EXAMINING THE LIQUIDITY RISK OF ASEAN BANKS BY USING PARTIAL ADJUSTMENT MODEL

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ABSTRACT

The aim of study is to examine whether ASEAN banks actively manage their liquidity or not and how effective the liquidity risk has been managed. Two liquidity measurements have been used, the first one is net stable funding ratio (NSFR) which indicates banks' long-term liquidity buffer and the second one is the short-term liquidity ratio (SHORT). The study used annual data of 87 banks that operate in 6-ASEAN countries over 20-year period (1996-2015). Firstly, partial adjustment model is employed to examine whether ASEAN banks do have liquidity target ratios. The findings showed thatthe average estimated liquidity target for NSFR is 1.4936, and 0.6417 for SHORT. These findings confirm that ASEAN banks do have liquidity targets. Secondly, generalized method of moments (GMM) is employed to estimate the speed of adjustment of ASEAN banks towards their liquidity target ratios. The findings revealed that the adjustment speed for NSFR is 0.406 and 0.366 for SHORT, this implied that ASEAN banks adjust their NSFR quicker than their SHORT. Thirdly, GMM estimation method is used to examine the determinants of banks' liquidity target ratios. The results showed that bank size was found positively related with NSFR and negatively with SHORT. Furthermore, equity ratio and asset quality negatively affected both NSFR and SHORT, while bank growth plan, funding cost and interest rate spread were positively influencing the liquidity targets for both NSFR and SHORT. In addition, GDP was found insignificant for both NSFR and SHORT. Fourthly, ordinary least squares (OLS) regression estimation technique is used to examine the determinants of ASEAN banks' speed of adjustment toward liquidity. The results showed that the liquidity distance from target level (GAP) was positively related with the adjustment speed whereasbank size, GDP growth, and financial crises had negative impacts on the banks' speed of adjustment. Lastly, OLS regression is used to examine the impact of speed of adjustment toward liquidity on banks' profitability. The results showed that the liquidity's speed of adjustment affected banks' profitability negatively.

Keywords: ASEAN Countries; Commercial banks; NSFR; Short-term liquidity ratio; Liquidity management; Partial adjustment models: GMM; Speed of adjustment.

ABSTRAK

Kajian ini bermatlamat untuk menyelidik sama ada bank ASEAN mengurus elemen kecairan (*liquidity*) mereka secara aktif ataupun tidak dan cara bank tersebut menangani risiko kecairan dengan berkesan. Dua ukuran kecairan diupayakan dalam kajian ini. Ukuran yang pertama ialah nisbah dana stabil bersih (NSFR) yang memperlihatkan penimbal kecairan jangka panjang bank dan ukuran yang kedua ialah nisbah kecairan jangka pendek (SHORT). Kajian ini menggunakan data tahunan bagi tempoh dua puluh tahun (1996-2015) untuk sejumlah 87 bank yang beroperasi di enam negara ASEAN. Pertama sekali, model pelarasan separa diupayakan untuk menyelidik sama ada bank ASEAN mempunyai nisbah sasaran kecairan ataupun tidak. Dapatan menunjukkan bahawa sasaran kecairan yang dianggarkan secara purata untuk NSFR ialah 1.4936 dan 0.6417 untuk SHORT. Dapatan ini mengesahkan bahawa bank ASEAN mempunyai sasaran kecairan. Kajian kemudiannya menggunakan kaedah momen teritlak (GMM) untuk menganggarkan kelajuan pelarasan bank ASEAN bagi nisbah sasaran kecairan mereka. Dapatan memaparkan bahawa kelajuan pelarasan NSFR ialah 0.406 dan kelajuan pelarasan SHORT pula ialah 0.366. Hal ini menunjukkan bahawa bank ASEAN menyelaraskan NSFR mereka lebih cepat berbanding SHORT. Seterusnya, kaedah anggaran GMM digunakan untuk meneliti penentuan nisbab sasaran kecairan bank. Dapatan memperlihatkan bahawa saiz bank didapati berkait secara positif dengan NSFR dan berkait secara negatif dengan SHORT. Selain itu, nisbah ekuiti dan kualiti asest mempengaruhi secara negatif kedua-dua NSFR dan SHORT, manakala rancangan pembangunan bank, kos dana, dan rebakan kadar faedah mempengaruhi secara positif sasaran kecairan untuk NSFR dan SHORT. GDP juga didapati tidak signifikan untuk kedua-dua NSFR dan SHORT. Teknik anggaran regresi kuasa dua terkecil biasa (OLS) pula digunakan untuk mengkaji penentu kelajuan pelarasan kecairan bagi bank ASEAN. Dapatan menunjukkan bahawa jarak kecairan daripada tahap sasaran (GAP) berkait secara positif dengan kelajuan pelarasan manakala saiz bank, pertumbuhan GDP, dan krisis kewangan memberikan impak yang negatif terhadap kelajuan pelarasan bank. Akhir sekali, regresi OLS digunakan untuk meneliti impak kelajuan pelarasan kecairan terhadap keuntungan bank. Dapatan memaparkan bahawa kelajuan pelarasan kecairan mempengaruhi keuntungan bank secara negatif.

Kata kunci: Negara ASEAN; bank perdagangan; NSFR; nisbah kecairan jangka pendek; pengurusan kecairan; model pelarasan separa; GMM; Kelajuan pelarasan

Dedicated to my wonderful mother who could not see this thesis completed. There's nothing that I value more than your love, the world classifies you as dead but my heart classifies you as immortal.

May ALLAH (SWT) grant you the highest rank in paradise.

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CHAPTER ONE

INTRODUCTION

1.1 Background of Study

The recent line of banking theoretical literature emphasizes the role of banks in creating liquidity on the base of financing long-term assets with short-term liabilities. However, the heavy reliance on short-term sources of funds has exposed banks to liquidity risk that was very clear over the global financial crisis 2007-2008. Banks in many countries experienced liquidity shortages because of the turmoil of wholesale bank funding markets. The most vulnerable banks in US banking system were heavily affected to the extent that these banks found themselves unable to renew their borrowing. This segment of banks and other financial institutions have suffered big losses on their investments in the subprime market that leads to illiquidity and which necessitated government support (Acharya & Merrouche, 2013; Brunnermeier & Pedersen, 2009; Cornett, McNutt, Strahan, & Tehranian, 2011; Huang & Ratnovski, 2011; King, 2013)

In response to that crisis, the Basel Committee on Banking Supervision (BCBS) has developed the third record "Basel III" to strengthen the existing capital requirements and to cope with the illiquidity issues and funding unrests arose during the crisis. By introducing the new record, BCBS aimed to address deficiencies of Basel II that was adopted in 2004 which was structured around imposing capital requirements based on three

pillars: credit risk, market risk and operational risk. Basel III introduced a package of reforms in order to enhance the resilience of individual banks and the banking system as a whole, these reforms covered three main fields: promoting both the quality and quantity of banks' capital, imposing maximum level of leverage, and enhancing the soundness of bank liquidity management (Chan & Worth, 2011).

The liquidity requirements that were introduced in December 2010, came into effect in 2015 but will not be fully implemented before 2019, consist of two liquidity standards, the first addresses the short-term liquidity risk -over 30 days- and was named the Liquidity Coverage Ratio (LCR), and Net Stable Funding Ratio (NSFR) to deal with the issue of long-term liquidity risk (BCBS, 2010).

Although, LCR is calculated by dividing "the bank's high-quality liquid assets (HQLA) over the total net cash outflows over the next 30 calendar days". It requires financial institutions to maintain enough liquid assets to pay a cash outflow of the coming 30 days in a stress scenario (BCBS, 2013). High-quality liquid assets (HQLA) consist of two assets groups; level 1 and level 2 assets. Level 1 revers to cash & equivalent item and other assets that could be easily liquidated in a stressed. Therefore, the entire market value of this category is added to HQLA. However, lower liquid assets are considered in the second category that consists of assets that are likely to be sold at nearly full value, only 85 percent of this category is added to the HQLA. Likewise, the liquid assets that were encumbered by third-party or used as collateral are excluded from HQLA. The denominator "Total net cash outflows" is calculated by subtracting projected inflows over the next 30 days (or 75

percent of outflow, whichever is lesser) from projected outflows over the next 30 days. That is "Total net cash outflows". Hence the degree of reliance on projected inflows to fund projected outflows is limited to only 75 percent, thus LCR forces the banking institutions to maintain liquid asset not less than 25% of their projected outflows (BCBS, 2013; Hartlage, 2012).

The second standard "net stable funding ratio (NSFR)" is calculated by dividing "the available stable funding (ASF) over the required stable funding (RSF). The aim of Basel committee for the introduction of NSFR is to induce financial institutions to finance their businesses through stable, longer-term sources of financing and to hold fewer illiquid assets. Therefore, holding more liquid assets and unencumbered assets that are not used as collateral will prompt banks soundness and resilience during tough times Though that would reduce interest income. On the flip side of the coin, holding more longer-term liabilities would push up interest expenses. Consequently, banks' net interest margins (NIM) as well as profitability would go down. (BCBS, 2014; Hartlage, 2012; Hong, Huang, & Wu, 2014; King, 2013).

While these specific policy prescriptions are new, there were always dozens of liquidity ratios developed either by bank supervisors or the banks themselves in a similar spirit to proposed LCR and NSFR. For example, DeYoung and Jang (2016) highlighted that the American Uniform Bank Performance Reports (UBPRs) includes three types of liquidity ratios to assess short term liquidity risk as LCR almost does. Namely; (short-term investments to short-term non-core funds; short-term assets to short-term liabilities; net

short-term liabilities to assets). On the other hand, UBPR currently includes two ratios that assess bank funding risk in line with the proposed NSFR objectives, namely; "net loans and leases to deposits; net loans and leases to core deposits".

In the literature, several studies have focused on the proposed regulatory requirements of Basel III, for instance, King (2013) assessed the impact of the proposed NSFR on banks' net interest margins, Dietrich, Hess, and Wanzenried (2014) and Gobat, Yanase, and Maloney (2014) analyzed NSFR's cost-benefit and its impact on banks. Cornett et al. (2011) studied how US banks managed their liquidity during the crisis and how the credit supply was affected. Silva (2016) examined the impact of the coordinated funding liquidity policies among commercial banks on the stability of financial system. Vazquez and Federico (2015) analyzed bank funding structures in the period prior to 2008 crisis and their implications on the stability of US and Europe financial systems. Bonfim and Kim (2013) examined if there is herding for bank liquidity risk, Distinguin, Roulet, and Tarazi (2013) focused on the relationship between Bank regulatory capital and liquidity. Chen, Chou, Chang, and Fang (2015) assessed the impact of excess lending on NSFR and liquidity creation.

Majority of the above-mentioned studies are done in US and Europe which are not applicable to other regions. Thus, there is a need to conduct more studies on the Asian emerging economies whose financial systems differ from US financial system in many ways. First, financial sectors in Asian emerging countries are smaller compared to US and European countries or even the advanced Asian countries. Furthermore, banks play the

main role in Asian financial sectors with small equity and bond markets unlike US where equity and bond markets dominate the financial sector. Additionally, Asian banks focus more on the traditional banking activities and relying less on investing in interbank or derivatives markets in contrast with US banks that are heavily involving in these markets (Allen, Chui, & Maddaloni, 2004; Walsh, 2014). These differences have been reflected on the structure of Asian banks' balance sheets which seem to be simpler and stronger with less complex securities.

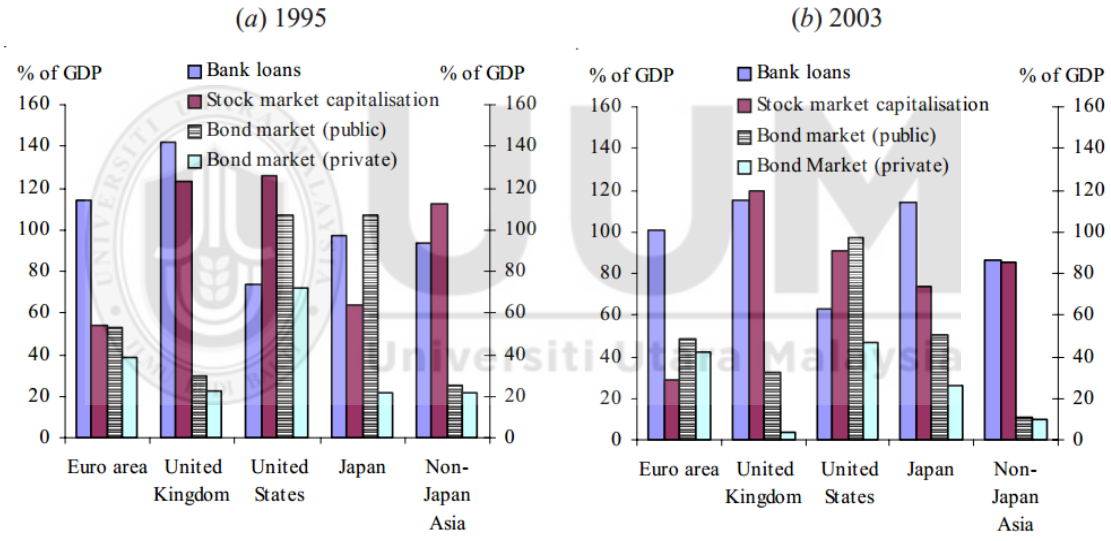

Figure 1. 1
Size of the Financial Markets by Country/region
Source: (Allen et al., 2004)

When it comes to financial sector, ASEAN countries in turn seem to be more distinguished than other regions across the world, they have experienced difficult times during the Asian financial crisis in 1997 which prompted them to carry out some important structural banking reforms that include restructuring bank sectors and overhauling regulatory and

supervisory systems (Burton, 2007) (more details in chapter two). These reforms have been reflected when the global financial crisis occurred in 2008 where ASEAN banks were less affected than the regions such as Europe as showed by (Ötker-Robe et al., 2010). Furthermore, based on a study done by Gobat, Yanase, and Maloney (2014), the ASEAN countries experience a good record in terms of the NSFR as shown in figure 1.2 below.

