	-.1859 (.6525)	.8706 (.3769)**	.4569 (.3779)
GDP Growth	.0516 (.0096)***	.1353 (.0953)***	-.2195 (.0647)***	-.3202 (.0675)***	-.0056 (.0367)	-.0153 (.0374)
Inflation Rate	-.0036 (.0062)	-.0023 (.0058)	.1155 (.0513)**	.0707 (.0500)	-.1061 (.0388)***	-.1009 (.0372)***
Constant	1.6846 (.2931)***	1.9723 (.3060)***	-2.9143 (2.1950)	-5.3601 (2.0576)***	14.9805 (2.8910)***	17.4502 (3.0809)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1817	1817	1891	1891	1891	1891
No. of Banks	162	162	164	164	164	164
No. of Instruments	160	160	160	160	160	160
Wald Test (P-value)	1607.22 (0.00)	1662.12 (0.00)	924.86 (0.00)	915.08 (0.00)	241.64 (0.00)	252.81 (0.00)
AR(1) (P-value)	-6.69 (0.00)	-6.67 (0.00)	-4.16 (0.00)	-6.67 (0.00)	-3.85 (0.00)	-3.73 (0.00)
AR(2) (P-value)	1.37 (0.170)	1.30 (0.192)	-0.11 (0.916)	1.30 (0.192)	-1.09 (0.275)	-1.09 (0.275)
Hansen's J Test (P-value)	150.80 (0.443)	149.62 (0.470)	151.01 (0.439)	0.192 (0.470)	155.05 (0.350)	153.32 (0.387)

This table exhibits two-step system GMM regression estimates to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error in order to correct heteroscedasticity among the banks. The dependent variable is *ln*Z-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in models 5 and 6 as proxy of bank stability. As the measure of competition instrumented with property right and financial freedom, H-statistic is used in models 1,3 and 5; and HHI is used in models 2, 4 and 6. The relationship between competition and bank stability is controlled by a number of bank specific factors including loan composition measured by the ratio of loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership of bank is a dummy variable with 1 for the foreign banks, otherwise zero, and operational efficiency measured by the ratio to cost to income; and also macroeconomic control variables including annual real GDP growth rate and inflation rate. Insignificant value of post diagnostic test, Hansen's J test ensures that instrumental variables are valid. Significant value of AR(1) and insignificant value of AR(2) implies that serial correlation is present at first order but it is absent at second. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix L: Two-step System GMM results for the effect of bank competition on bank stability in ASEAN-5 during 1990 to 2014 where revenue diversification is included as additional control variable.

Dependent Variable(DV)	***lnZ*-score**		**NPL ratio**		**Equity ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged DV	.6484 (.0341)***	.6587 (.0274)***	.5994 (.0566)***	.6098 (.0584)***	.4240 (.0826)***	.4201 (.0747)***
H-statistic	.2501 (.1233)**		-2.5039 (.7336)***		.3290 (.5627)	
HHI		-.8253 (.5973)		10.5566 (4.4606)**		-3.7677 (4.3707)
Loan Composition	-.0074 (.0034)**	-.0059 (.0028)**	.1221 (.0196)***	.1103 (.0184)***	-.0354 (.0201)*	-.0386 (.0193)**
Loan Quality	-.0304 (.0111)***	-.0277 (.0094)***	.3672 (.0805)***	.3613 (.0862)***	-.0199 (.0565)	.0073 (.0501)
Bank Size	-.0298 (.0311)	.0031 (.0285)	-.4531 (.2826)*	-.7227 (.3046)**	-.8114 (.2791)***	-.9055 (.3002)***
Revenue Diversification	3.3188 (1.0411)***	3.1967 (1.0549)***	13.1851 (8.6728)	10.6614 (8.1122)	-.0864 (7.3945)	-2.3382 (7.0134)
Operational Efficiency	-.0054 (.0021)**	-.0048 (.0022)**	-.0074 (.0134)	-.0080 (.0128)	.0034 (.0099)	-.0032 (.0085)
Foreign Ownership	.2139 (.0957)**	.2211 (.0998)**	-.8227 (.5923)	-.7491 (.5915)	.9112 (.3392)***	.9512 (.3274)***
GDP Growth Rate	.0452 (.0088)***	.0485 (.0095)***	-.2388 (.0565)***	-.2748 (.0624)***	-.0001 (.0370)	.0094 (.0355)
Inflation Rate	.0015 (.0076)	.0005 (.0069)	.0992 (.0512)*	.0896 (.0512)**	-.0924 (.0483)*	-.0868 (.0396)**
Constant	1.8498 (.3275)***	1.7519 (.2897)***	-2.8684 (2.1875)	-2.2363 (2.1441)	14.6002 (3.358)***	15.1768 (2.9507)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	160	160	160	160	160	160
Wald Test (P-value)	1206.07(.00)	1340.30(.00)	1023.13(.00)	946.03(.00)	189.67(.00)	175.46 (.00)
AR (1) (P-value)	-6.75 (.00)	-6.78 (.00)	-4.12 (.00)	-4.08 (.00)	-3.58 (.00)	-3.66 (.00)
AR (2) (P-value)	1.14 (.25)	1.17 (.24)	-0.18 (.86)	-0.31 (.75)	-1.11 (.26)	-0.97 (.33)
Hansen's J Test (P-value)	156.37 (.30)	151.06 (.42)	155.05(.33)	157.76 (.27)	159.73 (.24)	153.06 (.37)

This table exhibits two-step system GMM regression estimates to examine the effect of banking competition on the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error in order to correct heteroscedasticity among the banks. The dependent variable is *ln*Z-score in models 1 and 2, NPL ratio in models 3 and 4, and equity ratio in model 5 and 6 as proxy of bank stability. As the measure of competition instrumented with property right and financial freedom, H-statistic is used in models 1,3 and 5; and HHI in models 2, 4 and 6. The relationship between competition and bank stability is controlled by a number of bank specific factors including loan composition measured by the ratio of loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership of bank is a dummy variable with 1 for the foreign banks, otherwise zero and managers' operational efficiency measured by the ratio to cost to income; and also macroeconomic control variables including annual real GDP growth rate and inflation rate. Insignificant value of post diagnostic test, Hansen's J test ensures that instrumental variables are valid. Significant value of AR(1) and insignificant value of AR(2) implies that serial correlation is present at first order but it is absent at second. Besides, significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix M: Capital regulation effect on the relationship between bank competition and bank stability in ASEAN-5 from 1990 to 2014 using both dynamic OLS and dynamic fixed effect to ensure accuracy of the estimate of two step system GMM.

Dependent Variable(DV)	***ln*Z-score**				**NPL ratio**				**Equity ratio**			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.6946 (.02)***	.4708 (.02)***	.6864 (.02)***	.4718 (.02)***	.6322 (.04)***	.5478 (.05)***	.6323 (.04)***	.5476 (.05)***	.5889 (.05)***	.4022 (.051)***	.5887 (.049)***	.4006 (.05)***
H-statistic	.7941 (.24)***	1.2944 (.35)***	.4194 (.38)	1.4856 (.44)***	-3.0899 (1.46)**	-4.6771 (1.94)**	-3.0861 (1.53)**	-4.4014 (1.87)**	1.1528 (.91)	.5713 (.913)	2.1470 (1.569)	1.5634 (1.788)
H-statistic^2	-.5563 (.19)***	-.9271 (.25)***	-.4165 (.20)**	-.8789 (.21)***	1.8096 (1.31)	2.8800 (1.70)*	1.7913 (1.31)	2.8582 (1.66)*	-.3546 (.74)	-.6718 (.856)	.5034 (.775)	-.4389 (.899)
CRI	.0377 (.02)**	.0060 (.03)	.0232 (.03)	.0033 (.03)	-.5479 (.01)***	-.5604 (.14)***	-.5515 (.09)***	-.1050 (.16)	.3269 (.07)***	.3054 (.188)*	.2315 (.145)	.1801 (.192)
H-statistic*CRI			.0267 (.05)	.0779 (.06)			-.0043 (.12)	-.1858 (.11)*			.1792 (.230)	.4149 (.295)
Loan Composition	-.0028 (.00)**	.0024 (.00)	-.0024 (.00)**	.0041 (.00)	.0450 (.01)***	.0908 (.01)***	.0449 (.01)***	.0854 (.01)***	-.0127 (.01)*	-.0041 (.019)	-.0129 (.007)*	-.0061 (.020)
Loan Quality	-.0079 (.00)**	-.0158 (.00)***	-.0069 (.00)**	-.0159 (.01**	.3035 (.05)***	.3806 (.08)***	.3031 (.05)***	.3992 (.07)***	.0630 (.031)**	-.0277 (.036)	.0628 (.030)**	-.0279 (.036)
Bank Size	-.0079 (.012)	-.1349 (.06)	.0005 (.01)	-.1568 (.06)**	.1219 (.08)	.3996 (.33)	.1195 (.08)	1.0032 (.47)**	-.8239 (.105)***	-3.6435 (.569)***	-.8204 (.104)***	-3.6387 (.59)***
Operational Efficiency	-.0063 (.00)***	-.0087 (.00)***	-.0062 (.00)***	-.0086 (.00)***	.0016 (.01)	.0045 (.01)	.0016 (.01)	.0038 (.01)	-.0113 (.006)**	-.0035 (.005)	-.0114 (.005)**	-.0035 (.005)
Foreign Ownership	.0515 (.04)	.0188 (.05)	.0360 (.04)	-.0019 (.05)	-.3187 (.26)	-.1443 (.26)	-.3133 (.26)	-.0689 (.26)	.3654 (.201)*	.1216 (.218)	.3605 (.201)*	.1214 (.218)
GDP Growth Rate	.0083 (.00)*	.0124 (.01)*	.0456 (.01)***	.0485 (.01)***	-.2394 (.05)***	-.2023 (.05)***	-.2380 (.05)***	-.2316 (.05)***	-.0024 (.025)	.0267 (.025)	.0021 (.026)	.0334 (.025)
Inflation Rate	-.0192 (.00)***	-.0184 (.01)***	-.0071 (.01)	-.0028 (.01)	.1115 (.04)***	.1576 (.05)***	.1124 (.04)**	.1405 (.05)**	-.1468 (.030)***	-.1374 (.042)***	-.1447 (.030)***	-.1337 (.04)***
Constant	1.8162 (.17) ***	-45.8925 (13.08) ***	1.6008 (.20) ***	-64.4566 (14.81) ***	2.033 (1.18)***	-2.5077 (2.17)	1.9852 (1.25)	195.2701 (79.66) *	11.9126 (1.773) ***	-359.960 (70.977) ***	12.3023 (1.924) ***	-325.61 (71.03) ***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	2121	2121	2121	2121
No. of banks		174		174		176		176		176		176
F-test (P-value)	106.46 (0.00)	122.58 (0.00)	102.36 (0.00)	112.85 (0.00)	138.01 (0.00)	59.23 (0.00)	133.57 (0.00)	51.32 (0.00)	93.23 (0.00)	23.69 (0.00)	87.20 (0.00)	21.96 (0.00)
R^2	0.5260	0.4519	0.5346	0.4631	0.7473	0.7360	0.7474	0.6706	0.6733	0.4896	0.6734	0.4903

This table exhibits the estimation results of regression equations (3.10) and (3.11) using both dynamic OLS in models 1,3,5,7,9 and 11, and dynamic fixed effect in models 2, 4,6,8,10 and 12 to examine the effect of capital regulation on the relationship between banking competition and bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error to correct heteroscedasticity among the banks. The dependent variable is *lnZ*-score in models 1-4, NPL ratio in models 5-8, and equity ratio in model 9-12 as proxy of bank stability. H-statistic, as the measure of competition, is used in all models. Capital Requirements Index (CRI) is used to mediate the relationship between competition and stability in models 1,2,5,6,9, and 10; and an interaction term of capital requirements index and H-statistic is used in models 3,4,7,8,11, and 12 to determine mediating role of capital regulation on bank stability through the channel of competition. Additionally, the relationship between competition and bank stability is also control by a number of bank specific factors including loan composition measured by the ratio of net loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership of bank is a dummy variable with 1 for the foreign banks, otherwise zero and operational efficiency measured by the ratio to cost to income; and also macroeconomic control variables including annual real GDP growth rate and inflation rate. R square value indicates the independent variables reasonably explain the variations in dependent variable in all models. Besides, significant value of F test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix N: Activity restrictions effect on the relationship between bank competition and bank stability in ASEAN-5 from 1990 to 2014 using both dynamic OLS and dynamic fixed effect to ensure accuracy of the estimate of two-step system GMM.

Dependent Variable(DV)	***lnZ*-score**				**NPL ratio**				**Equity ratio**			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.6623 (.02)***	.4672 (.03)***	.6717 (.02)***	.4694 (.02)***	.6308 (.04)***	.5458 (.05)***	.6308 (.04)***	.5456 (.05)***	.5939 (.05)***	.4408 (.05)***	.5939 (.05)***	.4407 (.05)***
H-statistic	.5517 (.22)**	.8705 (.28)***	1.2016 (.46)***	.5703 (.68)	-3.7263 (1.51)**	-4.4865 (1.96)**	-5.8281 (3.38)*	-3.4618 (4.43)	1.0632 (.91)	.0992 (1.06)	.9965 (.94)	.2321 (1.08)
H-statistic^2	-.3990 (.18)**	-.6515 (.20)***	-.6059 (.19)***	-.7014 (.20)***	1.6632 (1.32)	2.4243 (1.71)	2.0442 (1.37)	2.8404 (1.69)*	.5263 (.75)	.2185 (.96)	.5133 (.75)	.2431 (.97)
ARI	-.0337 (.01)***	-.1244 (.04)***	-.1459 (.03)***	-.1881 (.06)***	.5230 (.06)***	.6045 (.19)	.9653 (.22)***	1.0013 (.29)***	-.2394 (.05)***	-1.0485 (.20)***	-.2352 (.05)***	-1.0562 (.21)***
H-statistic*ARI			.1707 (.04)***	.1208 (.06)**			-.7917 (.30)***	-.6747 (.36)**			.0078 (.03)	.0188 (.03)
Loan Composition	-.0030 (.00)**	.0031 (.00)*	-.0026 (.00)**	.0041 (.00)**	.0543 (.01)***	.0945 (.01)***	.0488 (.01)***	.0892 (.01)***	-.0166 (.01)**	-.0243 (.02)	-.0165 (.01)**	-.0245 (.02)
Loan Quality	-.0067 (.00)*	-.0149 (.01)**	-.0070 (.00)*	-.0150 (.01)**	.3082 (.05)***	.3787 (.08)***	.3054 (.05)***	.3790 (.07)***	.0628 (.03)**	.0126 (.04)	.0628 (.03)**	.0125 (.04)
Bank Size	.0078 (.01)	-.1525 (.06)**	-.0013 (.01)	-.1616 (.06)**	.0265 (.08)	.1047 (.28)***	.0160 (.07)	.0410 (.27)	-.7439 (.09)***	-2.0139 (.34)***	-.7433 (.09)***	-2.018 (.34)***
Operational Efficiency	-.0062 (.00)***	-.0086 (.01)***	-.0060 (.00)***	-.0085 (.00)***	.0021 (.01)	.0033 (.01)	.0014 (.01)	.0033 (.01)	-.0111 (.01)**	-.0012 (.01)	-.0111 (.01)**	-.0009 (.01)
Foreign Ownership	.0337 (.04)	-.0055 (.05)	.0391 (.04)	-.0052 (.05)	-.2983 (.26)	-.1019 (.26)	-.2306 (.26)	-.1027 (.26)	.3395 (.20)*	.2314 (.23)	.3368 (.20)*	.2379 (.23)
GDP Growth	.0416 (.01)***	.0488 (.01)***	.0086 (.01)**	.0444 (.01)***	-.0035 (.06)***	-.2090 (.05)***	-.1530 (.05)***	-.1810 (.05)***	-.0289 (.03)	-.0152 (.03)	-.0287 (.03)	-.0166 (.02)
Inflation Rate	-.0109 (.01)**	-.0027 (.01)	-.0255 (.01)*	-.0063 (.01)	.2168 (.05)***	.1509 (.05)***	.1856 (.05)***	.1729 (.05)***	-.1723 (.03)***	-.1613 (.04)***	-.1717 (.03)***	-.1625 (.04)***
Constant	2.0728 (.218) ***	-34.703 (12.82) ***	3.653 (.39) ***	-60.367 (20.83) ***	-7.7779 (1.39) ***	-9.8444 (4.11) ***	-12.068 (2.76) ***	-14.243 (4.98)	15.9977 (2.21) ***	36.2238 (5.74) ***	15.955 (2.23) ***	36.3058 (5.78) ***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	2121	2121	2121	2121
No. of banks		174		174		176		176		176		176
F-test (P-value)	109.98 (0.00)	127.40 (0.00)	114.10 (0.00)	127.46 (0.00)	139.09 (0.00)	57.25 (0.00)	135.05 (0.00)	56.09 (0.00)	101.20 (0.00)	23.40 (0.00)	93.36 (0.00)	21.47 (0.00)
R^2	0.5356	0.4668	0.5332	0.4307	0.7480	0.7406	0.7516	0.7435	0.6739	0.5447	0.6739	0.5446