Even though, the figure shows that ASEAN countries maintain good liquidity management; the concern is about how active effective are the ASEAN banks in terms of managing their liquidity. In other words, what is the speed of adjustment of ASEAN banks toward their target ratios? Accordingly, this study aims to study ASEAN bank liquidity management and explores how ASEAN banks have managed their liquidity risk and what are the determinants of liquidity and the speed of adjustment.

Dynamic panel data estimation is used in this study to answer the study questions by capturing the dynamic of bank liquidity risk management. This study follows DeYoung and Jang (2016) where a partial adjustment model is employed. This model allows finding the following aspects of bank liquidity management: firstly, estimating liquidity target ratio for each banking institution in each time period. Secondly, examining and estimating the factors that determine these target ratios. Thirdly, calculating the liquidity adjustment speed for each bank in each time period. Lastly, examining the determinant of these speeds of adjustment. After getting bank specific speed of adjustment, the impact of these speed on bank's profitability is examined.

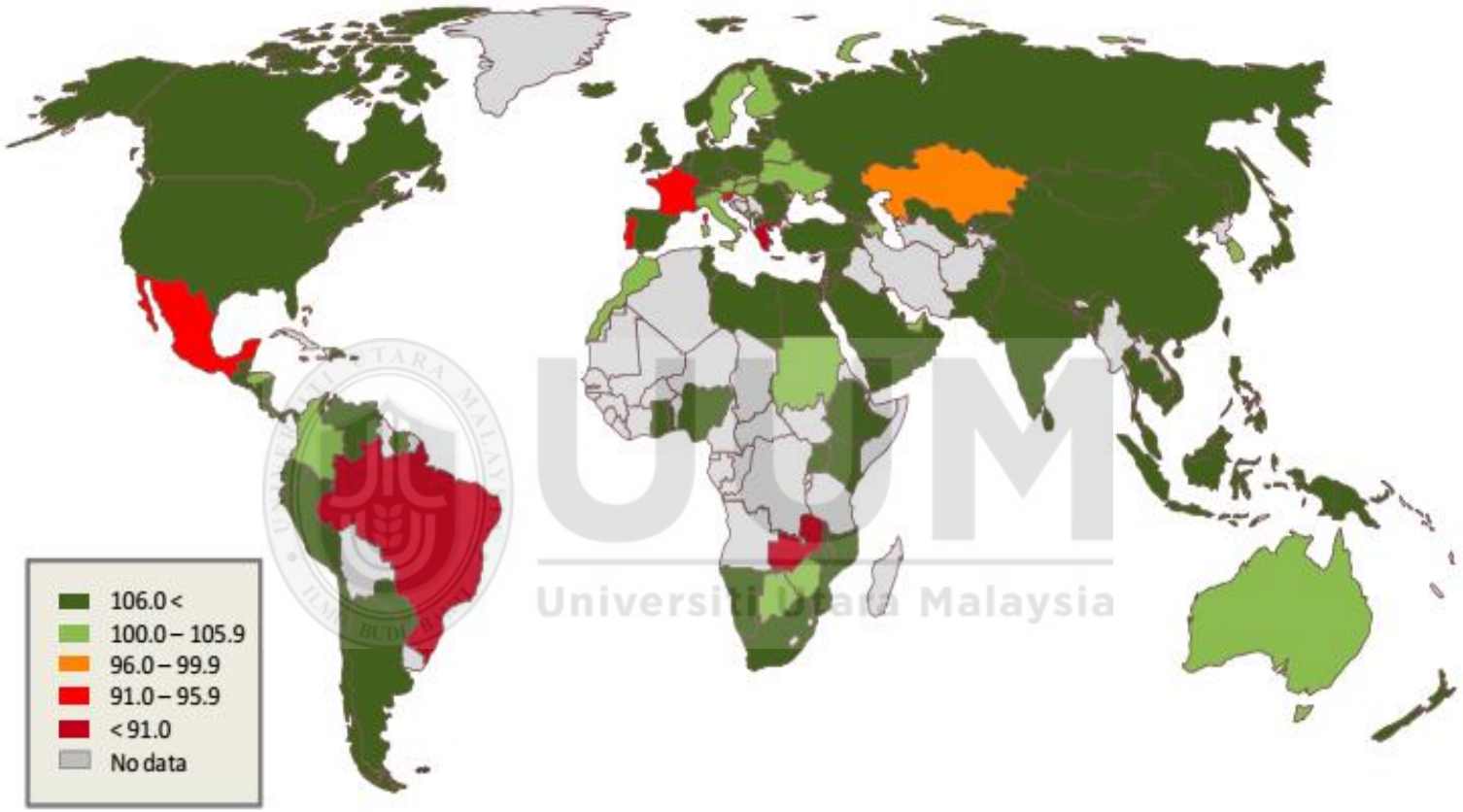

Figure 1. 2
Global Map of Un-Weighted NSFR Average by Country
Source: (Gobat et al., 2014)

1.2 Problem Statement

The global financial crisis 2007-2008 sparked controversy over the liquidity risk challenges faced by financial institutions/markets. These challenges could damage the proper functioning of banking sector in particular and financial market in general, causing a huge damage for the entire real economy. The liquidity crisis was on degree of length and enough severity that leads to huge damage in the economic sectors, resulting in the failure of key businesses, consumer wealth to go down by trillions of US dollars, and economic growth to slow down causing another great recession.

Prior to the crisis, the main concern of bank managers and supervisors is the bank capital adequacy as reflected in Basel II which did not include any liquidity requirements. Accordingly, there was an urgent need to make a substantial reassessment of banking industry and review its regulatory framework. In response to that, Basel Committee introduced in year 2010 Basel III which includes liquidity requirements that were adopted to be implemented consistently across jurisdictions for the first time. In the literature, several studies have focused on the proposed regulatory requirements of Basel III (King, 2013; Dietrich, Hess, & Wanzenried 2014; Gobat, Yanase, & Maloney 2014; Cornett et al. 2011; Silva, 2016; Vazquez & Federico, 2015; Bonfim & Kim, 2013; Distinguin, Roulet, & Tarazi, 2013; Chen, Chou, Chang, & Fang, 2015) Besides that, a wide line of literature focuses on the determinants of liquidity holdings such as (Angora & Roulet, 2011; Bonner, Lelyveld, & Zymek, 2014; Cucinelli, 2013; Delechat, Henao, Muthoora, & Vtyurina, 2012; Gregory & Hambusch, 2015; Hackethal, Rauch, Steffen, & Tyrell, 2010; Roman & Sargu, 2015; Singh & Sharma, 2016; Vodová, 2011).

Even though after global financial crisis and introducing Basel III several studies came up, the major concerns of these studies were to assess the expected effects of implementing NSFR and the determinants of bank liquidity holdings, and mainly focus on the US and Europe banks. Therefore, there is a gap in terms of examining how effective are banks regarding managing their liquidity risk. In other words, did banks have liquidity targets and how fast they adjust their liquidity buffers when they were moved away from their targets. The answers of such questions are in need to help in better understanding of bank liquidity risk management particularly after the liquidity requirements were set by Basel III. However, achieving the high ratios of liquidity for banks is not necessarily a good indicator of good liquidity risk management, what is importance is the banks' ability to adjust quickly toward their target ratios. The only study in the literature which highlighted this issue is DeYoung & Jang (2016) study. They estimated the liquidity speed of adjustment of US commercial banks and examined its determinants on the long-term liquidity buffer namely Loans to Core Deposits (LTCD). However, DeYoung and Jang (2016) was ignoring the short-term liquidity buffers. Furthermore, their findings cannot be generalized because of it being limited to US banks that work in the most sophisticated financial system in the world. Thus, there is a need to conduct more studies on the Asian emerging economies whose financial systems differ from US financial system in many ways.

1.3 Research Questions

In the light of the statement of the problem and the objectives of the study, the following questions are developed to guide the study:

1. Do ASEAN banks have liquidity targets ratios?

2. What is the ASEAN banks' adjustment speed toward the liquidity target ratios?
3. What are the relationships between ASEAN banks' liquidity targets and the economic condition, interest rate spread, banks' size, capital, assets quality, growth plan, and funding cost?
4. What are the relationships between ASEAN banks' adjustment speeds toward the liquidity target ratios and the economic condition, banks' size, distance from liquidity target ratio, the sign of liquidity gaps, and financial crises?
5. What is the relationship between ASEAN banks' adjustment speeds toward their liquidity target ratios and their profitability?

1.4 Objective of the Study

1. To investigate whether ASEAN banks have liquidity targets or not.
2. To estimate the speed of adjustment of ASEAN banks towards their liquidity target ratios.
3. To examine the relationships between ASEAN banks' liquidity targets and the economic condition, interest rate spread, banks' size, capital, assets quality, growth plan, and funding cost.
4. To examine the relationships between ASEAN banks' adjustment speeds toward the liquidity target ratios and the economic condition, banks' size, distance from liquidity target ratio, the sign of liquidity gaps, and financial crises.
5. To examine the relationship between ASEAN banks' adjustment speeds toward their liquidity target ratios and their profitability.

1.5 Significance of the Study

The 2007–08 financial crisis has raised the issue of the importance of understanding the challenges posed by bank liquidity risk management. It highlighted the importance of liquidity for the adequate functioning of financial markets and banking sectors. During the crisis, banks were not able to do their functions smoothly and number of banks cannot survive particularly in the US context. The crisis revealed the lack of either liquidity risk models or the forecasting models in banking sector. This study contributes to the wide literature of bank liquidity, by providing cross-country evidence namely six-ASEAN countries. Importantly, this study makes a valuable contribution to the banking literature by estimating the speed of adjustment toward liquidity targets which is still largely untouched area of research.

This study also enriches the literature by providing empirical evidence about the factors that affect the speed of adjustment toward liquidity targets among banks and how the speed of adjustment is influencing the banks' profitability. In the literature, this gap has been ignored except for one study done by DeYoung and Jang (2016) in the US context.

The findings of this study might be of interest for regulators in one hand, and for the policy makers in ASEAN countries in the other hand, to better understanding of ASEAN banks behavior of liquidity management. This means that the policy makers in ASEAN countries could be able to predict how banks will behave in the future. For example, policy makers in the ASEAN countries could get benefits from the findings of this study, especially after "Kuala Lumpur Declaration on ASEAN 2025" and the enforcement of the ASEAN

Economic Community (AEC) starting from December 31, 2015 that aims to enhance the integration of the region's economies, financial sectors, and in particular banking sectors which were be given special attention of the authorities who have announced the ASEAN Banking Integration Framework (ABIF) to achieve this objective (Almekinders, Fukuda, Mourmouras, Zhou, & Zhou, 2015; Isa, Choong, Fie, & Rashid, 2016).

The findings of this study might also be also of interest for researchers and bankers who pay a more attention on the liquidity risk, and how banks can manage their liquidity effectively by looking at the determinants of liquidity and the speed of adjustment determinants.

1.6 Scope of the Study

The study uses annual secondary data from 1996 to 2015. The sample of study consists of 87 commercial banks operate in six ASEAN countries (Singapore, Malaysia, Thailand, Indonesia, Vietnam, and Philippine). Bank level data is obtained from Thomson Reuters' database "DataStream" which provides data of only six countries out of ten ASEAN countries. Therefore, the study is limited to these countries, and limited to banks whose data is available by DataStream. Country level data is obtained from World Bank website. In this study, STATA 14 Program is used to achieve the study objectives where the Generalized Method of Moments (GMM) and the Ordinary Least Squares (OLS) are employed.

1.7 Organization of the Study

The study comprises of five chapters, chapter one is the introduction in which the background of study, the problem statement, the study's questions and objectives, its scope, and its significant were presented. The second chapter provides a background about banking sector and bank liquidity risk, as well as an overview about ASEAN economies. Chapter two further offers a critical review of bank liquidity literature. The third chapter presents the research design and methods whereas the empirical method of the study is explained, along with brief definitions of the variables and their measurements, the hypotheses development and theoretical framework, data collection and sources of the data. Chapter four discusses the empirical findings of the study and lastly, chapter five provides conclusion to the study which highlights the implications of the study, its limitations, and the recommendations for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Over the last century, the financial services industry has become more developed, varied and complex, which leads to new functions and challenges for the financial institutions. In turn, liquidity risk management has rapidly evolved and has drawn growing attention from management and regulators. It becomes a key issue in the financial services industry, according to Matz and Neu (2007), the element of liquidity crunch was present in the main crisis over the nineteenth and the turn of the millennium; Asian and Russian crises, LTCM's downfall (a large hedge fund management firm was called Long-Term Capital Management L.P.), and some other cases in the other economic sectors. Lastly, the global financial crisis has risen the importance of soundness liquidity management and revealed how dangerous liquidity crunch is.

This chapter provides an overview on the banking sector with shedding lights on it role in the financial system. This chapter also reviews the liquidity and the liquidity risk aspects and discusses the underlying theories of liquidity risk. Then empirical evidences on liquidity risk determinants are presented. In the last section, an overview on ASEAN countries and their banking sectors is presented.

2.2 Background about the Banking Sector

Traditionally, bank – as an essential ingredient of financial institutions - is known as the institution that accepts deposits and grants loans. Since the beginnings of the European Renaissance, banks have played a critical role in enhancing the economic development. Freixas and Rochet (2008) stated that banks, for centuries, has alone performed the economic functions of financial sector. However, with the massive developments of financial markets, financial system witnessed the emergence of new financial institutions and mechanisms. It starts to play an important role in the financial system without affecting the importance of banking sectors whose health have been interrelated with the economies' health as the latest financial crisis 2008 has revealed.

Financial systems consist of two wings namely financial markets and financial institutions. The main financial institutions that provide financial services are: banks, thrift institutions, insurance companies, investment companies, pension funds, finance companies, Securities brokers and dealers, and Real estate investment trusts (Saunders & Cornett, 2008). Banks are the major players in the financial system due to its roles and functions. The first function of banks is offering liquidity and payment services which can be considered as the first activity that banks have provided since their first appearance. Banks play this role through the traditional activities such as money changing, management of deposits, clearing merchants' positions. By doing this function and providing funds needed by firms, banks help corporates to growth and expand business activities which eventually enhances economic growth.

The second role of banks is to reduce search and transaction costs. Savers and investors could suffer some high costs by conducting the required research to make investment decisions whether to find the suitable choices for investing their surpluses or financing their financial needs. By engaging financial institutions such costs can be avoided which allow agent to enjoy economic gains by using financial institutions' products. Similarly, banks minimize transaction costs by minimizing the number of transaction and because of their standardized financial products (Matz & Neu, 2007; Saunders & Cornett, 2008).

Another function of banks and financial institutions represented in reducing monitoring costs. The ability of financial institutions to monitor assets is higher comparing to the individual savers. It can be said that monitoring is costly to the extent that could absorb all economic benefits. Accordingly, savers would resort to bank to invest instead doing that by themselves to avoid this type of costs. By doing this function, banks help in utilize the funds efficiently by borrowers and projects' managers.

Furthermore, banks can help in terms of overcoming the asymmetric information which could cause a large damage among investors. Due to the fact that banks have the abilities to know some details which are not available to public or to other agents. Banks also play a critical role in managing risk which has gained a growing importance in recent years. On one hand, banks offer set of diversified products help individuals to diversifying their investments. On the other hand, banks manage their own risks whether come from on-balance sheet or off-balance sheet activities.

Even though banks are doing all previous mentioned functions and play a critical role to push up the efficiency of resources allocation either for household, business sectors or on macroeconomic level which in turn helps in enhancing economic growth and development. Banks are still facing several risks which are threatening the survivals.

2.3 Liquidity Risk

Liquidity can be defined as the capacity of financial institutions to finance the expanding of assets and to fulfill their obligations as the liabilities mature (Kumar & Yadav, 2013). There are two dimensions of liquidity in banking institutions: liability liquidity and assets liquidity. The former refers to banks' ability to secure their financial needs from money market by borrowing, the later refers to the situation that bank sell some of their assets in the market to get liquidity (Kumar & Yadav, 2013). In terms of liquidity risk, it refers to the situation where banks or any institutions either financial or nonfinancial institution face difficulties to fulfill its obligations when they mature without negative effects on the financial conditions of the bank. DeYoung and Jang, 2016 defined liquidity risk at banks as "*the likelihood that the demand for cash by bank customers exceeds the bank's ready supply of cash*".

A soundness bank liquidity risk management is essential for economies and the bank itself as well. As for banks to be able to not only to avoid the high costs of getting liquidity during hard times, but also to survive. Liquidity crises could cause a huge damage for banks to the extent of collapsing as the global financial crisis has revealed. On the other flip of

coin, any disruption in the banking sector by collapsing of banks or their failure to fulfill the obligations will lead to instability for the financial system and thus, affecting the economy as a whole.

According to Saunders and Cornett (2008), both sides of balance sheet contribute in banks' liquidity risk namely the liability-side liquidity risk and the asset-side liquidity risk. The first type occurs when depositors unexpectedly withdraw their deposits immediately and not wait till these deposits' due dates. This type of risk arises particularly from institutional depositors (the whole sale deposits) who look for higher return and whose withdrawals are large to the extent that could affect bank's ability to pay them. The second type arises because of the unexpected drawing down loans commitments by clients who have line of credit. Lines of credit allow customers to get funds from banks on demand (borrowing fund by drawing down these lines of credit). Thus, to faces unexpected demand for funds, banks might borrow the required funds from money market or liquidate assets to fill funds gap.

To minimize the exposure to such risk, banks adjust the portion of balance sheet items in both sides. On the asset side, the higher portion of liquid assets (cash and equivalent, government securities and high quality short term assets) the more liquid and the less exposure to liquidity risk. On the liability side, the higher percent of core deposits and long term liabilities the lower exposure to liquidity risk. Although maintaining a large portion of liquid asset reduces liquidity risk, it has a cost represented in the low return comparing to the higher return of illiquid (long term assets). On the other side, using more capital and

long term liabilities is considered costly comparing to using short term liabilities. Accordingly, banks need to tradeoff between the costs and benefits of these choices.

Acharya (2006) differentiates between the two types of liquidity risk concerning banks. The first occurs because of the idiosyncratic -bank specific- shocks, this type is called funding liquidity. The other type caused by financial market as transaction cost of securities goes up, market prices go down and thus, banks face difficulties to liquidate assets without bearing noticeable losses or to borrow from money markets at reasonable costs, this type of risk is called market liquidity risk.

In the liquidity risk literature review, several theories have been developed. In the following section, the main underlying theories in the banking sectors are elaborated and the light would be shed to the underlying theories of banks' liquidity risk.

2.4 The Underlying Theories in the Banking Literature

2.4.1 General Banking Theories

In the banking literature, several theories are developed. Werner (2016) reviewed the literature of banking over the last century which tried to answer some questions such as: why banks exist, how do they operate and do they create money? Based on his review, there are three lines of banking literature that were dominant over the last century. First, the credit creation theory which considered as the oldest theory of banking, it was prevalent at the beginning of the twentieth century. Then, the second theory which is the fractional reserve theory that was dominant for a while before the third theory "financial

intermediation theory" came up and which is currently prevalent. In this section, these three theories are elaborated with other underlying theories related with banks.

To start with the credit creation theory, which is the oldest theory that was prevalent until the twenties of last century. It considers banks as non- financial intermediaries. It states that banks can give credit and create money from nothing either aggregately or individually; through transactions of granting loans and buying assets without the need to collect money for each transaction since these transactions do not go away from the bank in form of cash; instead, these financing transactions take the form of deposits held by the borrowers. Accordingly, banks' balance sheet as well as money supply tends to grow as a result of the increasing in banks' lending. Werner (2016) quoted the views of this theory supporters, on the top of those is Henry D. Macleod who has emphasized that the role of bank in creating credit not lending money, where bank's job is not limited to borrow from one side and to lend to the other. According to Macleod (1866) and Schumpeter (1954), banks gather some sums from a big number of customers, however, the essence of the bank' work is not to lend these sums to others, but to create double amounts of credit in form of deposits held by the borrowers who get promises from bankers to be paid at any time.

The second theory is the fractional reserve theory, Werner (2014) attributed the beginning of this theory to Alfred Marshall in the late nineteenth century. However, Marshall's arguments were not very popular at that time. By the end of the first world war, the theory started to gain more supporters among the economists who viewed that the credit creation

theory was mistaken in relation to the view of banks can individually create credit. The fractional reserve theory states that "*each bank is a financial intermediary, and the banking system collectively creates credit or money by multiplying the deposit expansion".*

According to Werner (2014) and (2016), the fractional reserve theory had been mainly pushed by Phillips (1920) who argued that what is true for banking system as a whole in the process of creating credit and money is not true for banks as individual. Later, the fractional reserve theory has gained supporting from some influential economist such like Crick (1927), Keynes (1930) and others (Werner, 2016).

The third theory is the the financial intermediation theory, this theory argues that banks are just financial intermediaries unvaried from non-bank financial intermediaries that rise funds by accepting deposits then lend these sums out. This theory has highlighted the creation of liquidity that banks are doing by lending long and borrow short. Although the domination of the financial intermediation theory has started only with the late sixties of last century, it has some root on the early literature of some economists such like John Maynard Keynes in his most influential book "General Theory", Keynes argued that there is a need to gather saving before investments to take place.

The argument of this theory has raised an important question: why do we need banks since they do not differ from the other non-bank financial institutions? And moreover, why do we need financial intermediaries in present of perfect financial markets. In the financial

markets literature, the answers of this question vary from researcher providing us a huge line of literature based on the assumptions of the intermediation theory.

The early related literature emphasized the reduction of transaction costs. Modigliani and Miller (1958) stated that the borrowers as well as depositors can use to perform their investment decisions or to get financial needs

The early related literature also has emphasized on the role of banks in decreasing transaction costs. According to Bhattacharya and Thakor (1993), among those who have highlighted the reduction of transaction costs were Benston and Smith (1976), Fama (1980), and Gurley and Shaw (1962). Another justification has been introduced by Leland and Pyle (1976) in which banks help to overcome the problem of asymmetric information. Their paper argued that financial intermediaries have the abilities to effectively assess the assets and projects, find out their qualities, aquire these assets to establish diversified portfolios, and then sell claims on these portfolios to the investors. This rationale of financial intermediaries' ability to establish diversified portfolios had given the financial mediation theory a large impetus. Leland and Pyle (1976) viewed that banks are able to get special information about borrowers at lower cost comparing to individuals.

The views of Leland & Pyle have been formalized by Diamond (1984) and Ramakrishnan and Thakor (1984), both articles highlighted the benefits of diversification as it helps to bring down the monitoring costs, while Ramakrishnan and Thakor (1984) limited their

study to non-depository financial intermediaries, Diamond (1984) dealt with depository financial intermediaries.

The second line of financial intermedation literature tried to answer why banks finance illiquid assets with short term liabilities. Bryant (1980) provided an explaintion of deposit contracts' role in which they serve investors to time their consumptions and money withdrawal. Deposits help in providing an insurance against random shocks raisied by some tiny risks that are suronding individuals income and properties which create liquidity needs for individuals leading to increasing demand of withdrawals. Deposits can play such role as they have a fixed price the issuer commits to pay where as the long term debt cannot play the same role due to the need of selling the calims of these debt contracts in the financial markets and at market prices. This indicates that nontraded instruments are serving to provide deposits with an insurance against preference shocks which raised the question of why?

Bhattacharya and Thakor (1993) answered that non-tradable deposit contracts which promise a "first come, first served" payoff offers unique economic benefits. They referred to the explaination of nontraded aspects of deposit provided by Bryant (1980), Diamond and Dybvig (1983), and Jacklin (1987) who argued that suppose there is no overall shocks influence the prices of traded debt contracts in secondary markets, non-traded instruments (deposits) would help in providing an "ex ante Pareto-superior allocation" when individual shocks could take place affecting the planed consumption and then creating financial needs. Therefor, the ideal condition for deposits is to be non traded.

Furthermore, Gorton and Pennacchi (1990) and Subrahmanyam (1991) suggested that financial intermediaries introduce liquid securities to satisify the demand of uniformed investors. Liquid securities provide almost no private information, these securities could be traded as diversified portfolios. Thus, deposit contracts provide a protection against the losses in trading illiquid instruments to those investors who suffer lack of information while this type of securities is considered as information-sensitive instruments.