This table exhibits the estimation results of regression equations (3.10) and (3.11) using both dynamic OLS in models 1,3,5,7,9 and 11, and dynamic fixed effect in models 2, 4,6,8,10 and 12 to examine the effect of activity restrictions on the relationship between bank competition and bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error to correct heteroscedasticity among the banks. The dependent variable is *ln*Z-score in models 1-4, NPL ratio in models 5-8, and equity ratio in models 9-12, as proxy of bank stability. H-statistic is the measure of competition, and ARI indicates Activity Restrictions Index as measure of bank regulation. The mediating role of activity restrictions on relationship between competition and stability is determined in models 1,2,5,6,9, and 10. The mediating role of activity restrictions on bank stability through the channel of competition is determined in models 3,4,7,8,11, and 12. Additionally, the relationship between competition and bank stability is controlled by a number of bank specific factors including loan composition measured by the ratio of loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership is a dummy variable with 1 for the foreign banks, otherwise zero and managers' operational efficiency measured by the ratio to cost to income; and also macroeconomic control variables including annual real GDP growth rate and inflation rate. R square value indicates the independent variables reasonably explain the variations in dependent variable in all models. Besides, significant value of F test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix O: Deposit insurance effect on the relationship between bank competition and bank stability in ASEAN-5 from 1990 to 2014 using both dynamic OLS and dynamic fixed effect to ensure accuracy of the estimate of two-step system GMM.

Dependent Variable(DV)	***ln*Z-score**				**NPL ratio**				**Equity ratio**			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.6615 (.02)***	.4901 (.02)***	.6626 (.02)***	.4738 (.02)***	.6404 (.04)***	.5511 (.05)***	.6423 (.04)***	.5490 (.04)***	.6084 (.06)***	.3945 (.06)***	.6083 (.06)***	.3928 (.06)***
H-statistic	.6439 (.23)***	1.1299 (.33)***	.7679 (.28)***	1.2648 (.37)***	-3.9504 (1.47)***	-5.024 (1.92)**	-6.8286 (1.68)***	-7.494 (2.05)***	.3543 (.86)	.9243 (.93)	.2784 (.91)	.8788 (.91)
H^2	-.4595 (.19)**	-.8673 (.23)***	-.5122 (.20)***	-.8775 (.23)***	2.0048 (1.30)	3.019 (1.71)*	3.2277 (1.34)**	3.7747 (1.67)**	-.5085 (.72)	-.9332 (.83)	-.4889 (.72)	-1.0633 (.83)
Deposit Insurance (DI)	.0820 (.04)*	.1165 (.09)	.1706 (.10)*	.0817 (.12)	-1.4895 (.29)***	-.1061 (.62)	-3.5380 (.66)***	-1.3662 (.75)*	.4887 (.20)**	1.4591 (.53)**	.3686 (.35)	1.8409 (.64)***
H*DI			-.1611 (.17)*	-.3358 (.26)			3.824 (.92)***	4.0717 (1.20)***			.2237 (.53)	1.0634 (.91)
Loan Composition	-.0021 (.00)*	.0014 (.00)	-.0020 (.00)*	.0039 (.00)**	.0392 (.01)***	.0833 (.01)***	.0368 (.01)***	.0765 (.01)***	-.0128 (.01)	-.0031 (.02)	-.0131 (.01)	-.0053 (.02)
Loan Quality	-.0071 (.00)*	-.0095 (.01)	-.0074 (.00)**	-.0156 (.01)**	.3021 (.05)***	.3982 (.07)***	.3081 (.05)***	.4007 (.07)***	.0824 (.02)**	-.0147 (.04)	.0829 (.02)***	-.0143 (.04)
Bank Size	.0066 (.01)	.0847 (.04)**	.0054 (.01)	-.1436 (.06)**	.0246 (.07)	.9301 (.45)**	.0406 (.07)	.8026 (.45)*	-.7172 (.11)***	-3.3606 (.54)***	-.7166 (.11)***	-3.4348 (.56)***
Operational Efficiency	-.0061 (.00)***	-.0078 (.00)	-.0060 (.00)***	-.0085 (.00)***	.0003 (.01)	.0042 (.01)	0.0001 (.00)	.0034 (.01)	-.0127 (.01)**	-.0039 (.01)	-.0126 (.00)**	-.0037 (.00)
Foreign Ownership	.0381 (.04)	.0272 (.05)	.0381 (.04)	-.0006 (.04)	-.3345 (.25)	-.0376 (.26)	-.3181 (.25)	-.0353 (.26)	.3602 (.19)*	.0744 (.21)	.3639 (.19)*	.0886 (.27)
GDP Growth Rate	.0423 (.01)***	.0404 (.01)***	.0418 (.01)**	.0482 (.01)***	-.1930 (.05)***	-.2382 (.05)***	-.1788 (.05)***	-.2208 (.05)***	-.0179 (.02)	.0338 (.02)***	-.0172 (.02)	.0367 (.02)***
Inflation Rate	-.0092 (.01)*	-.0081 (.01)	-.0097 (.01)**	-.0031 (.01)	.1431 (.04)***	.1339 (.05)***	.1572 (.04)***	.1452 (.04)***	-.1839 (.04)***	-.1792 (.05)***	-.1838 (.04)***	-.1806 (.05)***
Constant	1.5791 (.17)***	1.1703 (.35)***	1.5278 (.18) ***	-57.2062 (12.25) ***	1.3897 (1.25)	247.187 (75.62) ***	2.2000 (1.28)*	281.3552 (74.64) ***	12.1632 (2.15) ***	-455.059 (77.42) ***	12.1927 (2.15) ***	-446.345 (75.39) ***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	1906	1906	1906	1906
No. of banks		174		174		176		176		176		176
F-test (P-value)	121.01 (0.00)	122.95 (0.00)	102.58 (0.00)	109.48 (0.00)	133.57 (0.00)	55.49 (0.00)	125.49 (0.00)	54.57 (0.00)	89.07 (0.00)	22.04 (0.00)	82.28 (0.00)	20.76 (0.00)
R^2	0.5338	0.5065	0.5341	0.4635	0.7461	0.6700	0.7482	0.6725	0.6625	0.4526	0.6625	0.4536

This table exhibits the estimation results of regression equations (3.10) and (3.11) using both dynamic OLS in models 1,3,5,7,9 and 11, and dynamic fixed effect in models 2, 4,6,8,10 and 12 to examine the effect of deposit insurance on the relationship between banking competition and the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error to correct heteroscedasticity among the banks. The dependent variable is *ln*Z-score in models 1- 4, NPL ratio in models 5-8, and equity ratio in models 9-12 as proxy of bank stability. H-statistic, as the measure of competition, is used in all the models. Deposit insurance (DI) is captured with a dummy variable carrying 1, if the county has explicit deposit insurance and otherwise zero. Deposit insurance is used to mediate the relationship between competition and stability in models 1,2,5,6,9, and 10. An interaction term of deposit insurance and H-statistic is used in models 3,4,7,8,11, and 12 to determine the mediating role of deposit insurance on bank stability through the channel of competition. Additionally, the relationship between competition and bank stability is also controlled by a number of bank specific factors including loan composition measured by the ratio of loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership is a dummy variable with 1 for the foreign banks, otherwise zero and managers' operational efficiency measured by the ratio to cost to income; and also macro-economic control variables including annual real GDP growth rate and inflation rate. R square value indicates the independent variables reasonably explain the variations in dependent variable in all models. Besides, significant value of F-test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix P: Official supervision effect on the relationship between bank competition and bank stability in ASEAN-5 from 1990 to 2014 using both dynamic OLS and dynamic fixed effect to ensure accuracy of the estimate of two-step system GMM.

Dependent Variable(DV)	***lnZ*-score**				**NPL ratio**				**Equity ratio**			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.6762 (.02)***	.4819 (.02)***	.6874 (.02)***	.4567 (.03)***	.6535 (.04)***	.5495 (.04)***	.6322 (.04)***	.5447 (.04)***	.5966 (.04)***	.4544 (.05)***	.5966 (.01)***	.4524 (.04)***
H-statistic	.8020 (.23)**	1.1421 (.31)***	.7274 (.23)***	1.2841 (.34)***	-4.2325 (1.48)***	-5.6436 (1.95)***	-3.8022 (1.52)**	-5.0419 (1.89)**	.1712 (.86)*	1.9439 (1.04)*	.2286 (1.00)*	1.499 (1.03)
H-statistic^2	-.5196 (.19)*	-.9100 (.22)***	-.5029 (.19)***	-1.0285 (.24)**	2.1031 (1.31)*	3.6201 (1.74)**	2.0206 (1.29)	3.6051 (1.69)**	-.0944 (.73)	-1.888 (.92)**	-.0822 (.81)	-1.8501 (.89)**
Supervisory Power Index(SPI)	.0712 (.01)**	.1534 (.04)***	.0240 (.06)**	.1011 (.07)**	-.6030 (.12)***	-.7404 (.28)***	-.5779 (.11)***	-.6835 (.28)**	.1928 (.09)**	1.3322 (.30)***	.1893 (.10)	1.2957 (.29)***
H-statistic*SPI			.0313 (.06)*	.0702 (.07)**			-.0522 (.05)	-.1198 (.04)**			.0066 (.03)**	.0797 (.04)**
Loan Composition	-.0019 (.00)	.0017 (.00)	-.0009 (.00)	.0026 (.00)	.0397 (.01)***	.0904 (.01)***	.0406 (.00)***	.0929 (.01)***	-.0117 (.00)	-.0158 (.02)	-.0118 (.00)**	-.0176 (.02)
Loan Quality	-.0067 (.00)*	-.0096 (.01)*	-.0071 (.00)*	-.0128 (.00)**	.2989 (.05)***	.3744 (.07)***	.3000 (.05)***	.3778 (.07)***	.0617 (.03)**	.0177 (.03)	.0617 (.01)***	.0170 (.03)
Bank Size	.0002 (.01)	.0321 (.04)	.0008 (.01)	.0172 (.05)	.0377 (.07)	.1085 (.32)	.0382 (.08)	.1694 (.31)	-.7618 (.10)***	-1.996 (.35)***	-.7620 (.06)***	-2.0493 (.37)***
Operational Efficiency	-.0060 (.00)**	-.0081 (.00)***	-.0066 (.00)***	-.0096 (.00)***	-.0002 (.00)	.0042 (.01)	-.0004 (.01)	.0032 (.00)	-.0102 (.01)*	-.0027 (.01)	-.0102 (.00)***	-.0020 (.00)
Foreign Ownership	.0513 (.04)	.0284 (.05)	.0188 (.04)	.0171 (.05)	-.3559 (.25)	-.1720 (.25)	-.3742 (.25)	-.2066 (.26)	.3961 (.20)	.3460 (.22)	.3986 (.21)*	.3721 (.22)*
GDP Growth Rate	.0069 (.01)***	.0395 (.00)***	.0478 (.01)***	.0427 (.00)**	-.1947 (.05)***	-.1942 (.05)***	-.1942 (.05)***	-.1901 (.05)***	-.0157 (.02)**	-.0416 (.02)*	-.0157 (.03)	-.0442 (.02)*
Inflation Rate	-.0205 (.00)**	-.0092 (.01)*	-.0135 (.01)**	-.0133 (.00)**	.1358 (.04)***	.1639 (.05)***	.1379 (.04)***	.16930 (.05)***	-.1539 (.03)***	-.1828 (.04)***	-.1542 (.01)***	-.1869 (.04)***
Constant	1.0118 (.29)***	-.1258 (.47)	1.0495 (.32)**	-.0629 (.52)	7.5963 (2.00)***	5.8451 (2.35)**	7.3909 (1.98)***	5.0580 (2.37)**	10.3857 (2.10)***	7.9764 (2.99)***	10.418 (1.51)***	8.6471 (3.00)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	1906	1906	1906	1906
No. on banks		174		174		176		176		176		176
F-test (P-value)	121.85 (0.00)	128.81 (0.00)	102.16 (0.00)	109.45 (0.00)	187.48 (0.00)	64.90 (0.00)	172.47 (0.00)	61.59 (0.00)	101.67 (0.00)	19.35 (0.00)	357.96 (0.00)	18.25 (0.00)
R^2	0.5338	0.5108	0.5371	0.5082	0.7458	0.7339	0.7459	0.7331	0.6708	0.5754	0.6708	0.5712

This table exhibits the estimation results of regression equations (3.10) and (3.11) using both dynamic OLS in models 1,3,5,7,9 and 11, and dynamic fixed effect in models 2, 4,6,8,10 and 12 to examine the effect of official supervision on the relationship between banking competition and the bank stability of the banking sector in ASEAN-5 during 1990 to 2014, with robust standard error to correct heteroscedasticity among the banks. The dependent variable is *lnZ*-score in models 1-4, NPL ratio in models 5-8, and equity ratio in models 9-12 as proxy of bank stability. H-statistic, as the measure of competition, is used in all models. Official supervision is captured with a supervisory power index constructed based on survey of Barth et al., (2001, 2006, 2008, 2013). Supervisory power index is used to mediate the relationship between competition and stability in models 1,2,5,6,9, and 10; and an interaction term of the supervisory power index and H-statistic is used in models 3,4,7,8,11, and 12 to determine the effect of official supervision through the channel of competition. Additionally, the relationship between competition and bank stability is controlled by a number of bank specific factors including loan composition measured by the ratio of net loan to total assets, loan quality measured by the ratio of loan loss reserve to gross loan, bank size measured by natural logarithm of total assets, foreign ownership of bank is a dummy variable with 1 for the foreign banks, otherwise zero and managers' operational efficiency measured by the ratio to cost to income; and also macroeconomic control variables including annual real GDP growth rate and inflation rate. R-square value indicates the independent variables reasonably explain the variations in dependent variable in all models. Besides, significant value of F-test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix Q: Effect of bank regulation on the relationship between bank competition and bank stability removing the quadratic term of competition