Additionally, banks use short term liabilities to finance long term loans and illiquid assets. This process has been named as "maturity transformation" where banks enjoy twofold gain: the first is due to the high risk of long term assets, and the second is due to process of creating liquidity (Thakor, 1992). That gains encourage banks to maintain high maturity mismatch which positively influences the expected value but leads to higher volatility of banks' return on equity (Deshmukh, Greenbaum, & Kanatas, 1983; Niehans & Hewson, 1976). Flannery (1994) has attributed the longer maturity of loans to borrower's technologies, which characterized as longer and less liquid. The author suggested that the repricing of short-term deposits allows depositors to get payoff information. This puts banking institutions under frequent market reevaluation leading to optimal short term liabilities. On other hand, Diamond (1991) refered to the limited ablilty of deopositors to only assess bank's prospects while bank insiders earn non marketable control rents. Thus, at the time of refinancing, if banks were undervalued they could suffer "dissipative liquidation costs", this applies even to solvent banks.

Bhattacharya and Thakor (1993) also reviewed the previous banking literature and suggested that the most important type of transaction cost is the cost of asymmetric information. Then, they concluded that theories built on information-based give a more substantial interpretation. Allen and Anthony (1998) argued that although the emphasizing of intermediaries' role in minimizing transaction costs and asymmetric information is very strong, but as time is passing, financial industry has largely developed which makes such a role less relevant. Allen and Anthony (1998) viewed that intermediaries currently concentrate on two distinct functions; facilitating the transactions of risk transfer and dealing with the growing sophisticated, varied financial instruments and markets. Risk management has gained growing significance that made it among the most important activities of financial institutions. Nevertheless, the traditional financial intermediation theory has not provided sufficient explanation about this role. Moreover, the authors highlighted the participation in such activities as a very significant service provided by financial intermediaries. This participation has some costs represented in the involving in such new activities and financial markets accompanied with learning costs (how to deal with these new instruments and markets).

According to Berger and Bouwman (2009), the modern financial intermediation theory has attributed the existence of banks to the role of creating liquidity and transforming risk. While traditional financial intermediation theory focused on creating liquidity by using the items of balance sheet (using liquid liabilities to finance illiquid assets). The modern financial intermediation theory has introduced the role of creating liquidity by using off-

balance sheet items; such as loan commitments and claims comparable to liquid liabilities (Kashyap, Rajan, & Stein, 2002).

2.4.2 Risk Management and Liquidity Risk Management Theories

Turning into bank liquidity literature, Acharya and Naqvi (2012) suggested that bank liquidity tends to grow when macroeconomic risk goes up due to the shift of investors from using direct investment channels into banks deposits seeking insurance for their savings. Acharya and Naqvi (2002) added that banks gather deposits from savers and then use them to finance investment projects. Therefore, banks are subjected to unexpected withdrawals which could lead to liquidity shortfalls. These shortfalls of liquidity cause banks to suffer a panalty cost. This cost represented in the cost of getting liquidity by liquidating a share of bank's assets or borrowing from money markets. Therefore, banks set aside a specific ratio of deposits as reserves in form of cash and high quality and liquid assets and use the rest of deposits to grant loans to borrowers or invest in their projects.

Similarly, Gatev and Strahan (2006) have reached the same conclusion, they found that banks' deposits tend to increase when spreads of commercial paper market raise which lead to assets growth. Commercial paper spreads indicate that the investors' evaluation of risk, when macroeconomic risk is high the spreads on commercial paper increase, while during times of low macroeconomic risk commercial paper spreads tend to squeeze. Kowalik (2014) provided a generic model of liquidity provision in which banks that suffer liquidity shortage can choose between cash, borrowing from money market, or liquidating a share of their assets. Kowalik (2014) referred to the effect of asymmetric information that

influences the performance of money market. With symmetric information, illiquid banks find it the same whether to sell assets or to borrow from interbank market, but with the asymmetries of information, it is better for bank to borrow rather than liquidating assets due to higher cost of selling assets.

Kowalik (2014) focused on the three alternatives of dealing with different liquidity positions and credit risk whereas banks' decisions regarding the allocation of fund sources between risky assets, liquid – less risky – assets, or cash reserves. These decisions affect assets quality and create liquidity need. To deal with such situations, banks choose whether to use their cash reserves, or they could resort to interbank markets borrowing their liquidity needs or lending surplus, or banks may go to secondary markets seeking liquidity by selling assets or investing their liquidity excess by buying assets. According to Kowalik (2014), the bank liquidity literature have mainly focused on one of the two approaches mentioned above: interbank markets approach and secondary markets. Kowalik (2014) tried to link the two directions of literature to provide better understanding of bank liquidity risk management.

Liquidity risk emerges when banks do their main and traditional job, whereas the existence of banks has been mainly attributed to the joint issuance of loans and deposits as well as the interrelationships among them. Banks invest, by their nature, in range of assets that have uneven degree of liquidity. According to Vento and Ganga (2009), the large proportion of these assets are illiquid and difficult to liquidate without significant losses, whereas the liabilities are exposed to withdrawal at any time. Therefore, there are many factors that should be considered when analyzing the liquidity of banks. On one hand,

traditional financial intermediation is based on different degree of discretionary power as far as the timing of use of funds. Therefore, banks should preserve their depositors' confidence that they can withdraw their funds on demand as well as at due dates. On the other side, contemporary banking is based on more innovative financial services, which can also affect the capability of a bank to be liquid, as it has been demonstrated in year 2007 during the global financial crisis.

The banking literature distinguishes between two concepts of liquidity namely market liquidity and funding liquidity. Bonner, Lelyveld, and Zymek (2014) defined them as follows; funding liquidity means the ease of attracting money by banks and bank is deemed to have high funding liquidity when it has the ability to easily raise fund with rational costs. The ease of collecting money by selling banks' asset rather than borrowing against assets is referred as market liquidity, the easier raising funds the higher market liquidity. In case of high market liquidity, bank can sell the asset at fair price, while low market liquidity causes depress asset price.

Liquidity risk indicates the probability where bank will not be able to fulfill its obligations at some point of time. Given that the main activity of bank is to borrow short and lend long, banks are particularly exposed to liquidity risk. Saunders and Cornett, (2008) attributed bank liquidity risk to the two sides of balance sheet, asset-side liquidity risks in tandem with liabilities-side liquidity risks. The liabilities-side liquidity risk arises when banks' depositors withdraw their deposits more than the expectation. The second type of liquidity risk came from the asset-side liquidity in which borrowers may need funds so they resort

to take down their loan commitments at banks more than the expectation. These phenomena create a demand for liquidity on demand, whether because of liability withdrawals or loan commitments takedowns.

Kashyap et al. (2002) argued that the two banking functions, deposit-taking and granting loans, in a sense are two different aspects for the same function, which is to provide liquidity on demand. They emphasized the concept in which loan-commitments and demand deposits are acknowledged as an identical service. Therefore, they believe that there may be synergies between the two functions since the withdrawals of demand deposits and the takedowns of loan commitments are not positively correlated. Evan Gatev, Schuermann, and Strahan (2009) completed the model of Kashyap et al. (2002) by explaining how banks could provide a liquidity insurance to companies that need to borrow. During stress times whereas markets suffer tight liquidity, investors head to banks seeking the safety for their funds. At these times, depositing money with banks is deemed more safe than investing in financial markets. While borrowers come to banks seeking funds, investors go to banks depositing their money creating a natural liquidity hedge.

Distinguin, Roulet, and Tarazi (2013) highlighted the theoretical and empirical literature referring to a causal relationship which makes liquidity creation to be affected by bank capital. Two conflicting views has been developed, the first was introduced by Berger and Bouwman (2009) who argued that liquidity creation is impeded by the capitalization because of the impact of two factors which are the fragile financial structure and the crowding out of deposits. On one hand, there is a negative relationship between capital and

the monitoring, consequently monitoring in turn affect liquidity creation where lower monitoring decreases liquidity creation (Diamond & Rajah, 2000, 2001). On the other hand, high levels of capitalization would crowd out deposits causing liquidity creation to decrease (Gorton & Winton, 2000). On contrast, the second view states that high level of capitalization enhance banks' ability to manage risks leading to create more liquidity (Bhattacharya & Thakor, 1993; Repullo, 2004; Von Thadden, 2004). Distinguin et al. (2013) argued that higher liquidity creation exposes banks to liquidity risk in which they could find it difficult to cope with liquidity shocks.

2.4.3 The Determinants of Liquidity Buffers

In the literature several studies have examined the liquidity buffers. A recent study done by Singh and Sharma, (2016), investigated bank-specific and macroeconomic factors that determine the liquidity of Indian banks. The study used OLS, fixed effect and random effect estimates over 14 years (from 2000 to 2013) for a sample of 59 banks. They incorporated 6 bank specific determenants, namely; size of bank, profitability, funding cost, bank cabital, bank deposits, and the type of ownership. They also considered three country – specific factors, namely; GDP growth, infaltion rates and unemployment level. The result suggested that all above mentiond factors affect bank liquidty buffers exept funding cost,as a bank specific factor and unemployment as a country specific factors. Their findings revealed that bank size and GDP negatively affect bank liquidity whereas inflation, profitability, bank capital, and bank deposits level positively affect bank liquidity holds.

Silva (2016) examined whether the competitors' choices and the coordinated funding liquidity policies have effects on bank liquidity. He developed a new identification strategy in order to examine how interacted are the liquidity risk management of commercial banks by using data of 2,047 commercial banks operate in OECD countries (Organization for Economic Co-operation and Development) for period from 1999 to 2014. The results revealed that there is an interaction among banks when determining liquidity buffers and choosing liquidity choices. He suggested that banks' strategic liquidity decisions affect individually and aggregately default risk.

Another study done by Bonfim and Kim (2013) tested how European and U.S. banks manage their liquidity risk during the period covered 2002 through 2009. By using data of almost 3500 banks, they examined whether banks tend to bear high degree of liquidity risk exposure during crisis period. They used a set of bank factors as independent variable, namely; bank size, solvency, bank's profitability, bank's efficiency, and bank's specialization. They found that large, more efficient banks tend to bear high level of liquidity risk exposure, profitability was significant for some test and insignificant at others (five measures of liquidity have been considered as dependent variable), and finally bank capital was not statistically significant at all tests. Chen, Chou, Chang, and Fang (2015) investigated the effects of excess lending on bank liquidity in China over period (2006 – 2012) using 93 bank-level data. They considered some bank indicators such as lending ratio, assets quality represented by non-performing loan ratio, and the diversification. They found that excess lending leads banks to bear higher liquidity risk and heightens liquidity maturity mismatch. On the other side, bank capital was found having a negative

relationship with liquidity in some types of banks (joint-venture banks, state-owned banks and city commercial banks).

Dietrich, Hess, and Wanzenried (2014) analyzed selected factors that affect NSFR for Western European banks by using data of 921 banks covers 15-year time period (1996-2010). They calculated the NSFR over the period of study for each bank, the majority were found less than the required NSFR (100%), especially large, faster growing banks, investment banks and banks with active asset management. They found that safer and adequate banks are less exposed to liquidity risk, while faster growing banks expose highly to liquidity risk. Banks involved heavily in traditional banking activities (mainly granting loans and accepting deposits) have higher NSFR than those which involve heavily in non-traditional activities that have high ratio of non-interest income.

Another study done by Gobat, Yanase, and Maloney (2014) discussed the potential effects of introducing the NSFR by using data of over 2000 banks at the end of 2012. The sample covers 128 countries and they found that majority of banks had NSFR higher than or equal to the required ratio, their calculations revealed that larger bank had lower level of NSFR. They argued that NSFR is relatively consistent with the regulatory measure for capturing banks' funding risk.

Aspachs, Nier, and Tiesset (2005) analyzed the bank liquidity in UK, by using quarterly panel data of 57 banks cover 19-year period (1985 – 2003). Their results reveal that in presence of UK central bank's support during liquidity crisis, banks tend to have higher

exposure to liquidity risk. They found that bank liquidity is negatively related with country specific factors. In other words, banks tend to maintain higher levels of liquidity when economic growth suffers slowing, and decrease the liquidity holdings when economy grows fast. Additionally, banks were found to maintain larger liquidity holdings if short term interest rates go down and vice versa. Furthermore, bank liquidity holdings are negatively related to some bank specific factors such as loan growth and net interest margins, while bank size and profitability were found insignificant.

For the OECD countries, Bonner et al. (2014) used Generalized Methods of Moments (GMM) alongside OLS to examine the determinants of bank liquidity holdings. Using data of 7000 banks for a period of 10 years, they found that bank capital, profitability, deposits, the disclosure, the concentration, state-underwritten deposits to savings ratio, and the financial openness have impact on liquidity holdings. Interestingly, the results revealed that most of these determinants turn insignificant with the presence of bank liquidity regulations, but disclosure requirements probable complement these regulations. Moreover, they found that liquidity regulation is positively related with bank lending and interest rates. On the other side, with the presence of liquidity regulation at stress time, liquidity holdings go up while lending volumes go down. Cucinelli (2013) used OLS regression and panel data of 1080 Eurozone banks over 5-year time period 2006-2010, to examine the factors that determine bank liquidity holdings. He found that bank size, bank capitalization and bank specialization determine bank liquidity holdings. While larger banks tend to maintain less liquidity buffers, banks with high total capital ratio maintain

higher levels of liquidity buffers. Assets quality affects only short-term liquidity risk, banks that more focus on granting loans seems to have higher liquidity risk exposure.

Using a panel data of 96 commercial banks from Central America, Panama and the Dominican Republic for a five-year time period (2006-2010), Delechat, Henao, Muthoora, & Vtyurina, (2012) studied the factors that affect the ratio of liquid assets to deposits. Their results revealed that bank size, bank capital, profitability, and financial development affect banks' holdings of precautionary liquidity levels. Moreover, they found that liquidity holdings are positively related to deposit dollarization. Munteanu (2012) also studied the determinants of bank liquidity by using data of 27 Romanian commercial banks. He observed that the influence of Tier 1 Capital Ratio and Z-score mainly affect liquidity buffers over the period of 2002-2010, while the test of crisis year revealed that only Z-score affects liquidity buffers. He found also that the impaired loans indicator had a constant significant negative impact on liquidity buffers for all tests.

For 86 banks operate in CEE (Central and Eastern European) countries, Roman and Sargu (2015) examined the factors that might influence bank liquidity holdings, by using a panel data of over the period (2004-2011). Their results suggested that bank capitalization positively influences overall bank liquidity buffer, whereas assets quality negatively affects bank liquidity. Furthermore, the profitability represented by the return on equity influences bank liquidity. The same authors have Roman and Şargu (2014) have assessed a set of bank specific factors that might affect liquidity risk management in Bulgarian and Romanian

commercial banks over a period of 9 years (2003- 2011). They found that capital adequacy and assets quality affect bank liquidity holdings.

Vodová (2011) studies the Czech commercial banks' liquidity holdings, using panel data over 9 year (2001-2009). The results showed that bank liquidity is positively related to capital adequacy and interest rates on loans and interbank transaction, while it is negatively related to assets quality, inflation rate, business cycle and financial crisis. Furthermore, bank size have an ambiguous relationship with bank liquidity holdings. Hackethal, Rauch, Steffen, and Tyrell, (2010) used a multivariate dynamic panel regression and data over the period (1997-2006). They examined whether the average volume of loans affects liquidity creation on German savings banks. They found that banks that lend more create more liquidity. Angora and Roulet (2011) analyzed US and European listed commercial banks over the period of 2005-2009. They argued that liquidity risk that arises from liquidity transformation tend to decrease when banks maintain higher provision for loan loss and when banks concentrate their lending in liquid loans.

2.4.4 The Determinants of Adjustment Speeds

While there is an abundance of the empirical studies that have examined the adjustment speed of banks' capital ratios, there is (to the best of my knowledge) only an empirical study has analyzed the determinants of adjustment speeds toward target liquidity target ratios (DeYoung & Jang, 2016). These studies such as Mukherjee and Mahakud (2010) focused on a set of bank specific and macroeconomic factors such as the profitability, bank size, bank growth, and the distance between actual and desired leverage.

In US context, DeYoung and Jang (2016) examined the factors that affect banks' adjustment speeds toward liquidity target ratios, namely the distance between banks' liquidity actual ratios and target ratios, bank size, the economic condition, and the sign of liquidity gap (whether it is above target ratio or not). They reported that larger banks adjust their liquidity levels abit faster than small ones. They found a weak evidence that banks adjustment speeds twoard liquidity target ratios are affected by a helthy economic conditions. Regading the distance between the actual and target ratios (liquidity gap), they found that banks operate a way of their target tend to allocate a significant amount of funds to close these gaps when they first occur. Additionally, DeYoung and Jang (2016) also reported that banks operate above their target ratio adjust faster than those that operate under their targets.

2.5 Background of the Association of Southeast Asian Nations (ASEAN)

2.5.1 An Overview on ASEAN Economies

On August1967, five eastern Asian countries singed The Bangkok Declaration establishing the Association of Southeast Asian Nations (ASEAN). These countries are Indonesia, Malaysia, Philippines, Singapore, and Thailand. Later, and at different dates, other five eastern Asian countries have joined making up ASEAN's ten members, these countries are Brunei Darussalam (joined on 7 January 1984), Viet Nam (28 July 1995), Lao PDR and Myanmar (23 July 1997), and the last one was Cambodia (30 April 1999). In the following table, an economic overview is presented for the ASEAN countries. This overview includes the GDP, GDP growth, GDP per capita and the population in year 2015.

Based on Table 2.1, these countries are having a combined nominal GDP higher than USD2,442 billion in 2015. This made ASEAN countries ranked as the sixth largest economy in the world. While Indonesia is the largest economy among ASEAN countries, Singapore is the most developed economy and it has so far higher GDP per capita. This research paper will be limited to six ASEAN countries which account for 95 percent of the ASEAN combined GDP as shown in Table 2.1.

Table 2. 1
Economic overview about ASEAN countries

	GDP	**GDP growth**	**GDP per capita**	**Population**
Indonesia	861,933,968,740.33	4.79	3,346.49	257,563,815.00
Thailand	395,281,580,952.88	2.82	5,816.44	67,959,359.00
Malaysia	296,217,641,787.22	4.95	9,766.17	30,331,007.00
Singapore	292,739,307,535.64	2.01	52,888.74	5,535,002.00
Philippines	291,965,336,390.95	5.81	2,899.38	100,699,395.00
Vietnam	193,599,379,094.86	6.68	2,111.14	91,703,800.00
Myanmar	64,865,515,159.23	6.99	1,203.51	53,897,154.00
Cambodia	18,049,954,289.43	7.04	1,158.69	15,577,899.00
Brunei Darussalam	15,492,035,784.42	-0.50	36,607.93	423,188.00
Lao PDR	12,327,488,340.73	7.00	1,812.33	6,802,023.00
	2,442,472,208,075.70		11,761.08 (Av.)	630,492,642.00

For the banking industry in these countries, it is not at same level across ASEAN countries where it seems to be good established and high sophisticated in Singapore while the picture looks quite the opposite in some other countries such as Myanmar and Cambodia. Yamanaka, (2014) highlighted the similarities and differences of ASEAN members' financial sectors, where Malaysia and Singapore have well developed, fairly large capital markets comparable to those in developed countries. In contrast, the size of financial markets is still very small in Laos, Cambodia, Brunei and Myanmar. The other four countries come in between. On the same vein, Singaporean and Malaysian commercial banks have high average of assets exceed 14 billion dollars in 2009. Average of near 10 billion dollars in Thailand, followed by Philippine, Indonesia, Vietnam, and Brunei (1.8 to 3 billion). Furthermore, it did not exceed even USD200 million in the other three countries.

Based on the Table 2.2 shown below, the accessibility to banks in ASEAN countries is largely low even in Singapore and Malaysia comparing to developed countries. According to Financial Access Survey (2015) conducted by International Monetary Fund (IMF), the extensiveness of ASEAN commercial banks' branch networks is still low, whether banks branches or ATMs. In (2014) ASEAN countries had in average 44.23 ATMs, 10.66 branches per 1000 adults comparing to five advanced countries' averages at 122.3 and 29.7 respectively. In comparing between ASEAN countries with each other's; Laos, Cambodia and Myanmar are the lowest in terms of the accessibility to banks as well as the smallest percent of adults have deposit accounts with commercial banks. These countries, accompanied with Indonesia and Philippine had low levels of outstanding loans and

deposits reflecting the small size of banking industries in these countries as shown in table 2.2.

Table 2. 2
Financial Accessibility Indicators for ASEAN Countries

Economy	(ATMs) per 100,000 adults	Borrowers at commercial banks per 1,000 adults	Branches of commercial banks per 100,000 adults	Deposit a/c with commercial banks per 1,000 adults	Depositors with commercial banks per 1,000 adults	Loan a/c with commercial banks per 1,000 adults	Outstanding deposits with commercial banks (% of GDP)	Outstanding loans with commercial banks (% of GDP)
Brunei	79.27108	608.9272	19.73944	1930.724	1582.069	775.4341	56.31782	25.59573
Cambodia	10.87709		5.672926	216.1644		42.42564	53.53715	50.74903
Laos	19.92495	43.23299	2.902362	465.5666	395.3375	82.68347		
Myanmar	1.641345	1.862757	3.3061	171.918	171.7879	1.865515	25.60441	10.50461
Indonesia	49.47905	396.062	10.95108	901.3954		220.5386	39.02627	34.8517
Malaysia	52.17454	394.0555	10.76383	2469.452	832.8759	732.162	107.1304	112.9948
Philippines	23.35951		8.681494	530.7955	455.6038		45.85557	24.89119
Singapore	59.46432	1156.053	9.389103		2253.204		141.0828	155.6569
Thailand	111.3094	309.571	12.60891	1514.503	1180.076	416.4733	75.89852	74.10304
Vanuatu	34.82575	81.7733	22.60619	784.3858	654.5102	156.1477	69.09707	70.06788
ASEAN average	**44.2327**	**373.942**	**10.6621**	**998.323**	**940.683**	**303.466**	**68.1722**	**62.1572**
France	108.4973		38.15447				35.58369	38.68529
Germany	123.1982		14.53568				28.01118	21.36086
Japan	127.4544		33.88086	7246.883		188.9086	141.3196	101.4563
UK	129.9667						129.8377	124.7756
US			32.22736				57.9754	43.59643
Average	**122.279**	**N.A**	**29.6996**		**N.A**		**78.5455**	**65.9749**

Source: IMF, Financial Access Survey 2015

2.5.2 Banks' Financial Soundness of the 6-ASEAN Countries

In this section, the banks' financial soundness to the 6-ASEAN countries is elaborated. These countries which are Singapore, Malaysia, Thailand, Indonesia, Vietnam, and Philippine accounted to more than 95 percent of ASEAN GDP in 2015. It is noticeable that the amount of variance in the bank size among these countries. Singapore significantly sat on the top of banking industry by banks aggregate assets of approximately USD1,7 trillion in 2015, Malaysia came second. In the third and fourth Thailand and Indonesia came by a tight difference, and finally Vietnam and Philippine that had the lower banks size.

Table 2. 3
Banks' Financial Soundness Indicators of the 6- ASEAN Countries

	Singapore	**Malaysia**	**Thailand**	**Indonesia**	**Vietnam ***	**Philippine**
Banks size ** Total Assets (USDMillion)	1,691,402	603,182	464,880	456,411	292,294	236,134
Asset Quality						
NPL to Gross Loans	1.07	1.66	2.88	2.98	3.44	1.95
Capital Adequacy						
Capital to RWA	16.56	16.77	17.36	21.17	13.03	15.28
Tier 1 Capital to RWA	14.38	14.19	14.22	19.79	10.79	12.84
Capital to Assets	9.32	10.86	10.16	14.67	8.74	10.59
Earnings and profitability						
ROA (2016Q2)	1.24	1.40	1.40	2.20	0.47	1.46
ROE 2016Q2	13.30	13.35	11.02	15.42	5.37	14.19
Interest Margin to Gross Income	60.38	59.30	N.A	68.40	74.47	68.11
Liquidity						
Liquid Assets to Short Term Liabilities	76.43	133.09	166.79	32.63	N.A	59.80
Liquid Asset Ratio	69.16	22.08	18.93	22.15	15.31	37.80
Non-interbank loans to customer deposits	87.77	N.A	97.6***	98.38	77.96	77.38

* 2015Q2; ** 2015Q4

Source: IMF, Financial Soundness Indicators database & IMF Country Report No. 16/139

While Singapore came first in the asset quality indicator followed by Malaysia and Philippine, Indonesian banks were significantly more solvent and profitable and on the opposite end Vietnamese banks were low solvent and less profitable. The other countries came in between by convergent ratios as shown in Table 2.3. In terms of the liquidity, ASEAN countries banks' liquidity varied largely with high liquidity ratios recorded by Singaporean banks. The lower ratio of Interest Margin to Gross Income for Singapore and Malaysia reflected their diversification of income source by relying (more than the others) on nontraditional business activities.