Dependent Variable(DV)	*lnZ*-score				NPL ratio				Equity ratio			
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lagged DV	.6155 (.03)***	.6669 (.03)***	.6544 (.03)***	.5912 (.03)***	.5854 (.05)***	.5814 (.05)***	.5998 (.06)***	.6030 (.06)***	.4069 (.07)***	.4020 (.07)***	.4124 (.08)***	.4145 (.07)***
H-statistic	.0259 (.27)	.9013 (.76)	.2788 (.15)*	.1508 (.13)	-1.4071 (.72)*	-.1103 (4.65)	-5.1445 (1.04)***	-2.0656 (.72)***	3.5525 (1.30)	.4859 (.54)	.7616 (.64)	.6636 (.46)
CRI	.0471 (.03)				-.4275 (.16)**				.1015 (.17)			
H-statistic*CRI	.0234 (.04)				-.2150 (.12)*				.5420 (.23)**			
ARI		-.0881 (.04)**				.7117 (.29)**				-.3317 (.11)***		
H-statistic*ARI		.0951 (.07)*				-.1392 (.38)				.0083 (.03)		
DI			.1235 (.117)				-4.0869 (.81)***				.4792 (.524)	
H-statistic*DI			-.1418 (.21)				4.6532 (1.15)***				-.8690 (.68)	
SPI				.0667 (.05)				-.1722 (.30)				.3684 (.23)
H-statistic*SPI				.0078 (.00)				-.1414 (.05)***				.05581 (.04)
Loan Composition	-.0084 (.00)***	-.0050 (.00)**	-.0073 (.00)**	-.0056 (.00)	.0949 (.02)***	.1097 (.01)	.0909 (.02)***	.1183 (.02)***	-.0135 (.01)	-.0355 (.01)**	-.0115 (.02)***	-.0233 (.02)
Loan Quality	-.0272 (.02)**	-.0187 (.01)**	-.0324 (.01)***	-.0329 (.01)**	.3358 (.08)***	.3398 (.08)***	.4310 (.07)***	.3526 (.07)***	.0560 (.04)	.0307 (.04)	.0471 (.06)	.0286 (.05)
Bank Size	-.0665 (.03)***	-.0226 (.03)	-.0194 (.03)	-.0503 (.05)	-.2281 (.37)	-.4204 (.39)***	.1555 (.18)	-.5319 (.38)	-.7765 (.28)***	-.7498 (.28)***	-.6739 (.28)	-.7131 (.28)**
Operational Efficiency	-.0057 (.01)***	-.0059 (.07)***	-.0038 (.00)**	-.0066 (.00)***	-.0085 (.01)	-.0038 (.01)	.0006 (.01)	-.0173 (.01)	.0039 (.01)	.0025 (.01)	-.0017 (.01)	.0094 (.01)
Foreign Ownership	.3296 (.09)***	.1598 (.09)*	.2165 (.10)**	.2260 (.09)**	-.5136 (.58)	-.2667 (.59)	-.9326 (.60)	-.8959 (.60)	.7438 (.33)**	.5996 (.31)**	1.1759 (.34)***	.7672 (.32)**
GDP Growth Rate	.0138 (.01)	.0338 (.00)***	.0408 (.01)***	.0516 (.01)	-.2291 (.06)***	-.2128 (.05)***	-.2090 (.06)**	-.2261 (.06)***	-.0065 (.03)	-.0471 (.02)***	-.0268 (.03)	-.0233 (.03)
Inflation Rate	-.0185 (.01)***	-.0166 (.01)**	-.0076 (.01)	-.0027 (.01)*	.0997 (.05)***	.1378 (.05)**	.1667 (.04)***	.0836 (.05)*	.0841 (.04)**	-.1264 (.04)**	-.1176 (.04)***	-.1070 (.04)**
Constant	2.5344 (.35)***	2.9611 (.65)***	1.8692 (.36)***	1.1979 (.94)	-.6582 (2.37)	-8.9317 (4.93)***	-2.4930 (2.55)	1.4865 (4.99)	12.4718 (2.90)***	16.9731 (3.57)***	11.6300 (3.75)***	7.8281 (3.85)*
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1768	1927	1927	1768	2001	2001	2001	2001	2001	2001	2001	2001
No. of Banks	176	174	174	171		176	176	176	176	176	176	176
Instruments	142	142	142	142	142	142	142	142	142	142	142	142
Wald Test (P-value)	1206.70 (0.00)	1480.48 (0.00)	1433.89 (0.00)	1224.25 (0.00)	859.03 (0.00)	1013.74 (0.00)	1057.55 (0.00)	960.12 (0.00)	204.56 (0.00)	179.28 (0.00)	146.61 (0.00)	171.03 (0.00)
AR(1) (P-value)	-6.59(.00)	-6.78(.00)	-6.78(.00)	-6.63(.00)	-4.02(.00)	-4.09(.00)	-4.17(.00)	-3.99(.00)	-3.56(.00)	-3.61(.00)	-3.61(.00)	-3.73(.00)
AR(2) (P-value)	0.74(.45)	1.19(.23)	1.28(.20)	1.03(.30)	-0.39(.69)	-0.19(.85)	-.10(.92)	-.31(.76)	-.99 (.32)	-1.03(.31)	-1.03(30)	-1.05(.29)
Hansen's J Test (P-value)	137.95 (0.300)	150.79 (0.103)	148.32 (0.130)	129.11 (0.481)	139.24 (0.254)	138.40 (0.270)	138.34 (0.292)	142.04 (0.204)	142.22 (0.201)	142.59 (0.195)	138.26 (0.273)	141.44 (0.214)

This table exhibits two-step GMM regression outputs showing the effect of bank regulation on the relationship between competition and bank stability. The dependent variable is natural logarithm of Z-score in models 1-4, NPL ratio in models 5-8, and equity ratio in models 9-12 as bank stability measure. The effect of capital regulation is shown in models 1,5, 9, the effect of activity restrictions is shown in models 2,6 and 10, the effect of deposit insurance is shown in models 3,7 and 11, and the effect of official supervision is shown in models 4, 8 and 12 on the competition-stability nexus. Where, capital regulation is measured by capital requirements index (CRI), activity restrictions are measured by activity restrictions index (ARI), official supervision is measured supervisory power index (SPI), and competition is measured by H-statistic. DI indicates deposit insurance. It controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure managers' operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership of bank, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Insignificant value of Hansen's J-test and AR(2) ensure that instrumental variable are valid and the models are not suffering from serial correlation in second order. Besides, significant value of Wald test implies that all models are correctly specified. Standard deviations are reposted in parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significant

Appendix R: Effect of bank regulation on the relationship between bank competition and bank stability during sub-sample period of 2000-2014

Dependent Variable(DV)	*lnZ*-score				NPL ratio				Equity ratio			
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lagged DV	.5580 (.04)***	.5774 (.04)***	.5964 (.03)***	.5602 (.04)***	.5574 (.06)***	.5185 (.07)***	.5844 (.06)***	.5497 (.06)***	.5893 (.10)***	.6166 (.09)***	.5357 (.07)***	.5957 (.09)***
H-statistic	1.3775 (.75)*	1.8890 (.85)**	.3703 (.34)	1.7583 (1.76)	-14.5024 (4.32)***	-9.7954 (4.83)**	-9.7229 (2.31)***	-37.0072 (8.42)***	.9314 (.79)	.2467 (3.68)	.4132 (1.28)	.3716 (.98)
H-statistic^2	-.2891 (.25)	-.2516 (.22)	-.4965 (.23)**	-.2954 (.27)	2.7453 (1.18)**	3.2039 (1.18)	4.5291 (1.49)***	5.1847 (1.18)***	-.8707 (.89)	-1.3524 (.98)	-1.5803 (.87)**	-1.5325 (.94)*
CRI	.0665 (.06)*				-.9525 (.36)***				.1585 (.27)			
H-statistic*CRI	.2527 (.11)**				-1.8465 (.68)***				.1936 (.46)			
ARI		-.1117 (.04)**				1.1439 (.25)***				-.1934 (.23)		
H-statistic*ARI		.1784 (.08)**				-1.3125 (.42)***				.0623 (.33)		
DI			.4445 (.20)**				-2.5803 (.98)***				.5405 (.38)*	
H-stat.*DI			-.2025 (.24)				4.2674 (1.57)***				-.3693 (.76)	
SPI				.1097 (.09)				-1.7034 (.45)***				.1667 (.18)**
H-statistic*SPI				.1372 (.13)				-2.5414 (.66)***				.0797 (.04)**
Loan Composition	-.0009 (.00)	-.0003 (.00)	-.0087 (.00)**	-.0006 (.00)	.0393 (.01)***	.0585 (.02)***	.0554 (.02)***	.0307 (.01)**	-.0095 (.01)	-.0016 (.02)	-.0106 (.01)	-.0133 (.01)
Loan Quality	.0014 (.01)	.0028 (.01)	.0024 (.01)	.0039 (.00)	.5095 (.10)***	.4456 (.06)***	.4992 (.10)***	.4645 (.07)***	.1205 (.02)***	.1216 (.03)***	.1803 (.03)***	.1139 (.03)***
Bank Size	.0419 (.04)	.0208 (.03)	.0671 (.03)*	.0037 (.04)	-.3469 (.24)	-.4595 (.25)*	-.6228 (.31)**	-.2662 (.23)	-.3745 (.19)**	-.2350 (.24)	-.5665 (.18)**	-.2725 (.25)
Operational Efficiency	-.0087 (.00)***	-.0099 (.00)***	-.0064 (.00)**	-.0120 (.003)***	-.0125 (.02)	.0073 (.01)	-.0216 (.01)	.0002 (.01)	-.0148 (.01)	-.0107 (.02)	-.0191 (.01)	-.0104 (.01)
Foreign Ownership	.1126 (.09)	.1266 (.08)	.0647 (.08)	.0954 (.08)	-.3231 (.36)	-.3574 (.43)	-.5807 (.43)	-.5079 (.52)	.0765 (.44)	.2271 (.36)	.4649 (.40)	.0134 (.36)
GDP Growth Rate	.0166 (.01)	.0022 (.01)	.0008 (.00)	.0140 (.01)	-.0414 (.03)	-.0119 (.04)	-.0099 (.03)	.0005 (.03)	-.0161 (.04)	-.0188 (.03)	-.0231 (.03)	-.0094 (.04)
Inflation Rate	-.0078 (.01)	.0049 (.01)	-.0122 (.01)	-.0070 (.01)	-.1308 (.05)***	-.0521 (.04)	-.1525 (.05)***	-.1624 (.04)***	-.0214 (.05)	-.0788 (.05)	-.0254 (.05)	-.0114 (.06)
Constant	2.205 (.51)***	.3902 (.72)	.7543 (.49)*	3.2887 (1.24)***	8.5823 (2.94)***	-10.1490 (3.66)***	7.0166 (3.23)**	24.153 (6.14)***	7.2278 (2.64)***	9.8341 (3.86)***	7.8874 (2.43)***	4.5479 (3.54)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1487	1487	1487	939.09	1508	1508	1508	1508	1508	1508	1303	1303
No. of Banks	168	168	168	168	169	169	169	169	169	169	162	162
Instruments	97	123	144	123	97	123	97	123	123	123	115	115
Wald Test (P-value)	965.30 (0.00)	1129.83 (0.00)	932.09 (0.00)	939.09 (0.00)	1730.97 (0.00)	2382.57 (0.00)	1562.63 (0.00)	2715.69	158.44 (0.00)	151.56 (0.00)	284.89 (0.00	170.13 (0.00)
AR(1) (P-value)	-6.12(.00)	-6.24(.00)	-6.24(.00)	-6.21(.00)	-2.92(.00)	-2.99(.00)	-3.06(.00)	-3.01(.00)	-3.42(.00)	-3.63(.00)	-3.19(.00)	-3.51(.00)
AR(2)(P-value)	-0.01(.98)	-0.02(.98)	0.14(.89)	-0.24(.81)	-1.77(.77)	-1.64(.11)	-1.60(.11)	-1.64(.11)	-0.03(.97)	0.11(.00)	0.07(.94)	0.16(.86)
Hansen's J Test (P-value)	97.41 (0.15)	121.23 (0.20)	139.36 (.29)	120.58 (0.211)	95.42 (0.18)	125.81 (0.129)	95.80 (0.16)	123.78 (0.16)	127.29 (0.12)	125.51 (0.13)	110.01 (0.254)	124.59 (0.146)

This table exhibits two-step system GMM regression outputs showing the effect of bank regulation on the relationship between competition and bank stability during the sub-sample period 2000-2014, aftermath of the adoption of post AFC reform strategies. The dependent variable is *lnZ*-score in models 1-4, NPL ratio in models 5-8, and equity ratio in models 9-12, as bank stability measure. The main variable of interest bank regulation is captured with capital requirements index (CRI) in models 1,5 and 9; Activity restrictions index (ARI) in models 2, 6 and 10; deposit insurance (DI) in model 3, 7 and 11, and supervisory power index (SPI) in models 4, 8 and 12; while competition is measured with H-statistic in all models. This study controls several bank level variables such as ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure managers' operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Insignificant value of Hansen's J-test and AR(2) ensure that instrumental variable are valid and the models are not suffering from serial correlation in second order. Besides, significant value of Wald test implies that all models are correctly specified. Robust standard deviations are reposted in parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significant

Appendix S: The effect of bank regulation on the relationship between bank competition and bank stability in ASEAN-5 during 1990-2014 using OLS

Dependent Variable	***ln*Z-score**				**NPL ratio**				**Equity ratio**			
Model	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS	(9) OLS	(10) OLS	(11) OLS	(12) OLS
H-statistic	.6276 (.22)***	.5373 (.23)**	.5275 (.22)**	.6571(. 23)***	-1.8316 (1.33)	-2.1712 (1.36)	-4.1182 (1.25)***	-2.0739 (1.32)	1.8819 (1.06)*	1.6080 (1.10)	.9614 (1.00)	1.2368 (1.06)
H-statistic^2	-.5251 (.18)***	-.36134 (.20)*	-.4774 (.18)***	-.5122 (.19)***	1.0099 (1.05)	1.6991 (1.13)	2.1099 (1.02)**	.803313 (1.09)	.7380 (.84)	.9638 (.92)	.2525 (.81)	.5725 (.88)
CRI	.0346 (.02)*				-.5415 (.12)***				.3173 (.09)***			
H-statistic*CRI	.0925 (.04)**				-.6961 (.24)***				.0161 (.03)			
ARI		-.0012 (.01)				.5070 (.06)***				-.2176 (.05)***		
H-statistic*ARI		.0038 (.02)				-.0612 (.09)				.0035 (.00)		
DI			.1568 (.09)*				-1.4483 (.56)***				.3271 (.45)	
H-statistic*DI			-.6878 (.29)***				6.0877 (1.74)***				-.8006 (1.41)	
SPI				.0506 (.02)**				-.6071 (.13)***				.2063 (.10)*
H-statistic*SPI				.0286 (.02)				-.0245 (.00)***				.0043 (.00)
Loan Composition	-.0003 (.00)	-.0001 (.00)	-.0002 (.00)	-.0009 (.00)	.0350 (.01)***	.0446 (.00)***	.0262 (.00)***	.0308 (.00)***	-.0055 (.00)	-.0010 (.00)*	-.0064 (.00)	-.0044 (.00)
Loan Quality	-.005 (.00)**	-.0049 (.00)*	-.0055 (.00)**	-.0045 (.00)*	.2939 (.02)***	.2986 (.01)***	.2918 (.01)***	.2905 (.01)***	.0911 (.01)***	.0898 (.01)***	.0869 (.01)***	.0899 (.01)***
Bank Size	.0107 (.01)	.0152 (.01)	.0132 (.01)	.0146 (.01)	.0047 (.07)	-.0792 (.07)	-.0907 (.07)	-.0742 (.07)	-.7306 (.06)***	-.6693 (.06)***	-.6604 (.06)***	-.6671 (.06)***
Operational Efficiency	-.006 (.00)***	-.0059 (.00)***	-.0059 (.00)***	-.0059 (.00)***	-.0005 (.00)	-.0009 (.00)	-.0018 (.00)	-.0024 (.00)	-.0115 (.00)***	-.0109 (.00)***	-.0104 (.00)***	-.0101 (.00)***
Bank Ownership	.0148 (.04)	.0138 (.04)	.0285 (.04)	.0144 (.04)	-.2162 (.25)	-.2056 (.25)	-.1164 (.25)	-.267 (.25)	.3614 (.20)*	.3472 (.20)*	.3964 (.20)	.3911 (.20)*
GDP Growth Rate	.0305 (.03)	.0399 (.03)	.0376 (.03)	.0527 (.03)	-.0818 (.21)	-.0985 (.20)	.0778 (.20)	.0654 (.20)	-.0985 (.16)	-.1645 (.16)	-.1516 (.16)	-.1893 (.16)
Inflation Rate	-.0027 (.00)	-.0068 (.00)	-.0029 (.01)	-.0065 (.00)	.0681 (.04)*	.1492 (.04)***	.1434 (.04)***	.1040 (.04)***	-.0569 (.03)*	-.1098 (.03)***	-.0591 (.03)*	-.0694 (.03)**
Constant	1.6814 (.18)***	1.7791 (.24)***	1.7237 (.18)***	1.1921 (.31)***	2.9422 (1.05)***	-5.9720 (1.35)***	1.9410 (.98)**	8.6154 (1.89)***	10.5819 (.93)***	14.3717 (1.20)***	11.2376 (.92)***	8.6982 (1.56)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1906	1906	1906	1906	1969	1969	1969	1969	1969	1969	1969	1969
No. of Banks	174	174	174	174	176	176	176	176	176	176	176	176
R^2	0.5463	0.5460	0.5464	0.5462	0.7527	0.7545	0.7525	0.7519	0.6768	0.6760	0.6733	0.6737
Adjusted R^2	0.5432	0.5428	0.5433	0.5431	0.7510	0.7528	0.7509	0.7502	0.6747	0.6738	0.6711	0.671
F-test (P-value)	175.25 (0.00)	175.00 (0.00)	175.31 (0.00)	175.16 (0.00)	457.69 (0.00)	462.06 (0.00)	457.34 (0.00)	455.71 (0.00)	314.93 (0.00)	312.54 (0.00)	309.93 (0.00)	310.48 (0.00)