2.5.3 Banking Sector Reforms Following ASEAN Crisis in 1997

Following ASEAN financial crisis in 1997, a set of bank restructuring strategies have been developed and imposed by ASEAN authorities targeting the reform of banking sectors and aiming to overcome the effects of crisis, recover banks' soundness, enhance bank competition and efficiency, and to avoid the possibility of recurrence of the crisis again. These measures (which contained legal and institutional framework) ranging from strengthening viable financial institutions, shutting down insolvent ones, dealing with impaired assets, improving prudential regulations and banking supervision, and promoting transparency in the financial system. In the literature, several studies have studies these reforms (Ilene Grabel et al., 2007; Lindgren et al., 1999; Randhawa & Maru, n.d.; Takatoshi & Hashimoto, 2007)

The government intervention to strengthening banking sector by encouraging or even enforcing- mergers and acquisitions between banking institutions or closing insolvent ones,

has led to less numbers but stronger commercial banks. Lindgren et al., (1999) summarized the number of merger transactions over period of two years (June 1997- June 1999), where four Indonesian commercial banks, fifteen Malaysian finance companies and commercial banks, four Philippines commercial banks, and seventeen Thai finance companies and commercial banks were involved in merger transactions. Takatoshi and Hashimoto (2007) illustrated that because of merger transactions, the number of domestic commercial banks has decreased from 23 banks in 2006 to only 10 banks. On same context, policies taken by ASEAN countries has succeed in reducing the ratios of non- performing loans (NPL) in all countries experienced high levels of NPL because of the crisis.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter deals with the methodology used in the research. In particular, it explains the research framework, discussions and development of hypotheses, model specification, variables definition and measurement, sample description, sources and methods of data collection, as well as the statistical techniques used for data analysis.

3.2 Research framework

The main aim of study is to examine whether ASEAN banks manage their liquidity or not. if so, how effective the liquidity risk has been managed. To achieve that, the process of research will go through three stages; the first stage is examining whether banks had liquidity targets or not and what are the factors that determine these targets (NSFR and Short-term liquidity ratio). This means in the first stage the NSFR and Short-term liquidity ratio represent the dependent variable of first regression. The independent variables are a set of bank specific and macroeconomic factors (bank size, capital, assets quality, growth plan, cost of funding, economic condition, and interest rate spread). This stage is illustrated in the figure 3.1.

The second stage examines how quickly banks adjust their liquidity buffers ratios when they move away from target ratios, and what are the factors that affect these adjustment speeds. The size and sign of gap between target and actual liquidity ratios accompanied

with the economic condition, bank size, and the financial stress as independent variables in this stage, while the change of liquidity target ratio is considered as the dependent variable. Figure 3.2 illustrates the second stage. The final stage is designed to test how effective bank liquidity risk management was in the sense that relates to maximizing profits in which the profitability represents the dependent variable, the adjustment speed is the independent variable along with bank size, bank capital and loan loss reserve ratio as a control variables. figure 3.3 illustrates this stage.

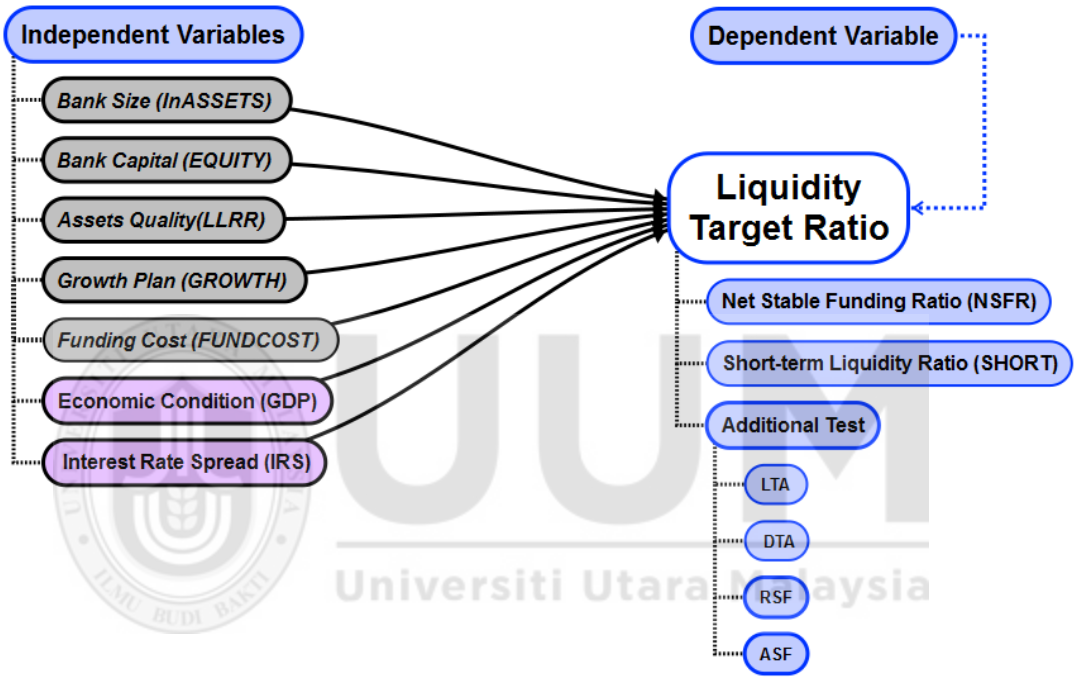

Figure 3. 1
Research Framework A: Determinants of Liquidity Target Ratios

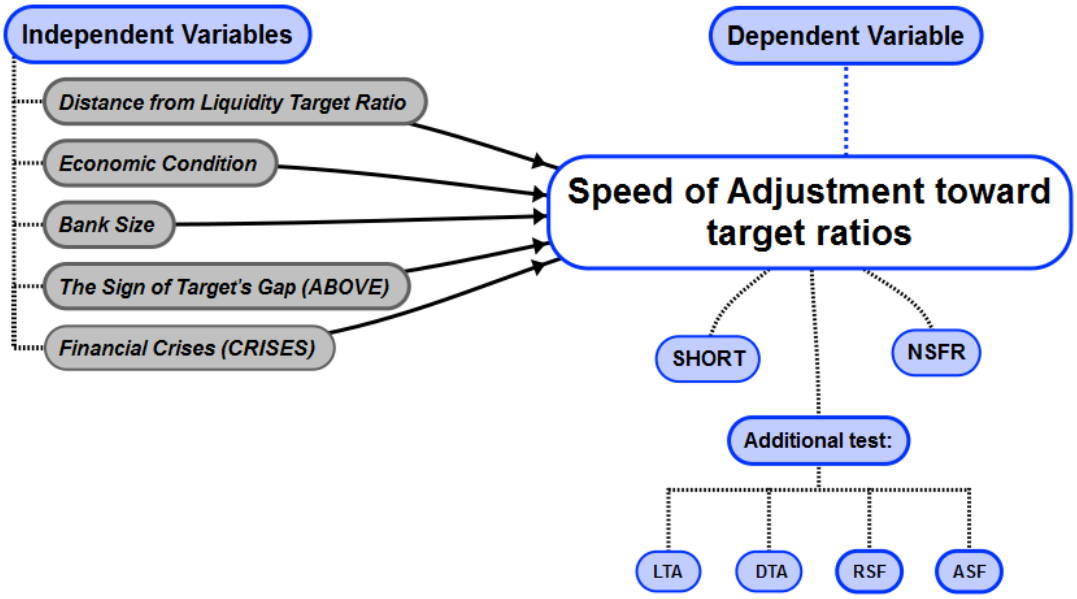

Figure 3. 2
Research Framework A: Determinants of Adjustment Speeds

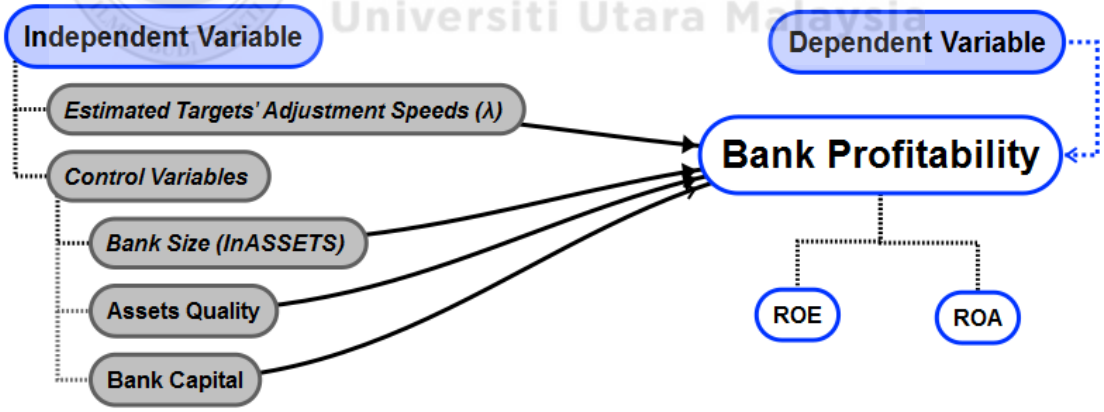

Figure 3. 3
Research framework (c): The Effect of Adjustment Speeds on Banks' Profitability

3.3 Hypotheses Development

Liquidity as a subject of study has gained considerable attention of researchers and policy makers in recent years. The major empirical studies examined the determinants of liquidity buffers, but after liquidity requirements were introduced in Basel III, researcher has mainly focused on the impact of imposing the new introduced NSFR and LCR on banks' financial situation. Only one study -to the best of my knowledge- namely DeYoung and Jang (2016) tried to answer the question of how fast banks did adjust their liquidity holdings when they were moved away from their targets.

Starting with the adjustment speed of liquidity target ratio that can be observed on the light of the coefficient of lagged dependent variable which is considered as an indicator of the existence of dynamic liquidity structure as section 3.4 Shows. Results of DeYoung and Jang (2016) revealed that dynamic liquidity management was significantly observed, DeYoung and Jang (2016) reported that US banks close approximately 26% of the gap between actual loans to core deposits ratios and the target loans to core deposit ratios within a year. Therefore, it is hypothesized:

H1a: ASEAN commercial banks converge towards NSFR.

H1a: ASEAN commercial banks converge towards short term liquidity target ratio (SHORT).

One of the factors that drive liquidity target ratios is the bank size. Theoretically, bank size is negatively associated with liquidity holdings. Chen and Mazumdar (1992) argued that larger banks tend to be less risk-averse than smaller banks. Boyd and Runkle (1993)

confirmed this, where larger banks are more probably to get public support in crises times which encourages them to bear high liquidity risk profiles. Other study done by Dietrich, Hess, and Wanzenried (2014) found that larger banks have historically not fulfilled the minimum required NSFR. Similarly, results of Cucinelli (2013a), Kashyap, Rajan, and Stein (2002), Kashyap and Stein (1995) and (2000), and Singh and Sharma (2016) suggest that bigger banks have a higher liquidity risk exposure, while smaller banks seem to be more risk-aversion as they face difficulties in accessing capital markets. (Aspachs, Nier, & Tiesset, 2005) found that the relationship between bank size and the liquidity holdings is not significant while results of (Vodová, 2011) suggest that it is ambiguous. As discussed above, theories as well as empirical studies suggested that bank size has negative impact on liquidity. This implies that when bank size increases, liquid holdings decrease. Therefore, the following hypotheses are developed as follow:

H2a: Bank size has a significant relationship with NSFR.

H2b: Bank size has a significant relationship with short term liquidity ratio.

Another variable was included as a determinant of liquidity which is bank capital. Berger and Bouwman (2009), Diamond and Rajah (2000) and (2001) stated that capital might have a relationship with liquidity. (Dietrich et al., 2014) found that banks with higher capital ratios tend to maintain a stronger structural liquidity. Dietrich, Hess, and Wanzenried (2014) confirmed that as well. Additionally, Cucinelli, (2013b), Roman and Sargu (2015), Singh and Sharma (2016), and Vodová (2011) found that the banks' capitalization positively affects overall bank liquidity. Theoretically, two conflicting views has been developed as was explained by Distinguin, Roulet, and Tarazi (2013). The first view states

that the relationship between bank capital and its liquidity holdings is positive (Berger & Bouwman, 2009; Diamond & Rajah, 2000, 2001; Gorton & Winton, 2000). On contrast, the second view states that high level of capitalization enhance banks' ability to manage risks leading to create more liquidity (Bhattacharya & Thakor, 1993; Repullo, 2004; von Thadden, 2004). Thus, the following hypotheses are developed:

H3a: Bank capital has a significant relationship with NSFR.

H3a: Bank capital has a significant relationship with short term liquidity ratio.

Loan loss reserves ratio is another factor which captures the riskiness of bank assets and the banks' degree of risk. A study done by (Roman & Sargu, 2015; Vodová, 2011) found a negative link between bank liquidity and its assets quality. (Cucinelli, 2013a) revealed that assets quality impacts only on the measure of the short-term liquidity risk. In contrast, results of Chen, Chou, Chang, and Fang (2015) shows negative link between non-performing loans – the higher NPL the lower assets quality- and banks' liquidity buffers. Therefore, the fourth hypothesis is developed as follows:

H4a: Quality of bank assets has a significant relationship with NSFR.

H4b: Quality of bank assets has a significant relationship with short-term liquidity ratio.

Banks that plan to achieve high levels of growth are expected to target higher levels of long term and illiquid assets. Consequently, banks would maintain low levels of liquidity buffers and this leads to more liquidity risk exposure. Dietrich, Hess, and Wanzenried (2014) found that banks with more rapid past growth have lower NSFRs, results of DeYoung and Jang

(2016) also show that fast growing banks maintain high levels of loans to core deposits. Hence, two hypotheses are developed as follow:

H5a: Bank's growth plan has a significant relationship with NSFR.

H5b: Bank's growth plan has a significant relationship with the short-term liquidity ratio.

Another variable that is included in the model and could have an effect on liquidity is the cost of funding. It represents costs paid by banks for funds. Bunda and Desquilbet (2008) found that funding cost influences banks' liquidity buffer. Alger and Alger (1999) and Munteanu (2012) also reported that an increase in liability cost leads banks to depend more on liquid assets. This implies that funding cost might influence the liquidity of banks positively. Accordingly, it is hypothesized the followings:

H6a: Bank's funding cost has a significant relationship with NSFR.

H6b: Bank's funding cost has a significant relationship with short-term liquidity ratio.

By moving to country specific factors that could determine bank liquidity levels, it is argued that bank liquidity tends to grow when macroeconomic risk goes up due to the shift of investors from using direct investment channels into banks deposits seeking insurance for their savings (Acharya & Naqvi, 2012). Similarly, Gatev and Strahan (2006) argued that banks deposits tend to increase when spreads of commercial paper market raise which leads to assets growth. According to Aspachs, Nier, and Tiesset (2005) and Delechat, Henao, Muthoora, and Vtyurina (2012), banks' liquidity holdings are negatively associated with GDP growth and policy interest rates. Similarly, Valla and Saes-Escorbia (2006)

reported that bank liquidity is negatively associated with GDP growth. Along the same line, the results of Dinger (2009) showed that the relationship is negative between banks liquidity buffers and the economic condition measured by real GDP growth and real gross domestic product per capita. In addition, Vodová (2011) found negative impact of inflation rate and business cycle on banks' liquidity. Agenor, McDermott, and Prasad (2000) and Saxegaard (2006) reported that policy interest rates negatively affect the excess reserves. Lucchetta (2007) emphasized that interbank interest rate is deemed motives banks hold liquid assets. Therefore, four hypotheses are developed as follow:

H7a: GDP real growth has a relationship with NSFR.

H7b: GDP real growth has a relationship with short-term liquidity ratio.

H8a: Interest rate spread has a relationship with NSFR.

H8b: Interest rate spread has a relationship with short-term liquidity ratio.

In the literature, there is a lack in terms of examining the adjustment speeds of banks toward liquidity targets. Thus, this study follows DeYoung and Jang (2016) which is the only study that addressed the adjustment speeds of liquidity targets. Besides, the two studies that addressed the speed of adjustment of banks toward the capital targets (Berger, DeYoung, Flannery, Lee, & Öztekin, 2008; Mukherjee & Mahakud, 2010). It is expected that banks that operate at longer distance from their target ratio adjust their liquidity levels more faster than those that operate at shorter distances from target ratios. Therefore, the distance between actual and target ratios (the GAP) is considered as a factor that influence the bank's speed of adjustment following DeYoung and Jang (2016) study.

Furthermore, it is also argued that the degree of adjustment speeds' responding to liquidity gap could be affected by some external and internal factors. Among these factors are the economic conditions where banks may find it easy to adjust their liquidity levels during times of economic growth. DeYoung and Jang (2016) provided an evidence on this argument. Additionally, it is also argued that the financial crises are expected to have impact on the degree of adjusting liquidity buffers. On one hand, banks may find some difficulties at stressed times to easily adjust their liquidity buffers. On the other hand, banks are expected to be wary of operating away from their liquidity target levels during crises times. Therefore, it is expected that banks quickly adjust their liquidity buffers during crisis.

When turn into internal factor, bank size is always deemed as a key factor that should be considered. Therefore, it is argued that bank size has an effect on the speed of adjusting liquidity levels. DeYoung and Jang (2016) stated that larger banks have faster adjustment speeds, maybe because it is easier for large bank to quickly adjust their liquidity level due to their higher abilities to access financial markets than small banks. Another justification is that larger banks could operate a way from their liquidity targets in the short-term horizon without suffering adverse consequences. lastly, DeYoung and Jang (2016) argued that banks operate above their target ratio adjust their liquidity levels faster than those that operate under their targets. Based on the above discussion and in line with DeYoung and Jang (2016), the following hypotheses are developed:

H9a: Distance between liquidity actual ratio and target ratio has a significant relationship with NSFR's speed of adjustment.

H9b: Distance between liquidity actual ratio and target ratio has a significant relationship with short term liquidity ratio's speed of adjustment.

H10a: Bank size has a significant relationship with NSFR's speed of adjustment.

H10b: Bank size has a significant relationship with short term liquidity ratio's speed of adjustment.

H11a: GDP real growth has a significant relationship with NSFR's speed of adjustment.

H11b: GDP real growth has a significant relationship with short term liquidity ratio's speed of adjustment.

H12a: Banks that are operating above their targets quickly adjust their long-term liquidity targets.

H12a: Banks that are operating above their targets quickly adjust their short-term liquidity targets.

H13a: Stresses of financial crises have a significant relationship with NSFR's speed of adjustment.

H13a: Stresses of financial crises have a significant relationship with short term liquidity ratio's speed of adjustment.

In line with DeYoung and Jang (2016), it is argued that banks that have faster speed of adjustment more likely would have high profitability. As these banks are able actively manage their liquidity. Therefore, the following hypotheses are developed as:

H14a: NSFR's speed of adjustment has a significant relationship with bank's profitability.

H14b: SHORT's speed of adjustment has a significant relationship with bank's profitability.

3.4 Model Specification

Dynamic panel data estimation is used in this study to answer the study questions by capturing the dynamic of bank liquidity risk management. This study follows (DeYoung & Jang, 2016) where a partial adjustment model is employed. This model allows finding the following aspects of bank liquidity management: firstly, estimating liquidity target ratio for each banking institution in each time period. Secondly, examining and estimating the factors that determine these target ratios. Thirdly, calculating the liquidity adjustment speed for each bank in each time period. Moreover and lastly, examining the determinant of these speeds of adjustment. After getting bank specific speed of adjustment, the impact of these speed on bank's profitability is examined.

The partial adjustment model starts with the assumption that each bank has a target liquidity ratio (TR) which is a linear function of a set of factors as shown in equation (1):

$$TR_{i,t} = \sum_{i=1}^{n} \beta V_{i,t-1} \qquad (1)$$

Where:

TR is either NSFR or short-term liquidity target ratio of bank *i* at time *t*.

$V_{i,t-1}$ is the set of bank characteristics that affect liquidity targets, including bank size, bank capital, assets quality, bank's growth plan, funding cost, GDP growth, and interest rate spread, and

β is a vector of coefficients to be estimated, if the estimated value of β = 0 that could be attributed to either of two reasons: banks do not have systematic liquidity targets, or V is misspecified.

Generally, banks should maintain their liquidity holdings at their desire -targets- ratios, meaning that the liquidity target ratio $TR_{i,t}$ should be equal to the observed -actual- ratio ($AR_{i,t}$): $TR_{i,t} = AR_{i,t}$. However, banks could move away from their targets under the impact of internal or external factors. To return to their liquidity targets, banks make adjustment that potentially could be costly. Assuming that; the change in liquidity level from the last period to current period represents liquidity adjustment that a bank has made to close the gap between target and actual ratio. This adjustment toward liquidity target is not likely to be completed within one year. Thus, banks will partially adjust their liquidity holdings toward desire liquidity targets but not fully to the extent that actual ratios will be equal to target ratios. Therefore, banks close a constant proportion λ of the gap between $AR_{i,t-1}$ and $TR_{i,t}$ each period as shown in equation (2):

$$AR_{i,t} - AR_{i,t-1} = \lambda \left(TR_{i,t} - AR_{i,t-1}\right) + \hat{\delta}_{i,t} \qquad (2)$$

Where:

λ is the scalar adjustment speed to be estimated

$\hat{\delta}_{i,t}$ is a random error term.

Substituting equation (1) into (2) yields the following equation:

$$AR_{i,t} - AR_{i,t-1} = \lambda \left(\sum_{i=1}^{n} \beta V_{i,t-1} - AR_{i,t-1} \right) + \hat{\delta}_{i,t} \quad (3)$$

Rearranging equation (3):

$$AR_{i,t} = \lambda \left(\sum_{i=1}^{n} \beta V_{i,t-1} - AR_{i,t-1} \right) + AR_{i,t-1} + \hat{\delta}_{i,t} \quad (4)$$

$$AR_{i,t} = \left(\sum_{i=1}^{n} \lambda \beta V_{i,t-1} \right) - \lambda AR_{i,t-1} + AR_{i,t-1} + \hat{\delta}_{i,t} \quad (5)$$

$$AR_{i,t} = \left(\sum_{i=1}^{n} \lambda \beta V_{i,t-1} \right) + (1 - \lambda) AR_{i,t-1} + \hat{\delta}_{i,t} \quad (6)$$

Since liquidity target ratio $TR_{i,t}$, is considered to be dependent upon bank and country specific factors, namely: bank size (lnASSETS), capital (EQUITY), assets quality (LLRR), bank growth plan (GROWTH), funding cost (FUNDCOST), economic condition (GDP), and interest rate spread (IRS). Accordingly, equation (6) can be expanded as:

$$\begin{aligned} AR_{i,t} = (1 - \lambda) AR_{i,t-1} + \lambda \beta_1 \mathrm{lnASSETS}_{i,t-1} + \lambda \beta_2 \mathrm{EQUITY}_{i,t-1} + \lambda \beta_3 \mathrm{LLRR}_{i,t-1} \\ + \lambda \beta_4 \mathrm{GROWTH}_{i,t-1} + \lambda \beta_5 \mathrm{FUNDCOST}_{i,t-1} + \lambda \beta_6 \mathrm{GDP}_{i,t-1} \\ + \lambda \beta_7 \mathrm{IRS}_{i,t-1} + \hat{\delta}_{i,t} \quad (7) \end{aligned}$$

By replacing $(1 - \lambda)$ with δ_0 and $\lambda \beta_k$ with δ_k, equation (7) can be rewritten as:

$$AR_{i,t} = \delta_0 AR_{i,t-1} + \delta_1 \text{lnASSETS}_{i,t-1} + \delta_2 \text{EQUITY}_{i,t-1} + \delta_3 \text{LLRR}_{i,t-1} + \delta_4 \text{GROWTH}_{i,t-1} + \delta_5 \text{FUNDCOST}_{i,t-1} + \delta_6 \text{GDP}_{i,t-1} + \delta_7 \text{IRS}_{i,t-1} + \hat{\delta}_{i,t} \quad (8)$$

$\hat{\lambda}$ can be recovered by subtracting the estimated δ_0 from 1($\lambda = 1 - \delta_0$). β_k can be calculated by dividing $\delta_k$by $\hat{\lambda}$. Then it is possible to use equation (1) to calculate the liquidity target ratio for each bank in each time period ($TR_{i,t}$).

The coefficient λ in equation (7) represents the adjustment coefficient for banks. It illustrates the amount of adjustment that banks -in average- were adjusting their liquidity levels within one year. A value of $0 < |\lambda| < 1$ reflects the impact of the adjustment costs which cause liquidity adjustment to be less than 1, meaning that banks do not completely adjust their liquidity holdings toward target levels within one year. A value of $|\lambda| = 1$ means that banks completely adjust their liquidity holdings within one year. A high estimated value of adjustment speed λ reflects that banks were actively managing their liquidity buffers and/or facing lower adjustment costs and vice versa.

Following (DeYoung & Jang, 2016), equation (8) is estimated using Generalized Method of Moments (GMM) to estimate the adjustment speed and to identify which of bank and country specific factors influence banks liquidity target ratios. The estimation of Equation (8) helps to estimate banks' individual target ratio ($TR_{i,t}$), it allows also to find the average adjustment speed for the entire sample, but it does not allow to estimate banks' individual adjustment speeds that is expected to change over time. To estimate bank's individual

adjustment speed, It is assumed that it is a linear function of some predetermined explanatory factors as follows:

$$\lambda_{i,t} = \sum_{i=1}^{n} \Lambda X_{i,t-1} \qquad (9)$$

Where:

$\lambda_{i,t}$ is the bank-specific, time-varying speed of adjustment toward the liquidity target ratio $TR_{i,t}$.