This table exhibits OLS regression output showing the effect of banking regulation on the relationship between competition and bank stability. The dependent variable is natural logarithm of Z-score in models 1-4, NPL ratio in model 5-8, and equity ratio in models 9-12 as bank stability measure. On the competition-stability nexus, the effect of capital regulation is shown in models 1,5, 9, the effect of activity restrictions is shown in models 2,6 and 10, the effect of deposit insurance is shown in models 3,7 and 11, and the effect of official supervision is shown in models in 4, 8 and 12. Where, capital regulation is measured by capital requirements index (CRI), activity restrictions are measured by activity restrictions index (ARI), official supervision is measured supervisory power index (SPI), and competition is measured by H-statistic. DI indicates deposit insurance. This study controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture assets quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . We also control GDP growth rate and inflation rate to capture macro-economic instability. Significant value of F test implies that all models are correctly specified. Standard deviations are reposted in parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significant.

Appendix T: The effect of bank regulation on the relationship between bank competition and bank stability in ASEAN-5 during 1990-2014 using fixed effect model

Dependent Variable	***ln*Z-score**				**NPL ratio**				**Equity ratio**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Model	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE
H-statistic	.9034 (.24)***	.8030 (.25)***	.9013 (.24)***	.9901 (.24)***	-3.8209 (1.37)***	-3.3496 (1.42)**	-5.7963 (1.34)***	-4.0853 (1.38)***	.1985 (1.01)	.3666 (1.06)	1.7092 (.99)*	1.1868 (1.02)
H-statistic^2	-.7772 (.20)***	-.5586 (.21)***	-.8028 (.20)***	-.8471 (.20)***	2.5786 (1.09)***	2.4115 (1.16)**	3.8921 (1.07)***	2.9092 (1.11)***	-1.1652 (.81)	.5355 (.87)	-1.962 (.80)**	-1.6869 (.83)**
CRI	.0862 (.02)***				-.3897 (.15)***				.7933 (.12)***			
H-statistic*CRI	.0466 (.04)				-.9796 (.25)***				.2579 (.19)			
ARI		-.1074 (.03)***				.3936 (.17)***				-.9962 (.13)***		
H-statistic*ARI		.0116 (.01)				-.2809 (.10)***				.1046 (.07)		
DI			.1716 (.11)				-.2268 (.65)				1.3577 (.49)***	
H-statistic*DI			-.1068 (.33)				4.0922 (1.93)**				4.1161 (1.46)***	
SPI				.2063 (.04)***				-.7725 (.27)***				1.3658 (.21)***
H-statistic*SPI				.0046 (.02)				-.4688 (.12)***				.1209 (.09)
Loan Composition	-.0049 (.00)***	-.0040 (.00)**	-.0052 (.00)***	-.0058 (.00)**	.0841 (.01)***	.091 (.01)***	.0809 (.01)***	.0853 (.01)***	-.0137 (.00)*	-.0193 (.00)**	-.0218 (.00)***	-.0101 (.00)
Loan Quality	-.0089 (.00)***	-.0082 (.00)**	-.0083 (.00)**	-.0083 (.00)**	.3593 (.02)***	.3624 (.02)***	.3530 (.02)***	.3597 (.02)***	.0292 (.01)**	.0442 (.01)***	.0520 (.01)***	.0451 (.01)***
Bank Size	-.0101 (.04)	.0062 (.04)	.0390 (.04)	-.0135 (.04)	.0969 (.27)	-.1651 (.22)	-.3090 (.23)	.0643 (.24)	-2.4604 (.21)***	-1.8428 (.18)***	-1.2836 (.18)***	-1.8883 (.19)***
Operational Efficiency	-.008 (.00)***	-.0079 (.00)***	-.0077 (.00)***	-.008 (.00)***	-.0021 (.00)	-.0032 (.00)	-.0015 (.00)	-.0025 (.00)	-.0014 (.00)	-.0003 (.00)	.0001 (.00)	-.0007 (.00)
Foreign Ownership	.0063 (.04)	-.0024 (.04)	.0142 (.04)	.0069 (.04)	-.0405 (.25)	-.0906 (.25)	.0085 (.26)	-.0826 (.25)	.2827 (.19)	.2071 (.19)	.3259 (.19)*	.3102 (.19)
GDP Growth Rate	.0472 (.03)	.0274 (.03)	.0524 (.03)	.0619 (.03)*	-.0504 (.21)	-.2468 (.21)	-.1195 (.21)	-.1084 (.21)	-.0610 (.16)	.0461 (.16)	-.1076 (.16)	-.2236 (.16)
Inflation Rate	-.0041 (.00)	-.0023 (.00)	-.0024 (.00)	-.0097 (.00)	.1794 (.05)***	.1387 (.05)***	.1773 (.05)***	.1755 (.05)***	-.1522 (.04)***	-.1529 (.03)***	-.1430 (.04)***	-.1961 (.04)***
Constant	1.7410 (.37)***	3.1746 (.59)***	1.568 (.35)***	-.2638 (.49)	-.4705 (2.08)	-4.7121 (3.35)***	.6934 (2.04)	7.4027 (2.91)***	23.2383 (1.66)***	33.230 (2.69)***	17.8168 (1.60)***	6.1220 (2.17)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1906	1906	1906	1906	1969	1969	1969	1969	1969	1969	1969	1969
No. of Banks	174	174	174	174	176	176	176	176	176	176	176	176
R^2	0.5275	0.4898	0.5272	0.5133	0.7419	0.7442	0.7396	0.7374	0.5719	0.5557	0.6379	0.5787
F-test (P-value)	113.42 (0.00)	114.96 (0.00)	112.71 (0.00)	114.55 (0.00)	277.91 (0.00)	275.98 (0.00)	273.33 (0.00)	277.76 (0.00)	0.5719 (0.00)	121.54 (0.00)	115.14 (0.00)	119.42 (0.00)

This table exhibits fixed effect regression outputs showing the effect of bank regulation on the relationship between competition and bank stability. The dependent variable is natural logarithm of Z-score in models 1-4, NPL ratio in models 5-8 and equity ratio in models 9-12 as bank stability measure. The mediating role of capital regulation on competition-stability nexus is presented in models 1,5, 9, the role of activity restrictions is presented in models 2,6 and 10, the role of deposit insurance is presented in models 3,7 and 11, and the role of official supervision is presented in models 4, 8 and 12. Where, capital regulation is measured by capital requirements index (CRI), activity restrictions are measured by activity restrictions index (ARI), official supervision is measured supervisory power index (SPI), and competition is measured by H-statistic. DI indicates deposit insurance. This study controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Significant value of F test implies that all models are correctly specified. Standard deviations are reposted in parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significant

Appendix U: Effect of bank regulation on the relationship between bank competition and bank stability considering Lerner index as measure of competition

Dependent Variable	*ln*Z-score				NPL ratio				Equity ratio			
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LDV	.6759 (.03)***	.6666 (.03)***	.6369 (.03)***	.6859 (.03)***	.6127 (.06)***	.61258 (.06)***	.61831 (.05)***	.6162 (.05)***	.42624 (.08)***	.4436 (.07)***	.4473 (.08)***	.4531 (.08)***
Lerner Index	-.7279 (.25)***	-.5109 (.23)***	-.8167 (.20)***	-.5982 (.23)***	4.250 (.29)***	2.2698 (1.41)	4.2644 (.97)***	4.4757 (1.46)***	-2.262 (1.180)**	-1.5498 (1.07)*	-1.5813 (.95)*	-2.0534 (1.02)**
Lerner^2	.2635 (.40)	.2805 (.40)	.3156 (.38)	-.0689 (.37)	.0113 (1.97)	1.2651 (1.96)	1.9483 (1.78)	2.9808 (1.75)*	1.3013 (1.59)	2.4078 (1.62)	.6486 (1.64)	.5155 (1.59)
CRI	.0206 (.03)				-.3639 (.15)**				.3355 (.16)**			
Lerner*CRI	-.1193 (.04)***				.3684 (.29)				-.3361 (.23)			
ARI		-.0509 (.01)***				.41684 (.10)***				-.3594 (.10)***		
Lerner*ARI		-.0349 (.01)**				.0224 (.11)				-.069 (.08)		
DI			.2727 (.08)***				-.4860 (.47)				.34952 (.47)	
Lerner*DI			.7693 (.18)***				-1.8715 (1.14)*				-2.73232 (.80)***	
SPI				.0311 (.04)				-.3716 (.22)*				.4745 (.20)***
Lerner*SPI				-.042 (.01)***				.1386 (.12)				-.1314 (.07)*
Loan Composition	-.0035 (.00)	-.0048 (.00)	.0042 (.00)	-.0015 (.00)	.0419 (.01)**	.071 (.02)***	.0437 (.01)**	.0422 (.01)**	-.0124 (.02)	-.0382 (.02)*	.0068 (.01)	-.0002 (.02)
Loan Quality	-.0032 (.01)	-.0069 (.01)	.01375 (.00)	-.0017 (.01)	.3484 (.08)***	.3308 (.09)***	.3335 (.08)*	.3128 (.09)***	.1026 (.04)**	.0812 (.04)*	.1273 (.04)***	.1241 (.04)***
Bank Size	-.0142 (.03)	.0022 (.03)	.0309 (.03)	.002 (.03)	-.0913 (.25)	-.1896 (.26)	-.4713 (.24)**	-.417 (.28)*	-.8124 (.28)***	-.4897 (.24)**	-.6677 (.21)***	-.5735 (.25)*
Operational Efficiency	-.0081 (.00)***	-.006 (.00)**	-.0121 (.00)***	-.0069 (.00)***	-.0302 (.01)*	-.0345 (.01)**	-.0199 (.01)	-.0266 (.01)	.0027 (.01)	.0064 (.01)	.0037 (.01)	.0046 (.01)
Foreign Ownership	.1338 (.09)	-.0022 (.09)	.1459 (.09)	.0872 (.09)	.1200 (.59)	.5703 (.57)	-.2394 (.54)	-.2332 (.56)	.6614 (.38)*	.3724 (.33)	.6386 (.39)	.589 (.36)*
GDP Growth Rate	.0089 (.04)	.0126 (.04)	-.0351 (.03)	-.0071 (.04)	-.1098 (.28)	-.1521 (.24)	-.0556 (.13)	-.006 (.19)	-.0109 (.15)	.031 (.18)	-.1076 (.13)	-.113 (.14)
Inflation Rate	-.0143 (.01)	-.0249 (.01)***	-.0246 (.01)*	-.0096 (.01)	-.0553 (.08)	.0549 (.07)	-.1487 (.07)**	-.1211 (.08)	-.1615 (.07)**	-.1951 (.07)***	-.1148 (.06)*	-.1439 (.07)**
Constant	2.0357 (.49)***	2.6474 (.62)***	1.6255 (.42)***	1.4445 (.70)**	3.588 (2.81)	-4.1443 (2.92)	4.6266 (2.73)*	8.6835 (4.81)*	12.0193 (3.25)***	16.505 (3.94)***	10.699 (2.81)***	5.2847 (3.29)*
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1793	1793	1793	1793	1856	1856	1856	1856	1856	1856	1856	1856
No. of Banks	174	174	174	174	176	176	176	176	176	176	176	176
Instruments	131	131	131	131	131	131	129	129	129	129	129	129
Wald Test (P-value)	978.19 (0.00)	1232.34 (0.00)	903.84 (0.00)	1115.28 (0.00)	1186.10 (0.00)	1247.10 (0.00)	1043.95 (0.00)	1150.47 (0.00)	195.17 (0.00)	162.60 (0.00)	150.30 (0.00)	144.62 (0.00)
AR(1) (P-value)	-6.66 (0.00)	-6.67 (0.00)	-6.67 (0.00)	-6.68 (0.00)	-3.57 (0.00)	-3.60 (0.00)	-3.63 (0.00)	-3.56 (0.00)	-3.23 (0.00)	-3.44 (0.00)	-3.31 (0.00)	-3.33 (0.00)
AR(2) (P-value)	0.92 (0.356)	0.78 (0.434)	0.79 (0.432)	0.96 (0.338)	-1.01 (0.312)	-0.90 (0.367)	-1.05 (0.295)	-1.06 (0.291)	0.31 (0.755)	0.03 (.976)	0.37 (0.710)	0.26 (0.795)
Hansen's J Test (P-value)	132.10 (0.177)	130.96 0.196	130.94 (0.196)	128.15 (0.247)	127.75 (0.254)	127.05 (0.268)	124.79 (0.272)	133.88 (0.123)	130.99 (0.162)	133.66 (0.125)	125.94 (0.249)	127.17 (0.225)

This table exhibits the system GMM estimates showing the effect of regulation on the competition-bank stability nexus. The dependent variable is *ln*Z-score in models 1-4, NPL ratio in models 5-8, and equity ratio in models 9-12 as bank stability measure. The role of capital regulation on the competition-stability nexus is presented in model 1,5, 9, the role of activity restrictions is presented in models 2,6 and 10, the role of deposit insurance is presented in models 3,7 and 11, and the role of official supervision is presented in models 4, 8 and 12. Where, capital requirements index (CRI), activity restrictions index (ARI), supervisory power index (SPI), and deposit insurance (DI) used as regulation variable. Competition is measured by using Lerner index, which measures competition through market power. This study controls bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure managers' operational efficiency, and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Insignificant value of Hansen's J-test and AR(2) ensure that instrumental variable are valid and the models are not suffering from serial correlation in second level. Significant value of Wald test implies that all models are correctly specified. Standard deviations are reposted in parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significant.

Appendix V: The effect of capital requirement on the relationship between bank competition and bank stability during crisis period term using Dynamic OLS and Dynamic fixed effect

Dependent Variable	***ln*Z-score**						**NPL ratio**		
Model	DOLS (1)	DFE (2)	DOSL (3)	D.FE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)
Lagged DV	.6713 (.02)***	.4777 (.02)***	.6727 (.02)***	.4847 (.02)***	.6622 (.02)***	.4844 (.02)***	.6479 (.04)***	.5532 (.05)***	.6478 (.04)***
H-statistic (H)	.7923 (.23)***	1.1706 (.31)***	.6739 (.23)***	1.128 (.30)***	.6613 (.23)***	1.1321 (.30)***	-5.3448 (1.57)***	-5.2258 (1.93)***	-4.6404 (1.55)***
H-statistic^2	-.5533 (.19)***	-.8662 (.22)***	-.5135 (.19)***	-.856 (.22)***	-.5312 (.19)***	-.8421 (.22)***	3.0740 (1.37)**	3.1170 (1.71)*	2.8468 (1.35)**
Crisis	-.2994 (.06)***	-.2806 (.06)***	-1.278 (.22)***	-1.13 (.22)***	-1.202 (.23)***	-1.1813 (.22)***	.9039 (.26)***	.5108 (.30)*	7.1769 (1.00)***
CRI*Crisis			.1782 (.04)***	.154 (.04)***	.1289 (.06)**	.1835 (.05)***			-1.1435 (.15)***
H*CRI*Crisis					.0558 (.05)	-.0326 (.05)			
Loan Composition	-.0025 (.00)**	.0041 (.00)**	-.0018 (.00)	.0048 (.00)***	-.0017 (.00)	.0049 (.00)***	.0481 (.01)***	.0819 (.01)***	.0441 (.01)***
Loan Quality	-.0084 (.00)**	-.0169 (.01)***	-.0082 (.00)**	-.016 (.01)***	-.0084 (.00)**	-.0167 (.01)***	.3061 (.05)***	.3995 (.07)***	.3061 (.05)***
Bank Size	.0014 (.01)	-.1654 (.06)***	-.0082 (.00)	-.161 (.06)***	.0008 (.01)	-.1639 (.06)***	.0744 (.07)	.9512 (.47)**	.0817 (.07)
Operational Efficiency	-.0062 (.00)***	-.0088 (.00)***	-.0064 (.00)***	-.009 (.00)***	-.0064 (.00)***	-.0089 (.00)***	.0003 (.01)	.0044 (.01)	.0010 (.00)
Foreign Ownership	.0328 (.04)	-.0081 (.04)	.0100 (.04)	-.021 (.05)	.0105 (.04)	-.0209 (.05)	-.3766 (.26)	-.0258 (.26)	-.2308 (.26)
GDP Growth Rate	.0262 (.00)***	.0301 (.01)***	.0178 (.01)*	.021 (.01)**	.0156 (.01)*	.0228 (.01)***	-.1847 (.06)***	-.2024 (.06)***	-.1290 (.05)**
Inflation Ratio	-.0089 (.01)***	-.0044 (.01)	-.008 (.00)***	-.003 (.01)	-.0081 (.00)**	-.0038 (.01)	.1179 (.04)***	.1382 (.05)***	.1126 (.04)***
Constant	1.7539 (.18)***	-51.89 (11.58)***	1.837 (.18)***	-44.9 (11.4)***	1.851 (.18)***	-45.383 (11.55)***	-.3706 (1.21)	241.3048 (66.53)***	-.8804 (1.23)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2047	2047	2121	2121	2121
No. of Banks		174		174		174		176	
F-statistics (P-value)	113.32 (0.00)	127.79 (0.00)	104.88 (0.00)	124.10 (0.00)	97.75 (0.00)	114.66 (0.00)	98.96 (0.00)	55.44 (0.00)	103.77 (0.00)
R^2	0.5385	0.4681	0.5448	0.4732	0.5451	0.4733	0.7439	0.6702	0.7475

This table exhibits regression outputs of both dynamic OLS and dynamic fixed effect to ensure the accuracy of the GMM regression outputs in determining the nexus between, capital regulation, competition and bank stability during crisis period. This is because, Roodman (2006) argued the coefficient of the lagged dependent variable of two-step system GMM model lies in between the coefficient of the lagged dependent variables of dynamic OLS and dynamic fixed effect. The dependent variable is natural logarithm of Z-score in models 1-6, NPL ratio in models 7-12, and equity ratio in models 13-18, as bank stability measure. The effect of financial crisis on bank stability is presented in models 1-2, 7-8, and 13-14. Effect of capital regulation on competition-stability nexus during crisis is presented in models 3-4, 9-10 and 15-16, where competition is measured by H-statistic. This study

uses triple terms interaction of capital requirement index, H-statistic and crisis to show the mediating effect of capital regulation on competition-stability nexus during crisis period in models 5-6, 11-12, and 17-18, where, dynamic OLS and dynamic fixed effect regressions are used in every alternative model. It controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicates that the independent variables necessarily explains the dependent variable in the specifications. The robust standard errors are reported in the parenthesis.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly.

Appendix V: Continue

Dependent Variable	NPL Ratio			Equity ratio					
Model	DOLS (10)	DFE (11)	DOLS (12)	DFE (13)	DOLS (14)	DFE (15)	DOLS (16)	DFE (17)	DOLS (18)
LDV	.5548 (.04)***	.6122 (.02)***	.4844 (.02)***	.5959 (.04)***	.4245 (.05)***	.5958 (.04)***	.4244 (.05)***	.5958 (.04)***	.4244 (.05)***
H-statistic(H)	-5.1346 (1.93)***	.6613 (.23)***	1.1321 (.30)***	.2538 (.86)	1.1685 (.94)	-.0171 (.87)	1.1701 (.94)	-.0348 (.87)	1.1377 (.95)
H-statistic^2	3.1219 (1.71)*	-.5312 (.19)***	-.8420 (.22)***	-.4644 (.73)	-1.003 (.87)	-.3766 (.73)	-1.0031 (.87)	-.3713 (.73)	-1.002 (.87)
Crisis	3.0120 (1.23)**	-1.2017 (.23)***	-1.1814 (.22)***	-.2282 (.34)	-.3685 (.32)	-2.6341 (.93)***	-.3124 (.85)	-2.611 (.92)***	-.2675 (.84)
CRI*Crisis	-.4521 (.18)**	.1289 (.05)**	.1835 (.05)***			.4386 (.17)**	-.0102 (.15)	.4301 (.16)**	-.0302 (.14)
H*CRI*Crisis		.0558 (.05)	-.0326 (.05)					.01803 (.07)	.0517 (.06)
Loan Composition	.0796 (.01)***	-.0017 (.00)	.0049 (.00)***	-.0146 (.01)*	-.0028 (.02)	-.0130 (.01)*	-.0028 (.01)***	-.0129 (.00)*	-.0027 (.02)
Loan Quality	.3989 (.07)***	-.0084 (.00)**	-.0167 (.00)***	.0559 (.03)*	-.0320 (.03)	.0559 (.03)*	-.0321 (.04)	.0558 (.03)*	-.0329 (.03)
Bank Size	.9389 (.46)**	.0009 (.01)	-.1639 (.06)***	-.7758 (.10)***	-3.578 (.55)***	-.7790 (.10)***	-3.5795 (.55)	-.7790 (.10)***	-3.5916 (.56)***
Operational Efficiency	.0046 (.01)	-.0064 (.00)***	-.0089 (.00)***	-.0106 (.01)*	-.0034 (.01)	-.0109 (.01)*	-.0034 (.01)	-.0108 (.01)**	-.0033 (.01)
Foreign Ownership	.0109 (.26)	.010 (.04)	-.0209 (.05)	.4053 (.20)**	.0917 (.22)	.3494 (.21)*	.0926 (.22)	.3474 (.20)*	.0871 (.22)
GDP Growth Rate	-.1767 (.05)***	.0157 (.00)*	.0227 (.01)***	-.0140 (.02)	.0101 (.03)	-.0354 (.03)	.0107 (.03)	-.0343 (.02)	.0138 (.04)
Inflation Rate	.1362 (.04)***	-.0081 (.00)*	-.0038 (.00)	-.1469 (.03)***	-.1335 (.04)***	-.1448 (.02)***	-.1335 (.04)***	-.1448 (.02)***	-.1335 (.04)***
Constant	222.2824 (64.96)***	1.8510 (.18)***	-45.38 (1.55)***	12.8324 (1.83)***	-420.72 (76.32)***	13.0336 (1.84)***	-421.17 (7.86)***	13.0254 (1.85)***	-420.72 (7.06)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	2121	2047	2047	2121	2121	2121	2121	2121	2121
No. of Banks	176		176		176		176		176
F-test (P-value)	51.70 (0.00)	97.75 (0.00)	114.66 (0.00)	96.56 (0.00)	23.85 (0.00)	89.40 (0.00)	22.10 (0.00)	84.58 (0.00)	20.83 (0.00)
R^2	0.6709	.5451	0.4733	0.6703	.4886	0.6714	0.4886	0.6714	0.4888

This table exhibits regression outputs of both dynamic OLS and dynamic fixed effect to ensure the accuracy of the GMM regression outputs in determining the nexus between, capital regulation, competition and bank stability during crisis period. This is because, Roodman (2006) argued the coefficient of the lagged dependent variable of two-step system GMM model lies in between the coefficient of the lagged dependent variables of dynamic OLS and dynamic fixed effect. The dependent variable is natural logarithm of Z-score in models 1-6, NPL ratio in models 7-12, and equity ratio in models 13-18, as bank stability measure. The effect of financial crisis on bank stability is presented in models 1-2, 7-8, and 13-14. Effect of capital regulation on competition-stability nexus during crisis is presented in models 3-4, 9-10 and 15-16, where competition is measured by H-statistic. This study uses triple terms interaction of capital requirements index, H-statistic and crisis to show the mediating effect of capital regulation on competition-stability nexus during crisis period in models 5-6, 11-12, and 17-18, where, dynamic OLS and dynamic fixed effect regressions are used in every alternative model. It controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicates that the independent variables necessarily explains the dependent variable in the specifications. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly.

Appendix W: The effect of activity restrictions on the relationship between bank competition and bank stability during crisis period using both dynamic OLS and dynamic fixed effect

Dependent Variable	*ln*Z-score				NPL ratio				Equity ratio			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
LDV	.6615 (.02)***	.4817 (.02)***	.6603 (.02)***	.4832 (.02)***	.6491 (.04)***	.5534 (.04)***	.6508 (.04)***	.5556 (.04)***	.5941 (.04)***	.4243 (.05)***	.5941 (.04)***	.4244 (.05)***
H-statistic(H)	.7115 (.23)***	1.1381 (.30)***	.6456 (.23)***	1.1122 (.30)***	-5.063 (1.55)***	-5.006 (1.91)**	-4.746 (1.54)***	-4.682 (1.89)***	.0973 (.87)	1.1661 (.95)	.0835 (.87)	1.1452 (.95)
H-statistic^2	-.5090 (.19)***	-.8415 (.22)***	-.5415 (.19)***	-.8554 (.22)***	2.893 (1.37)**	2.9641 (1.70)*	2.9775 (1.36)**	3.1377 (1.68)*	-.3896 (.73)	-1.005 (.87)	-.3904 (.73)	-1.012 (.87)
Crisis	1.0195 (.26)***	.8537 (.25)***	.7788 (.26)***	.7565 (.25)***	.6828 (.30)**	.3256 (.32)	2.337 (.69)***	2.2817 (.69)***	3.0532 (1.45)**	.4699 (1.25)	3.0234 (1.46)**	.4168 (1.27)
ARI*Crisis	-.1219 (.02)***	-.1049 (.02)***	-.1338 (.02)***	-.1095 (.02)***	.0815 (.03)**	.0713 (.03)**	.0802 (.03)**	.0697 (.03)**	-.3035 (.11)**	-.0776 (.10)	-.3033 (.12)**	-.0771 (.10)
H*ARI*Crisis			.0582 (.01)***	.0228 (.01)			-.2592 (.08)***	-.3044 (.08)***			.0125 (.03)	.0222 (.04)
Loan Composition	-.0025 (.00)**	.0041 (.00)***	-.0019 (.00)*	.0042 (.00)**	.0488 (.01)***	.0822 (.01)***	.0462 (.01)***	.0804 (.01)***	-.0149 (.00)*	-.0028 (.02)	-.0147 (.01)**	-.0027 (.01)
Loan Quality	-.0084 (.00)**	-.0168 (.01)**	-.0087 (.01)**	-.0169 (.00)***	.3039 (.05)***	.3953 (.07)***	.3039 (.05)***	.3958 (.07)***	.0554 (.03)*	-.0322 (.03)	.0552 (.03)**	-.0329 (.03)
Bank Size	.0019 (.01)	-.1529 (.06)**	.0041 (.01)	-.1485 (.06)**	.0734 (.07)	.8906 (.45)*	.0634 (.07)	.8475 (.45)*	-.7790 (.10)***	-3.572 (.55)***	-.7791 (.10)***	-3.578 (.55)***
Operational Efficiency	-.0063 (.00)***	-.0087 (.00)**	-.0063 (.00)***	-.0087 (.00)***	.0002 (.00)	.0042 (.01)	.0003 (.01)	.0041 (.01)	-.0107 (.01)*	-.0033 (.01)	-.0107 (.00)*	-.0033 (.01)
Foreign Ownership	.0152 (.04)	-.0172 (.04)	.0112 (.04)	-.0181 (.04)	-.3853 (.25)	-.0339 (.26)	-.3731 (.25)	-.0244 (.26)	.3631 (.20)*	.0847 (.21)	.3609 (.20)*	.0812 (.22)
GDP Growth Rate	.0128 (.01)	.0187 (.01)***	.0071 (.00)	.0163 (.01)*	-.1502 (.05)***	-.1719 (.06)***	-.1292 (.05)**	-.1457 (.05)***	-.0496 (.02)*	.0013 (.03)	-.0477 (.03)	.0044 (.03)
Inflation Rate	-.0146 (.00)***	-.0082 (.00)	-.0135 (.00)***	-.0077 (.01)	.1221 (.04)***	.1407 (.04)***	.1145 (.04)***	.1323 (.05)***	-.1618 (.03)***	-.1366 (.04)***	-.1618 (.03)***	-.1371 (.04)***
Constant	1.893 (.18) ***	-46.31 (11.17) ***	1.9339 (.18) ***	-44.98 (11.27) ***	-.7999 (1.22)	235.098 (65.47) ***	-.8943 (1.22)	222.4522 (64.64) ***	13.2479 (1.88) ***	-417.01 (76.86) ***	13.231 (1.89) ***	-416.27 (77.00) ***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	2121	2121	2121	2121
No. of Banks		174		174		176		176		176		176
F-test (P-value)	103.96 (0.00)	122.58 (0.00)	98.37 (0.00)	115.66 (0.00)	91.82 (0.00)	52.33 (0.00)	86.08 (0.00)	50.51 (0.00)	90.05 (0.00)	22.01 (0.00)	85.68 (0.00)	21.12 (0.00)
R^2	0.5454	0.4737	0.5478	0.4741	0.7447	0.6711	0.7454	0.6724	0.6716	0.4888	0.6716	0.4889

This table exhibits regression outputs of both dynamic OLS and dynamic fixed effect to ensure the accuracy of the GMM regression outputs in determining the nexus between, activity restrictions, competition and bank stability during crisis period. Because, Roodman (2006) argued the coefficient of the lagged dependent variable of two-step system GMM model lies in between the coefficient of the lagged dependent variables of dynamic OLS and dynamic fixed effect. The dependent variable is natural logarithm of Z-score in models 1-4, NPL ratio in models 5-8, and equity ratio in models 9-12, as bank stability measure. The effects of activity restrictions on the competition-stability nexus during crisis are presented in models 1-2, 5-6, and 9-10 where competition is measured by H-statistic. The study use triple terms interaction of activity restrictions index, H-statistic and crisis dummy to show the mediating effect of activity restrictions on competition-stability nexus during crisis period in models 3-4, 7-8, and 11-12. This study control a number of bank level variables such as ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure managers' operational efficiency, and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicate that the independent variables necessarily explains the dependent variables in the specifications. The robust standard errors are reported in the parenthesis

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix X: The effect of deposit insurance on the relationship between bank competition and bank stability during crisis period using dynamic OLS and dynamic fixed effect

Dep. Variable	*lnZ*-score				NPL ratio				Equity ratio			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.6696 (.02)***	.4784 (.02)***	.6697 (.02)***	.4773 (.02)***	.6475 (.04)***	.5537 (.04)***	.6474 (.04)***	.5537 (.04)***	.5959 (.04)***	.4243 (.05)***	.5959 (.04)***	.4243 (.05)***
H-statistic(H)	.7995 (.23)***	1.1998 (.30)***	.8076 (.23)***	1.1876 (.31)***	-5.3985 (1.55)***	-5.2638 (1.91)***	-5.4029 (1.55)***	-5.2663 (1.90)***	.2532 (.87)	1.0751 (.92)	.2555 (.86)	1.0643 (.92)
H^2	-.5972 (.19)***	-.9227 (.21)***	-.5839 (.19)***	-.8728 (.22)***	3.3286 (1.36)**	3.1864 (1.67)*	3.3266 (1.37)**	3.2594 (1.71)*	-.4618 (.73)	-.8515 (.85)	-.4625 (.74)	-.8546 (.86)
Crisis	-.5107 (.10)***	-.4442 (.09)***	-.4977 (.10)***	-.4115 (.09)***	2.2325 (.43)***	.7153 (.50)	2.2285 (.43)***	.7784 (.50)	-.2140 (.44)	.0478 (.37)	-.2148 (.44)	.0501 (.37)
DI*Crisis	.3139 (.12)***	.2443 (.11)**	.5081 (.20)**	.7103 (.19)***	-1.9635 (.51)***	-.3035 (.56)	-2.0224 (1.16)*	.6153 (1.37)	-.0209 (.56)	-.6209 (.47)	-.0158 (.56)	-.6639 (.44)
H*DI*Crisis			-.3123 (.28)	-.7393 (.29)**			.0946 (1.52)	-1.4567 (1.80)			-.0162 (.51)	.1647 (.49)
Loan Composition	-.0019 (.00)*	.0044 (.00)**	-.0020 (.00)*	.0045 (.00)**	.0453 (.01)***	.0817 (.01)***	.0453 (.00)***	.0816 (.01)***	-.0146 (.01)*	-.0033 (.02)	-.0146 (.00)*	-.0032 (.01)
Loan Quality	-.0084 (.00)***	-.0171 (.00)***	-.0082 (.00)**	-.0168 (.01)***	.3064 (.05)***	.3995 (.07)***	.3065 (.05)***	.3997 (.07)***	.0559 (.03)*	-.0316 (.03)	.0559 (.03)*	-.0320 (.03)***
Bank Size	.0013 (.01)	-.1639 (.06)**	0.0005 (.01)***	-.1709 (.06)***	.0749 (.07)	.9506 (.46)**	.0754 (.07)	.9352 (.46)**	-.7759 (.10)***	-3.5836 (.56)***	-.7759 (.10)***	-3.589 (.55)
Operational Efficiency	-.0061 (.00)***	-.0088 (.00)***	-.0061 (.00)***	-.0087 (.00)***	.0001 (.01)	.0044 (.01)	.0001 (.01)	.0045 (.00)	-.0106 (.01)*	-.0034 (.01)	-.0106 (.01)*	-.0034 (.01)
Foreign Ownership	.0237 (.04)	-.0125 (.04)	.0230 (.04)	-.0142 (.04)	-.3193 (.26)	-.0206 (.26)	-.3191 (.26)	-.0226 (.26)	.4059 (.21)**	.1034 (.22)	.4062 (.20)*	.1005 (.22)
GDP Growth Rate	.0237 (.04)**	.0256 (.01)***	.0219 (.01)***	.0292 (.01)***	-.1451 (.05)***	-.1965 (.05)***	-.1456 (.05)***	-.1899 (.06)***	-.0136 (.03)	.0222 (.04)	-.0137 (.03)	.0232 (.04)
Inflation Rate	-.0125 (.00)**	-.0072 (.01)	-.0136 (.00)***	-.0106 (.01)*	.1408 (.04)***	.1419 (.04)***	.1412 (.04)***	.1344 (.04)***	-.1466 (.03)***	-.1262 (.04)***	-.1466 (.03)***	-.1268 (.04)***
Constant	1.7966 (.18)***	-48.89 (1.63)***	1.7938 (.18)***	-49.54 (1.66)***	-.6162 (1.22)	237.55 (6.12)***	-.6164 (1.22)	23.4737 (7.40)***	12.8297 (1.83)***	-428.49 (7.24)***	12.8306 (1.83)***	-428.09 (7.24)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	2121	2121	2121	2121
No. of Banks		174		174		176		176		176		176
F-test (P-value)	105.57 (0.000	119.90 (0.00)	98.22 (0.00)	108.16 (0.00)	94.65 (0.00)	51.31 (0.00)	89.28 (0.00)	47.59 (0.00)	89.18 (0.00)	22.11 (0.00)	83.87 (0.00)	20.78 (0.00)
R^2	0.5405	0.4694	0.5407	0.4709	0.7450	0.6703	0.7450	0.6704	0.6703	0.4891	0.6704	0.4891

This table exhibits regression outputs of both dynamic OLS and dynamic fixed effect to ensure the accuracy of the GMM regression outputs in determining the nexus between, deposit insurance, competition and bank stability during crisis period. Because, Roodman (2006) argued the coefficient of the lagged dependent variable of two step system GMM model lies in between the coefficient of the lagged dependent variables of dynamic OLS and dynamic fixed effect. The dependent variable is natural logarithm of Z-score in models 1-4, NPL ratio in models 5-8, and equity ratio in models 9-12, as bank stability measure. The effect of deposit insurance on the competition-stability nexus during crisis are presented in models 1-2, 5-6, and 9-10, where competition is measured by H-statistic. The study use triple terms interaction of deposit insurance, H-statistic and crisis to show the mediating effect of deposit insurance on the competition-stability nexus during crisis period in models 3-4, 7-8, and 11-12. This study controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicate that the independent variables necessarily explains the dependent variables in the specifications. The robust standard errors are reported in the parenthesis. ***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix Y: The effect of official supervision on the relationship between bank competition and bank stability during crisis period using both dynamic OLS and dynamic fixed effect.

Dependent variable	***lnZ*-score**				**NPL ratio**				**Equity ratio**			
Model	DOLS (1)	DFE (2)	DOLS (3)	DFE (4)	DOLS (5)	DFE (6)	DOLS (7)	DFE (8)	DOLS (9)	DFE (10)	DOLS (11)	DFE (12)
Lagged DV	.6602 (.02)***	.4801 (.02)***	.6695 (.02)***	.4812 (.02)***	.6460 (.04)***	.5536 (.04)***	.6485 (.04)***	.5556 (.05)***	.5963 (.04)***	.4246 (.05)***	.5963 (.04)***	.4245 (.05)***
H-statistic(H)	.7976 (.23)***	1.2256 (.30)***	.7291 (.23)***	1.2070 (.29)***	-5.4258 (1.56)***	-5.3392 (1.90)***	-4.9824 (1.56)***	-5.1127 (1.88)***	.2748 (.86)	1.2919 (.93)	.2446 (.87)	1.2566 (.93)
H-statistic^2	-.5846 (.19)***	-.9448 (.21)***	-.5989 (.19)***	-.9539 (.21)***	3.2461 (1.36)**	3.2650 (1.67)*	3.2436 (1.35)**	3.3439 (1.65)**	-.5267 (.73)	-1.1593 (.86)	-.5188 (.73)	-1.1623 (.86)
Crisis	-2.7574 (.61)***	-2.518 (.56)***	-2.5236 (.60)***	-2.4319 (.57)***	11.8081 (2.59)***	4.2364 (2.50)*	10.4333 (2.47)***	3.1998 (2.39)	-4.7271 (2.97)	-4.1768 (1.96)**	-4.6144 (2.97)	-4.0321 (1.95)**
SPI*Crisis	.2046 (.05)***	.1864 (.04)***	.1531 (.05)***	.1669 (.05)***	-.9081 (.21)***	- .3106 (.20)	-.6152 (.20)***	-.0818 (.19)**	.3745 (.25)	.3176 (.17)*	.3613 (.24)	.2986 (.17)*
H*SPI*Crisis			.0526 (.01)***	.0199 (.02)			-.2924 (.09)***	-.2306 (.09)***			.0175 (.04)	.0334 (.03)
Loan Composition	-.0017 (.00)	.0045 (.00)**	-.0014 (.00)	.0045 (.00)**	.0448 (.01)***	.0814 (.01)***	.0433 (.01)***	.0807 (.01)***	-.0131 (.00)*	-.0022 (.02)	-.0130 (.00)*	-.0020 (.01)
Loan Quality	-.0079 (.00)**	-.0169 (.01)***	-.0083 (.00)**	-.0169 (.01)***	.3059 (.05)***	.3994 (.07)***	.3059 (.05)***	.3993 (.07)*	.0565 (.03)*	-.0323 (.03)	.0563 (.03)*	-.0334 (.03)
Bank Size	.0028 (.01)	-.1613 (.06)**	.0051 (.01)	-.1571 (.06)**	.0675 (.07)	.9465 (.47)**	.0539 (.07)	.9039 (.46)	-.7727 (.10)***	-3.5724 (.55)***	-.7729 (.10)***	-3.5877 (.55)***
Operational Efficiency	-.0061 (.00)***	-.0088 (.00)***	-.0062 (.00)***	-.0088 (.00)***	.0000 (.01)	.0044 (.01)	.0002 (.01)	.0044 (.01)	-.0104 (.01)*	-.0034 (.01)	-.0104 (.01)*	-.0033 (.01)
Foreign Ownership	.0215 (.04)	-.0139 (.05)	.0178 (.04)	-.0148 (.04)	-.3241 (.26)	-.0153 (.26)	-.3038 (.26)	-.0055 (.26)	.3842 (.20)*	.0806 (.21)	.3801 (.20)*	.0733 (.22)
GDP Growth Rate	.0155 (.00)*	.0210 (.01)**	.0095 (.00)	.0185 (.01)*	-.1347 (.05)***	-.1865 (.05)***	-.0999 (.05)**	-.1578 (.06)***	-.0347 (.03)	-.0059 (.03)	-.0319 (.03)	-.0013 (.03)
Inflation Rate	-.0125 (.00)**	-.0075 (.01)	-.0114 (.00)**	-.0069 (.01)	.1342 (.04)***	.1437 (.04)***	.1278 (.04)**	.1367 (.04)***	-.1535 (.03)***	-.1391 (.04)***	-.1538 (.03)***	-.1399 (.04)***
Constant	1.7802 (.18)***	-47.063 (11.55) ***	1.8318 (.18)***	-45.989 (11.56) ***	-.4803 (1.22)	233.567 (65.80) ***	-.7379 (1.23)	222.485 (65.46) ***	12.8761 (1.83) ***	-412.76 (76.70) ***	12.8597 (1.83) ***	-411.95 (76.92) ***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2047	2047	2047	2047	2121	2121	2121	2121	2121	2121	2121	2121
No. of Banks		174		174		176		176		176		176
F-test (P-value)	106.92 (0.000	122.22 (0.00)	99.74 (0.00)	115.35 (0.00)	96.48 (0.00)	51.33 (0.00)	90.91 (0.00)	48.21 (0.00)	89.31 (0.00)	22.28 (0.00)	84.56 (0.00)	21.02 (0.00)
R^2	0.5432	0.4723	0.5449	0.4726	0.7452	0.6704	0.7459	0.6710	0.6708	0.4892	0.6708	0.4895

This table exhibits regression outputs of both dynamic OLS and dynamic fixed effect to ensure the accuracy of the GMM regression outputs in determining the nexus between, official supervision, competition and bank stability during crisis period. Because, Roodman (2006) argued the coefficient of the lagged dependent variable of two-step system GMM model lies in between the coefficient of the lagged dependent variables of dynamic OLS and dynamic fixed effect. The dependent variable is natural logarithm of Z-score in models 1-4, NPL ratio in models 5-8 and equity ratio in models 9-12 as bank stability measure. The effect of official supervision on the competition-stability nexus during crisis are presented in models 1-2, 5-6, and 9-10, where competition is measured by H-statistic. This study uses triple terms interaction term of supervisory power index, H-statistic and crisis to show the mediating effect of official supervision on the competition-stability nexus during crisis period in models 3-4, 7-8, and 11-12. It controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicate that the independent variables necessarily explains the dependent variables in the specifications. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix Z: The effect of capital regulation on the relationship between bank competition and bank stability during crisis period excluding the quadratic term of H-statistic

Dependent Variable	*lnZ*-score			NPL ratio			Equity Ratio		
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lagged DV	.653 (.032)***	.649 (.031)***	.649 (.031)***	.623 (.060)***	.616 (.058)***	.601 (.061)***	.517 (.066)***	.507 (.069)***	.507 (.069)***
H-statistic(H)	.253 (.109)***	.141 (.112)	.131 (.118)	-3.093 (.730)***	-2.647 (.770)***	-2.591 (.798)***	.082 (.550)	.292 (.564)	.369 (.567)
Crisis	-.315 (.077)***	-1.236 (.269)***	-1.228 (.280)***	.831 (.314)***	5.451 (1.39)***	5.289 (1.48)***	-.377 (.305)	-2.258 (1.018)**	-2.128 (1.008)**
CRI*Crisis		.168 (.045)***	.160 (.064)**		-.828 (.223)***	-.835 (.246)***		.336 (.183)*	.301 (.178)*
H*CRI*Crisis			.010 (.050)			-.023 (.083)			.068 (.062)
Loan Composition	-.009 (.002)***	-.006 (.002)**	-.006 (.002)**	.118 (.018)***	.104 (.018)***	.101 (.017)***	-.036 (.014)***	-.033 (.014)*	-.032 (.014)**
Loan Quality	-.036 (.011)***	-.033 (.011)***	-.033 (.011)***	.375 (.083)***	.380 (.084)***	.410 (.076)***	-.009 (.045)	-.011 (.045)	-.012 (.045)
Bank Size	-.031 (.031)	-.043 (.031)	-.041 (.032)	-.340 (.356)	-.246 (.345)	-.101 (.392)	-.658 (.226)***	-.741 (.237)***	-.738 (.236)***
Operational Efficiency	-.006 (.002)***	-.007 (.002)***	-.007 (.002)***	-.013 (.015)	-.007 (.015)	-.009 (.014)	.005 (.007)	.002 (.007)	.003 (.007)
Foreign Ownership	.248 (.095)***	.194 (.090)**	.196 (.091)**	-.531 (.627)	-.234 (.630)	-.323 (.578)	.634 (.348)*	.533 (.362)	.510 (.372)
GDP Growth Rate	.025 (.011)**	.018 (.011)*	.018 (.010)*	-.184 (.069)***	-.140 (.065)**	-.170 (.068)**	-.039 (.035)	-.055 (.034)	-.050 (.034)
Inflation Rate	-.003 (.006)	-.003 (.006)	-.003 (.006)	.073 (.050)	.068 (.052)	.132 (.062)**	-.061 (.035)*	-.064 (.036)*	-.065 (.036)*
Constant	2.295 (.339)***	2.360 (.336)***	2.355 (.338)***	-3.165 (2.551)	-3.587 (2.515)	-5.048 (2.663)**	12.391 (2.58)***	13.180 (2.80)***	13.100 (2.74)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observation	1927	1927	1927	2001	2001	2001	2001	2001	2001
No. of Banks	174	174	174	176	176	176	176	176	176
No. of instruments	142	142	142	142	142	142	142	142	142
Wald Test (P-value)	1509.12 (0.00)	1698.01 (0.00)	1676.05 (0.00)	957.01 (0.00)	997.63 (0.00)	952.42 (0.00)	177.71 (0.00)	169.02 (0.00)	170.41 (0.00)
AR(1) (P-value)	-6.79 (0.00)	-6.75 (0.00)	-6.75 (0.00)	-4.12 (0.00)	-4.10 (0.00)	-3.74 (0.00)	-4.08 (0.00)	-3.99 (0.00)	-3.99 (0.00)
AR(2) (P-value)	1.12 (0.264)	1.04 (0.301)	1.03 (0.304)	-0.15 (0.879)	-0.31 (0.758)	-0.29 (0.770)	-0.88 (0.380)	-0.86 (0.351)	-0.83 (0.404)
Hansen's J Test (P-value)	0.264 (0.130)	145.39 (0.154)	144.91 (0.146)	138.84 (0.282)	136.85 (0.301)	141.04 (0.203)	135.94 (0.343)	138.55 (0.268)	138.10 (0.256)

The table exhibits two-step system GMM regression outputs showing the effect of capital requirements on the relationship between competition and bank stability during financial crisis excluding the quadratic term of H-statistic. The dependent variable is natural logarithm of Z-score in models 1-3, NPL ratio in models 4-6, and equity ratio in models 7-9 as bank stability measure. The effect of financial crisis on bank stability is presented in models 1, 4, and 7. The effect of capital regulation on the nexus of stability and competition during crisis are presented in models 2, 5 and 8, where competition is measured by H-statistic. The study use triple terms interaction term of capital requirements index, H-statistic and crisis to show the mediating effect of capital regulation on the competition-stability nexus during financial crisis in models 3, 6, and 9. The study control a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% . This study also controls GDP growth rate and inflation rate to capture macroeconomic instability. The significant value of Wald test implies that all models are correctly specified. The robust standard errors are reported in the parenthesis. Insignificant value of AR(2) and Hansen J test indicate that second order serial correlation is absent in first difference and instrumental validity respectively.
***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix AA: The effect of activity restrictions on the relationship between bank competition and bank stability during crisis period excluding quadratic term of H-statistic

Dependent Variable	*ln*Z-score		NPL ratio		Equity ratio	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Lagged DV	.6554 (.0357)***	.6511 (.0369)***	.6408 (.0584)***	.6444 (.0584)***	.4698 (.0751)***	.4717 (.0769)***
H-statistic(H)	.2674 (.1143)**	.1991 (.1286)	-2.5572 (.7278)***	-2.1168 (.8286)**	.0956 (.5717)	.1121 (.5877)
Crisis	-.8302 (.3109)***	-.6662 (.3341)**	.6261 (.3511)*	1.9776 (.8956)**	-2.4144 (1.3961)*	-2.3262 (1.4284)*
ARI*Crisis	-.1075 (.0280)***	-.1127 (.0301)***	.0879 (.0381)**	.0867 (.0373)**	-.2668 (.1158)**	-.2619 (.1191)**
H*ARI*Crisis		.0328 (.0207)		-.2045 (.1170)*		.0234 (.0398)
Loan Composition	-.0075 (.0027)***	-.0066 (.0028)**	.1109 (.0201)***	.1054 (.0208)**	-.0411 (.0162)**	-.0396 (.0160)**
Loan Quality	-.0341 (.0118)***	-.0339 (.0121)***	.3495 (.0800)***	.3447 (.0814)**	-.0236 (.0473)	-.0229 (.0480)
Bank Size	-.0563 (.0352)	-.0518 (.0355)	-.4227 (.4029)	-.4584 (.3873)	-.8835 (.2468)***	-.8919 (.2542)***
Operational Efficiency	-.0069 (.0021)***	-.0074 (.0020)***	-.0211 (.0157)	-.0199 (.0163)	.0027 (.0071)	.0029 (.0071)
Foreign Ownership	.1439 (.1022)	.1473 (.1036)	-.7372 (.6234)	-.7330 (.6149)	.5086 (.3115)	.4990 (.3109)
GDP Growth Rate	.0067 (.0109)	.0029 (.0108)	-.1584 (.0733)**	-.1379 (.0688)**	-.0806 (.0328)**	-.0759 (.0322)**
Inflation Rate	-.0143 (.0056)***	-.0134 (.0059)**	.0861 (.0494)*	.0788 (.0486)*	-.1025 (.0373)***	-.1046 (.0381)***
Constant	2.4168 (.3801)***	2.4261 (.3712)***	-2.3720 (2.6794)	-2.2775 (2.6309)	14.6168 (3.0192)***	14.5604 (3.0206)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	142	142
Wald Test (P-value)	1456.10 (0.00)	1506.53 (0.00)	925.74 (0.00)	1018.04 (0.00)	144.58 (0.00)	147.43 (0.00)
AR(1) (P-value)	-6.76 (0.00)	-4.11 (0.00)	-4.11 (0.00)	-4.09 (0.00)	-3.81 (0.00)	-3.79 (0.00)
AR(2) (P-value)	1.04 (0.298)	-0.04 (0.966)	-0.09 (0.927)	-0.08 (0.939)	-1.03 (0.304)	-1.03 (0.302)
Hansen's J Test (P-value)	145.99 (0.146)	144.83 (0.161)	143.29 (0.168)	144.58 (0.150)	140.40 (0.232)	139.92 (0.222)

This table exhibits two-step system GMM regression outputs showing the effect of activity restrictions on the relationship between competition and bank stability during financial crisis excluding the quadratic term of H-statistic. The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6, as bank stability measures. The effect of activity restrictions on stability and competition nexus during crisis are presented in models 1, 3 and 5, where competition is measured by H-statistic. This study uses triple terms interaction term of activity restrictions index (ARI), H-statistic and crisis in order to show the mediating effect of activity restrictions on the competition-stability nexus during crisis period in models 2, 4, and 6. It controls a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. In addition, significant value of Wald test implies that all models are correctly specified. Insignificant value of AR(2) and Hansen J test indicate that second order serial correlation is absent in first difference and instrumental validity respectively . The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix AB: The effect of deposit insurance on the relationship between bank competition and stability during financial crisis eliminating quadratic term of competition.

Dependent Variable	***lnZ*-score**		**NPL ratio**		**Equity ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
LDV	.6471 (.0372)***	.6516 (.0365)***	.6268 (.0609)***	.6256 (.0605)***	.4884 (.0670)***	.4883 (.0672)***
H-statistic(H)	.2044 (.1134)*	.2528 (.1118)**	-3.1236 (.7172)***	-3.3784 (.7856)***	.1823 (.5904)	.2165 (.6015)
Crisis	-.5313 (.1093)***	-.5038 (.1103)***	1.2620 (.6397)**	1.1482 (.6086)*	-.5419 (.3618)	-.5199 (.3623)
DI*Crisis	.2873 (.1315)**	.5995 (.2261)***	-.7159 (.7447)	-2.3821 (1.3993)*	.3807 (.4905)	.2892 (.4733)
H*DI*Crisis		-.4923 (.2984)*		2.5688 (1.6578)		.3096 (.4858)
Loan composition	-.0071 (.0031)**	-.0072 (.0031)**	.1141 (.0214)***	.1149 (.0213)***	-.0394 (.0186)**	-.0382 (.0188)**
Loan quality	-.0425 (.0129)***	-.0417 (.0127)***	.3793 (.0858)***	.3785 (.0847)***	-.0296 (.0509)	-.0281 (.0512)
Bank size	-.0556 (.0362)	-.0607 (.0358)*	-.2643 (.3636)	-.2212 (.3582)	-.7363 (.2820)***	-.7493 (.2796)***
Operational efficiency	-.0049 (.0020)**	-.0044 (.0021)**	-.0143 (.0155)	-.0160 (.0160)	.0081 (.0097)	.0079 (.0095)
Foreign ownership	.1926 (.1029)*	.1877 (.1054)*	-.5128 (.6447)	-.4703 (.6393)	.6667 (.3485)**	.6619 (.3499)*
GDP growth	.0169 (.0108)	.0195 (.0109)*	-.1656 (.0649)**	-.1781 (.0646)***	-.0339 (.0360)	-.0299 (.0353)
Inflation rate	-.0093 (.0054)*	-.0117 (.0056)	.0949 (.0495)*	.1068 (.0484)**	-.0753 (.0363)**	-.0774 (.0366)**
Constant	2.3493 (.3865)***	2.3408 (.3801)***	-3.3541 (2.3913)	-3.4661 (2.3667)	12.9679 (2.9289)***	12.9643 (2.9220)***
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
Instruments	142	142	142	142	142	142
Wald test(P-value)	1558.88(0.00)	1571.09(0.00)	1109.48(0.00)	1144.91(0.00)	144.69(0.00)	145.63(0.00)
AR(1)(P-value)	-6.73(0.00)	-6.75(0.00)	-4.12(0.00)	-4.13(0.00)	-3.98(0.00)	-3.99(0.00)
AR(2)(P-value)	0.94(0.348)	0.99(0.321)	-0.13(0.898)	-0.08(0.933)	-1.03(0.304)	-1.01(0.301)
Hansen's J-test (P-value)	145.87(0.147)	147.22(0.118)	135.14(0.338)	133.48(0.352)	140.19(0.23)	139.99(0.22)

This table exhibits two-step system GMM regression outputs showing the effect of deposit insurance on the relationship between competition and bank stability during financial crisis excluding the quadratic term of H-statistic. The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6, as bank stability measure. The effect of deposit insurance on stability and competition nexus during crisis are presented in models 1, 3 and 5, where competition is measured by H-statistic. This study uses triple terms interaction term of deposit insurance (DI), H-statistic and crisis in order to show the mediating effect of deposit insurance on competition-stability nexus during financial crisis in models 2, 4, and 6. The study control a number of bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macroeconomic instability. In addition, significant value of Wald test implies that all models are correctly specified. . Insignificant value of AR(2) and Hansen J test indicate that second order serial correlation is absent in first difference and instrumental validity respectively. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix AC: The effect of official supervision on the relationship between bank competition and bank stability during financial crisis eliminating quadratic term of competition.

Dependent Variable	***ln*Z-score**		**NPL ratio**		**Equity ratio**	
Model	(1)	(2)	(3)	(4)	(5)	(6)
LDV	.6388 (.0368)***	.6312 (.0369)***	.6254 (.0608)***	.6255 (.0610)***	.4076 (.0739)***	.4060 (.0752)***
H-statistic(H)	.1924 (.1255)	.1109 (.1347)	-2.6255 (.8480)***	-2.6411 (.8516)**	.1698 (.5769)	.2817 (.5809)
Crisis	-3.4873 (.7685)***	-3.2531 (.7576)***	2.6503 (1.0128)***	5.1438 (3.7808)	-5.6947 (3.0288)*	-5.5479 (2.9857)*
SPI*Crisis	.2654 (.0630)***	.2196 (.0643)***	-.2378 (.1210)	-.2285 (.3198)	.4561 (.25167)*	.4346 (.2490)*
H*SPI*Crisis		.0417 (.0221)*		-.2029 (.1267)		.0576 (.0321)*
Loan Composition	-.0059 (.0031)*	-.0057 (.0031)*	.1207 (.0215)**	.1192 (.0219)***	-.0353 (.0153)**	-.0324 (.0149)**
Loan Quality	-.0392 (.0126)***	-.0399 (.0126)***	.3698 (.0811)***	.3726 (.0825)***	-.0181 (.0594)	-.0179 (.0580)
Bank Size	-.0530 (.0355)	-.0451 (.0363)	-.4833 (.3771)***	-.4542 (.3780)	-.7325 (.3010)**	-.7405 (.2982)**
Operational Efficiency	-.0071 (.0024)***	-.0078 (.0026)***	-.0107 (.0169)	-.0108 (.0167)	.0082 (.0096)	.0086 (.0097)
Foreign Ownership	.1853 (.0920)**	.1843 (.0951)**	-.6638 (.6123)	-.6252 (.6054)	.6243 (.3087)**	.5836 (.3120)*
GDP Growth Rate	.0160 (.0114)	.0107 (.0116)	-.1427 (.0637)**	-.1351 (.0635)**	-.0441 (.0415)	-.0329 (.0412)
Inflation Rate	-.0079 (.0065)	-.0059 (.0066)	.0721 (.0531)	.0756 (.0515)	-.0998 (.0397)***	-.1026 (.0397)***
Constant	2.2863 (.3859)***	2.3304 (.3783)***	-3.0227 (2.7468)	-3.1405 (2.7536)	13.8153 (3.2585)***	13.7073 (3.1829)**
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	1927	1927	2001	2001	2001	2001
No. of Banks	174	174	176	176	176	176
No. of Instruments	142	142	142	142	142	142
Wald Test (P-value)	1567.89 (0.00)	1501.75 (0.00)	1014.41 (0.00)	1043.99 (0.00)	140.03 (0.00)	154.29 (0.00)
AR(1) (P-value)	-6.67 (0.00)	-6.63 (0.00)	-4.10 (0.00)	-4.10 (0.00)	-3.60 (0.00)	-3.68 (0.00)
AR(2) (P-value)	0.95 (0.342)	0.87 (0.383)	-0.19 (0.846)	-0.19 (0.848)	-1.16 (0.246)	-1.13 (0.257)
Hansen's J Test (P-value)	145.96 (0.146)	144.40 (0.126)	140.77 (0.226)	139.48 (0.230)	141.26 (0.217)	141.74 (0.194)

This table exhibits two-step system GMM regression outputs showing the effect of official supervision on the relationship between competition and bank stability during financial crisis excluding the quadratic term of H-statistic. The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6, as bank stability measures. The effects of official supervision on stability and competition nexus during crisis are presented in models 1, 3 and 5, where competition is measured by H-statistic. The study use triple terms interaction term of supervisory power index (SPI), H-statistic and crisis to show the mediating effect of official supervision on competition-stability nexus during financial crisis in models 2, 4, and 6. This study controls a number of bank level variables such as ratio of net loan to total assets to capture assets composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50% .It also controls GDP growth rate and inflation rate to capture macroeconomic instability. Besides, significant value of Wald test implies that all models are correctly specified. Insignificant value of AR(2) and Hansen J test indicate that second order serial correlation is absent in first difference and instrumental validity respectively. The robust standard errors are reported in the parenthesis.

***, ** and * indicates the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix AD: The effect of bank capital requirements on the relationship between bank competition and bank stability during crisis period using fixed effect and OLS.

Dependent Variable	***InZ*-score**		**NPL ratio**		**Equity Ratio**	
Model	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)
H-statistic(H)	1.7917 (.3602)***	2.4468 (.4885)***	-13.6697 (2.7466)***	-12.0046 (3.1665)***	.3134 (1.3685)	2.1796 (1.2898)*
H-statistic^2	-1.8324 (.2854)***	-2.0855 (.3862)***	9.1889 (2.3777)***	7.3791 (2.7933)***	-.2278 (1.1699)	-1.5507 (1.1831)
Crisis	-.5804 (.2344)**	-.3434 (.2686)	5.8726 (1.5526)***	-1.5041 (1.8776)	-2.6019 (1.4232)*	1.2340 (1.1252)
CRI*Crisis	.0306 (.0605)	.0958 (.0670)	-1.2208 (.2360)***	-.0844 (.2779)	.4672 (.2637)*	.2784 (.1779)
H*CRI*Crisis	.1055 (.0562)*	.0735 (.0671)	-.2535 (.0926)***	-.0612 (.1063)	.0261 (.1143)	.0647 (.0841)
Loan Composition	-.0039 (.0016)**	.0129 (.0038)***	.04734 (.0135)***	.0600 (.0301)**	-.0471 (.0099)***	-.0096 (.0317)
Loan Quality	-.0351 (.0066)***	-.0310 (.0111)***	.7685 (.0746)***	.6865 (.1180)***	.0134 (.0374)	-.1098 (.0714)
Bank Size	.0289 (.0162)*	-.1922 (.0972)**	-.0887 (.1111)	-.4968 (.8431)	-2.1985 (.1184)***	-6.2307 (.9097)***
Operational Efficiency	-.0081 (.0008)***	-.0065 (.0014)***	.0173 (.0083)**	.0108 (.0081)	-.0227 (.0068)***	-.0058 (.0064)
Foreign Ownership	.0018 (.0573)	-.0573 (.0469)	.1259 (.3870)	.3059 (.3035)	.3211 (.3103)	-.0368 (.2356)
GDP Growth Rate	.0187 (.0109)*	.0526 (.0124)***	-.2075 (.0785)***	-.2617 (.0705)***	-.0908 (.0497)*	.0756 (.0507)
Inflation Rate	-.0095 (.0052)*	.0108 (.0056)*	.0859 (.0630)	.0519 (.0636)	-.2311 (.0389)***	-.1265 (.0439)***
Constant	3.8083 (.2258)***	-99.2051 (18.145)****	5.7108 (1.853)***	346.9596 (120.768)***	33.9755 (1.3887)***	-729.2862 (120.8223)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	2292	2292	1936	1936	2121	2121
No. of Banks	177	177		174		176
F-test (P-value)	22.37 (0.00)	17.22 (0.00)	33.46 (0.00)	11.39 (0.00)	38.46 (0.00)	6.29 (0.00)
R^2	0.1945	0.2661	0.4836	0.4586	0.2704	0.2315
Hausman Test (P-value)		121.91 (0.00)		51.41 (0.00)		270.86 (0.00)

This table exhibits static OLS and Fixed effect regression outputs showing the effect of capital requirements on the relationship between competition and bank stability during financial crisis. The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6 as bank stability measure, where OLS estimates are presented in the models 1,3 and 4, and Fixed effect estimates are presented in models 2, 4 and 6. Here, this table shows firstly the effect financial crisis on competition-stability nexus, secondly it shows effect of capital requirement on the nexus during financial crisis with the interaction term of capital requirement index (CRI) and crisis dummy. Finally, it shows the effect of capital requirement through the channel of competition during financial crisis using a triple terms interaction term of capital requirement index (CRI), H-statistic and crisis dummy. This study controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macro-economic instability. The value of Hausman test is reported to ensure that fixed effect is present in the models. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicate that the independent variables necessarily explains the dependent variables in the specifications. The robust standard errors are reported in the parenthesis.

***, ** and * indicate the coefficient are significant at 1%, 5 % and 10 % significantly.

Appendix AE: The effect of activity restrictions on the relationship between bank competition and bank stability during financial crisis using OLS and fixed effect

Dependent Variable	***lnZ*-score**		**NPL ratio**		**Equity ratio**	
Model	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)
H-statistic(H)	1.7466 (.3579)***	2.4563 (.4930)***	-15.5531 (2.8199)***	-13.7482 (3.3469)***	-.3327 (1.3586)	2.1639 (1.2991)*
H^2	-1.8254 (.2834)***	-2.1012 (.3884)***	10.4634 (2.4663)***	8.7532 (2.9798)***	.2715 (1.1692)	-1.5713 (1.1848)
Crisis	.8934 (.2939)***	.8287 (.3309)**	-.5751 (.9586)	-.0796 (.9745)	6.6250 (2.0408)***	1.2626 (1.6068)
ARI*Crisis	-.1282 (.0256)***	-.0728 (.0298)**	.0311 (.0467)	.0647 (.0387)*	-.6179 (.1635)***	-.1404 (.1315)
H*ARI*Crisis	.0684 (.0217)***	-.0191 (.0260)	-.0129 (.1220)	-.1081 (.1242)	.0216 (.0584)	.0154 (.0467)
Loan Composition	-.0039 (.0016)**	.0127 (.0037)**	.0592 (.0131)***	.0652 (.0266)**	-.0490 (.0099)***	-.0083 (.0318)
Loan Quality	-.0351 (.0066)***	-.0309 (.0112)**	.7834 (.0727)***	.7024 (.1153)***	.0123 (.0374)	-.1097 (.0716)
Bank Size	.0319 (.0160)**	-.1821 (.0971)*	-.1125 (.1092)	-.3142 (.7803)	-2.1927 (.1178)***	-6.1974 (.9077)***
Operational Efficiency	-.0081 (.0009)***	-.0064 (.0014)***	.0175 (.0078)**	.0160 (.0084)**	-.0225 (.0067)***	-.0059 (.0064)
Foreign Ownership	-.0031 (.0572)	-.0603 (.0471)	.1147 (.3697)	.4728 (.2716)*	.2956 (.3100)	-.0666 (.2355)
GDP Growth Rate	.0089 (.0109)	.0449 (.0130)***	-.2396 (.0694)***	-.2134 (.0612)***	-.1379 (.0498)***	.0435 (.0507)
Inflation Rate	-.0143 (.0054)***	.0077 (.0059)	.0767 (.0605)	.0643 (.0576)	-.2633 (.0393)***	-.1312 (.0444)***
Constant	3.8885 (.2268)***	-96.9561 (18.0277)***	5.7396 (1.8139)***	266.7041 (115.863)**	34.4538 (1.4183)***	-711.8249 (120.4635)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2292	2292	2121	2121	2121	2121
No. of Banks		177		174		176
F-test	24.86 (0.00)	17.86 (0.00)	26.08 (0.00)	12.20 (0.00)	39.00 (0.00)	28.30 (0.00)
R^2	0.1992	0.2683	0.4878	0.4734	0.2743	0.2312
Hausman Test (P-value)		127.15 (0.00)		67.34 (0.00)		7.00 (0.00)

This table exhibits static OLS and Fixed effect regression outputs showing the effect of activity restrictions on the relationship between competition and bank stability during financial crisis. The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6 as bank stability measure, where OLS estimates are presented in the models 1,3 and 4, and Fixed effect estimates are presented in models 2, 4 and 6. Here, this table shows firstly the effect financial crisis on competition-stability nexus, secondly it shows effect of activity restrictions on the nexus during financial crisis with the interaction term of activity restrictions index (ARI) and crisis dummy. Finally, it shows the effect of activity restrictions through the channel of competition during crisis period using a triple terms interaction of activity restrictions index (ARI), H-statistic and crisis dummy. This study controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macro-economic instability. The value of Hausman test is reported to ensure that fixed effect is present in the models. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicate that the independent variables necessarily explains the dependent variables in the specifications. The robust standard errors are reported in the parenthesis.

***, ** and * indicate the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix AF: The effect of deposit insurance on the relationship between bank competition and stability during financial crisis using OLS and fixed effect model

Dependent Variable	*ln*Z-score		NPL ratio		Equity ratio	
Model	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)
H-statistic(H)	1.9132 (.3629)***	2.4549 (.4900)***	-13.7923 (2.5357)***	-12.3889 (3.1264)***	.0659 (1.3677)	2.0581 (1.2805)
H-statistic^2	-1.8788 (.2910)***	-2.0968 (.3871)***	8.8061 (2.3171)***	7.0806 (2.8690)**	.1076 (1.1796)	-1.3612 (1.1778)
Crisis	-.3845 (.1206)***	-.1817 (.1289)	.8506 (.5582)	-1.1387 (.6865)*	-.0162 (.6429)	.3316 (.5504)
DI*Crisis	.8164 (.2204)***	.9158 (.2646)***	-5.3268 (1.5120)***	2.1372 (1.5847)	.1167 (.8187)	.8282 (.5666)
H*DI*Crisis	-.4894 (.3117)	-1.1021 (.4097)***	6.3118 (2.1464)***	.1615 (2.2807)	.4172 (.7841)	.0106 (.6201)
Loan Composition	-.0038 (.0016)**	.0129 (.0037)***	.0620 (.0124)***	.0743 (.0250)***	-.0493 (.0099)***	-.0091 (.0317)
Loan Quality	-.0345 (.0065)***	-.0308 (.0112)***	.7968 (.0669)***	.7064 (.1021)***	.0138 (.0372)	-.1083 (.0717)
Bank Size	.0269 (.0161)*	-.1924 (.0970)***	-.1811 (.1063)*	-.4039 (.7497)	-2.1952 (.1182)***	-6.2121 (.9102)***
Operational Efficiency	-.0079 (.0008)***	-.0064 (.0014)**	.0173 (.0066)***	.0131 (.0069)*	-.0224 (.0067)***	-.0061 (.0064)
Foreign Ownership	.0029 (.0573)	-.0587 (.0475)	.12055 (.3545)	.4736 (.2643)*	.3934 (.3110)	-.0361 (.2381)
GDP Growth Rate	.0214 (.0108)***	.0525 (.0118)***	-.2345 (.0664)***	-.2985 (.0706)***	-.0717 (.0521)	.0735 (.0465)
Inflation Rate	-.0177 (.0053)***	.0032 (.0063)	.0675 (.0507)	-.0422 (.0486)	-.2321 (.0391)***	-.1155 (.0429)***
Constant	3.7792 (.2222)***	-97.6628 (18.1817)***	5.7591 (1.7322)***	258.338 (108.5492)**	33.7906 (1.3894)***	- 729.4171 (118.413)****
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2292	2292	2330	2330	2121	2121
No. of Banks		177		177		176
F-test (P-value)	25.27 (0.00)	18.27 (0.00)	31.51 (0.00)	12.72 (0.00)	38.51 (0.00)	6.44 (0.00)
R^2	0.1961	0.2693	0.4731	0.4415	0.2692	0.2313
Hausman Test (P-value)		115.03 (0.00)		72.83 (0.00)		271.35 (0.00)

This table exhibits static OLS and Fixed effect regression outputs showing the effect of deposit insurance on the relationship between competition and bank stability during financial crisis. The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6 as bank stability measure, where OLS estimates are presented in the models 1,3 and 4, and Fixed effect estimates are presented in models 2, 4 and 6. Here, this table shows firstly the effect financial crisis on competition-stability nexus, secondly it shows effect of deposit insurance on the nexus during financial crisis with the interaction term of deposit insurance dummy(DI) and crisis dummy. Finally, it shows the effect of deposit insurance through the channel of competition during financial crisis using a triple terms interaction term of deposit insurance dummy (DI), H-statistic and crisis dummy. This study controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macro-economic instability. The value of Hausman test is reported to ensure that fixed effect is present in the models. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicate that the independent variables necessarily explains the dependent variables in the specifications. The robust standard errors are reported in the parenthesis.

***, ** and * indicate the coefficient are significant at 1%, 5 % and 10 % significantly

Appendix AG: The effect of official supervision on the relationship between bank competition and stability during financial crisis using OLS and Fixed effect

Dependent Variable	*lnZ*-score		NPL ratio		Equity ratio	
Model	OLS (1)	FE (2)	OLS (3)	FE (4)	OLS (5)	FE (6)
H-statistic(H)	1.826 (.3623)***	2.5182 (.4860)***	-13.8615 (2.5635)***	-12.8181 (3.0930)***	-.0379 (1.3630)	2.2482 (1.2802)*
H-statistic^2	-1.8711 (.2857)***	-2.1733 (.3828)***	8.9582 (2.3021)***	7.5368 (2.8308)***	.1015 (1.1733)	-1.7048 (1.1695)
Crisis	-2.8929 (.6814)***	-2.0759 (.7408)***	18.1739 (3.0517)***	1.3103 (3.0247)	-2.5509 (4.1354)	-3.4055 (2.6539)
SPI*Crisis	.2043 (.0593)***	.1796 (.0652)***	-1.6388 (.2593)***	-.1605 (.2713)	.2045 (.3496)	.2567 (.2207)
H*SPI*Crisis	.0526 (.0225)**	.0213 (.0274)	-.2253 (.1350)*	-.1171 (.1631)	.0343 (.0574)	.0421 (.0426)
Loan Composition	-.0033 (.0016)**	.0130 (.0037)***	.0589 (.0125)***	.0727 (.0252)***	-.0477 (.0098)***	-.0077 (.0316)
Loan Quality	-.0346 (.0066)***	-.0310 (.0111)***	.7952 (.0669)***	.7067 (.1022)***	.0134 (.0373)	-.1106 (.0716)
Bank Size	.0325 (.0161)**	-.1883 (.0972)*	-.2050 (.1062)*	-.3987 (.7451)	-2.1941 (.1182)***	-6.2207 (.9084)***
Operational Efficiency	-.0080 (.0008)	-.0064 (.0014)***	.0174 (.0066)***	.0129 (.0068)*	-.0223 (.0067)***	-.0059 (.0064)
Foreign Ownership	-.0009 (.0573)	-.0590 (.0474)	.1467 (.3525)	.5013 (.2643)*	.3639 (.3109)	-.0705 (.2359)
GDP Growth Rate	.0092 (.0109)	.0462 (.0125)***	-.1827 (.0646)***	-.2724 (.0689)***	-.0765 (.0526)	.0491 (.0465)
Inflation Rate	-.0134 (.0052)**	.0078 (.0057)	.0555 (.0530)	-.0136 (.0505)	-.2379 (.0391)***	-.1313 (.044)***
Constant	3.8039 (.2250)***	-96.7619 (18.1365)***	5.9068 (1.7571)***	238.7752 (107.4458)**	33.7707 (1.3812)***	-711.2362 (119.16)***
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2292	2292	2330	2330	2121	2121
No. of Banks		177		177		176
F-test (P-value)	24.43 (0.00)	18.84 (0.00)	33.36 (0.00)	12.90 (0.00)	38.59 (0.00)	6.25 (0.00)
R^2	0.1987	0.2683	0.4745	0.4402	0.2694	0.2315
Hausman Test (P-value)		98.45 (0.00)		58.60 (0.00)		259.62 (0.00)

This table exhibits static OLS and Fixed effect regression outputs showing the effect of official supervision on the relationship between competition and bank stability during financial crisis. The dependent variable is natural logarithm of Z-score in models 1-2, NPL ratio in models 3-4, and equity ratio in models 5-6 as bank stability measure, where OLS estimates are presented in the models 1,3 and 4, and Fixed effect estimates are presented in models 2, 4 and 6. Here, this table shows firstly the effect financial crisis on competition-stability nexus, secondly it shows effect of official supervision on the nexus during (SPI) and crisis dummy. Finally, it shows the effect of official supervision through the channel of competition during financial crisis using a triple terms interaction of supervisory power index (SPI), H-statistic and crisis dummy. This study controls several bank level variables including ratio of net loan to total assets to capture loan composition, ratio of loan loss reserve to gross loan to capture loan quality, log of total assets to capture banks size, cost to income ratio to measure operational efficiency and a dummy variable, with value 0 and 1, to capture foreign ownership, where a bank is considered as a foreign bank if its foreign shareholding is more than 50%. It also controls GDP growth rate and inflation rate to capture macro-economic instability. The value of Hausman Test is reported to ensure that fixed effect is present in the models. Besides, significant value of F- test implies that all models are correctly specified. The value of R-square indicate that the independent variables necessarily explains the dependent variables in the specifications. The robust standard errors are reported in the parenthesis.

***, ** and * indicate the coefficient are significant at 1%, 5 % and 10 % significantly