$X_{i,t-1}$ is a vector of bank and time period factors that influence the adjustment speed

Λ is a vector of coefficients to be estimated

Substituting equation (9) into (3) yields the complete model:

$$AR_{i,t} - AR_{i,t-1} = \left(\sum_{i=1}^{n} \Lambda X_{i,t-1} \right) \left(\sum_{i=1}^{n} \beta V_{i,t-1} - AR_{i,t-1} \right) + \hat{\delta}_{i,t} \qquad (10)$$

Since $\sum_{i=1}^{n} \beta V_{i,t-1}$ represents the estimated target ratio $TR_{i,t}$ as illustrated above, so the difference between target and actual ratio $\left(\sum_{i=1}^{n} \beta V_{i,t-1} - AR_{i,t-1} \right)$ can be renamed as $GAP_{i,t-1}$. The change in actual liquidity ratio AR from the last to current period $AR_{i,t} - AR_{i,t-1}$ is renamed as $\Delta AR_{i,t}$. Accordingly, equation (10) can be rearranged as follows:

$$\Delta AR_{i,t} = \sum_{i=1}^{n} \Lambda \left(X_{i,t-1} \; GAP_{i,t-1} \right) + \hat{\delta}_{i,t} \qquad (11)$$

Where $X_{i,t-1}$ $GAP_{i,t-1}$ is the vector of explanatory variables that affect the bank-specific, time-varying speed of adjustment. Following DeYoung and Jang (2016), equation (11) is estimated using ordinary least squares (OLS) to identify the factors that influence banks' adjustment speeds. Using the estimated coefficients of equation (11), the parameter Λ can be found. Thus, equation (9) is used to calculate the bank-specific and time-varying speed $\lambda_{i,t}$.

After estimating $\lambda_{i,t}$, (liquidity adjustment speeds) then its impact on the financial performance of banks is examined. Following DeYoung and Jang (2016), this impact is captured by using ordinary least squares (OLS) to estimate the following equation:

$$PROFIT_{i,t} = a + b\lambda_{i,t} + c\,\lambda^2{}_{i,t} + d\ln\text{ASSETS}_{i,t-1} + e\text{EQUITY}_{i,t-1} + f\text{LLRR}_{i,t-1} + \hat{\delta}_{i,t} \quad (12)$$

3.5 Variables Definition and Measurements

Bank liquidity has become more complex, especially with its abundance of potential risk sources. Thus, measuring liquidity was a main concern for the previous studies where several measurements have been used. In this study, Net Stable Funding Ratio (NSFR) is used to measure the long-term liquidity, while short term liquidity ratio (SHORT) is used to measure the short-term liquidity. This section provides brief definitions of these measurements.

For the long-term liquidity, the net stable funding ratio (NSFR) is used. NSFR was introduced by Basel committee in 2010 for first time to addresses the long-term liquidity risk. NSFR is calculated by dividing the available stable funding (ASF) over required stable funding (RSF). Basel committee aimed by introducing NSFR to induce financial institutions to finance their businesses through stable, longer-term sources of financing and to hold fewer illiquid assets. Basel Committee in (2014) introduced a guideline to explain how NSFR must be calculated. Basel Committee spells out the weight of assets that make up the required stable funding (RSF) and the weights of liabilities that make up the available stable funding (ASF).

The historical financial information published by banks do not allow to calculate NSFR as Basel III described it. However, NSFR can be reliable by estimating an approximate for the weights of assets and liabilities based on the available historical financial information. These weights have been used by previous studies such as (Ashraf, Barbara, & Rizwan, n.d.; Bonfim & Kim, 2013; T. H. Chen et al., 2015; DeYoung & Jang, 2016; Dietrich et al., 2014; Distinguin et al., 2013; Gobat, Yanase, & Maloney, 2014; King, 2013; Silva, 2016; Vazquez & Federico, 2015). In the following table 3.1, the designed weights are presented.

Table 3. 1
The weights of balance sheet items that comprise ASF and RSF to calculating NSFR

Items	weight
RSF:	
Treasury securities	0.05
Federal agency securities	0.05
State and municipal securities	0.05
Trading account securities	0.5
Securities purchased under resale agreements	0.5
Mortgage backed securities	0.5
Federal funds	0.5
Other securities	0.5
Other investments	0.5
Loans - net	0.85
Investments in unconsolidated subsidiaries	1
Customer liability on acceptances	1
Real estate assets	1
Property, plant, and equipment - net	1
ASF:	
Items	weigh
Demand deposits	0.90
Savings/other time deposits	0.95
Long term debt	1.00
Equity	1.00

Another dimension of liquidity risk is the short-term liquidity risk. Basel III introduced also the Liquidity Coverage Ratio standard (LCR) to address the short-term liquidity risk over 30 days. T calculate the LCR, it is required much of detailed information which was

not publicly disclosed. Thus, it is impossible for outsiders to calculate LCR based on the historical financial information published by banks. Therefore, another proxy is used to capture the liquidity risk in the short-term horizon. This proxy is used by (Delechat et al., 2012). This measurement is calculated by dividing liquid assets over the deposits and short term debt as follows:

Short term liquidity ratio = (Cash & due from banks plus investments)/ (deposits plus short term debt)

One of the must variables used in this study is the size of bank. It is argued that bank size is influencing the banks' ability to hold liquidity. According to Bonfim and Kim (2013), larger banks seem to be have high liquidity risk profile, showing smaller liquidity holdings, higher loans to deposits ratio, and lower stable funding ratio. In this study, bank size is captured by taking the natural logarithm of bank's total assets (lnASSETS). This measurement has been used by several researchers such as (Aspachs et al., 2005; Delechat et al., 2012; Dietrich et al., 2014; Distinguin et al., 2013). Another variable is the Bank Capital (EQUITY) which deemed to be a buffer against losses that banks could suffer while doing their business activities. It helps banks to stabilize and recover from uncertain shocks (Munteanu, 2012). Following (Bonfim & Kim, 2013; Bonner, Lelyveld, & Zymek, 2014; Dietrich et al., 2014; Horváth, Seidler, & Weill, 2014), Bank capital (EQUITY) is measured by using the ratio of equity to total assets.

In this study, assets quality is also included and measured by the ratio of loan loss reserves to gross loans. This ratio reflects the banks' degree of risk aversion as well as the

recognized riskiness of their loan portfolio. The higher the ratio of Loan Loss Reserve Ratio (LLRR), the more problematic are banks' assets and vice versa. LLRR as a measure of assets quality has been used by many previous studies such as (Dietrich et al., 2014; Distinguin et al., 2013). Banks' growth plan (GROWTH) is another variable included in this study, as banks that plan to achieve high level of growth are expected to maintain a lower level of liquidity buffers and invest heavily in loans and illiquid assets. Following DeYoung and Jang (2016), banks' growth plan is captured by by calculating the average growth of bank's total assets over the next two years. Additionally, **c**ost of funding (FUNDCOST) is also included. It refers to the cost paid by banks for funds and estimated as the amount of interest rate expenses divided by total liabilities. Alger and Alger (1999) used this measurement and explained that the high ratio of funding cost may stimulate banks to hold more liquid assets which leading banks' liquidity buffers to increase.

Another variable namely Gross Domestic Product (GDP) is used in this study as a country specific factor. This variable is included to capture the condition of economic and the business cycle as well. This variable is used by previous studies such as (Aspachs et al., 2005; Dietrich et al., 2014; Distinguin et al., 2013). Furthermore, Interest Rate Spread (IRS) is also included in this study. According to (Delechat et al., 2012), the difference between average lending and deposit interest rate (interest rate spread) is one of the country specific factors that could affect banks' decisions about their liquidity holdings. It is an indicator which measures the opportunity cost of holding liquid assets. The higher the interest rate spread is the higher opportunity cost of holding liquid assets which gives banks an incentive to hold less proportion of liquid assets and instead grant loans to maximize profits.

Following Berger et al. (2008) DeYoung and Jang, (2016) and Mukherjee and Mahakud, (2010), the distance between actual and target optimal, or desired ratios (GAP) is included in the dynamic model to examine the adjustment speeds of any target, optimal, or desired ratio. It is expected that banks operate away from their target ratio to adjust their liquidity levels more quickly than those that operate at shorter distances from target ratios. The distance between actual and target ratios (GAP) is obtained by subtracting the actual liquidity ratio from the estimated ratio (the target ratio) for each bank at each interval.

A dummy variable is included as value one is given, if actual ratio is higher than the estimated target ratio, otherwise zero is given. Following DeYoung and Jang (2016), it is expected that banks that operate above their NSFR targets (actual ratio is higher than the estimated target ratio) are more likely to adjust their liquidity levels faster than those that operate under their NSFR targets. This might be due to the difficulties of rising stable funds such as core deposit and long term debt. Another dummy variable is included to capture the global financial crisis. For this dummy variable value one is given if for years 2008 and 2009, other years are given zero. In the last stage of this study, bank profitability is included. Profitability has been heavily studied as a key issue that concern all players and dealers with banking sectors. Following DeYoung and Jang (2016) and to achieve the last objective of this study, which is examining the impact of adjustment speed of the banks' profitability, Return On Equity (ROE) is used to capture the banks' profitability.

Table 3. 2
Measurements of Variables

The variable	Notation	Measurement	Support
Bank liquidity: NSFR	NSFR	The available stable funding (ASF) divided by required stable funding (RSF)	(Ashraf et al., n.d.; Bonfim & Kim, 2013; T. H. Chen et al., 2015; DeYoung & Jang, 2016; Dietrich et al., 2014; Distinguin et al., 2013; Gobat et al., 2014; King, 2013; Silva, 2016; Vazquez & Federico, 2015)
Short term liquidity ratio	SHORT	Liquid assets divided by deposits and short term debt	(Delechat et al., 2012)
Bank size	lnASSETS	The natural logarithm of total assets	(Aspachs et al., 2005; Delechat et al., 2012; Dietrich et al., 2014; Distinguin et al., 2013)
Capital	EQUITY	Equity to total assets	(Bonfim & Kim, 2013; Bonner et al., 2014; Dietrich et al., 2014; Horváth et al., 2014)
Assets quality	LLRR	Loan loss reserves divided by gross loans	(Dietrich et al., 2014; Distinguin et al., 2013)
Growth Plan	GROWTH	The average growth of assets over the next two years.	(DeYoung & Jang, 2016)
Cost of funding	FUNDCOST	interest rate expenses divided by total liabilities	(Alger & Alger, 1999)
Economic condition	GDP	GDP growth	(Aspachs et al., 2005; Dietrich et al., 2014; Distinguin et al., 2013)
Interest rate spread	IRS	Lending rate minus deposit rate	(Delechat et al., 2012)
distance between actual and target ratios	GAP	Target ratio minus actual ratio	(DeYoung & Jang, 2016)

Table 3.2 *(continued)*

Above liquidity target dummy variable	ABOVE	=1 if ratio actual is higher than target ratio	(DeYoung & Jang, 2016)
Financial Crisis	CRISES	=1 at 2008&2009, otherwise: 0	
Profitability:			
Return on equity	ROE	Net income divided by total equity	(DeYoung & Jang, 2016)
Return on total assets	ROA	Net income divided by total assets	(DeYoung & Jang, 2016)

3.6 Sample Description and Data Collection

To achieve the objectives of the study, annual bank level data accompanied with country level data are used. Bank level data is obtained from Thomson Reuters DataStream while country level data is retrieved from World Bank reports. Thomson Reuters DataStream does not provide data of countries that does not have financial market, therefore the data of only six ASEAN countries is provided, namely; Indonesia, Malaysia, Philippine, Singapore, Thailand, and Vietnam.

The initial data set available in DataStream consists of 90 commercial banks. Three banks were omitted due to missing data, following DeYoung and Jang (2016), all variables are winsorized at the 1st and 99th percentile. The final sample of this study consists of 87 commercial banks with unbalance panel data over 20-year time period (1996-2015). The distribution of the 87 commercial banks by country is shown in the following Table 3.3.

Table 3. 3
The distribution of the sample banks by country

Country	Number of commercial banks
Indonesia	40
Malaysia	8
Philippine	16
Singapore	3
Thailand	11
Vietnam	9
Total	87

CHAPTER FOUR

EMPIRICAL FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the empirical findings of the study. It starts with the descriptive statistics for the study variables namely the central tendency measure (mean) and the variability measures (standard deviation, maximum and minimum). It also displays the collinearity between the study variables. Furthermore, the findings of the three models of this study are reported and compared with previous findings. In section 4.3 and 4.4, the findings from the first stage which uses partial adjustment model and GMM estimation is presented and discussed. This stage is to achieve the first three objectives of this study which are examining whether banks do have liquidity target ratios or not, if so, how quickly they adjust their liquidity toward target levels, and what are the determinants of these target ratios? The next section presents and discusses results of the second stage which examine what are the determinants of speed of adjustment toward liquidity targets, this stage achieves fourth objective. Subsequently, 4.6 section reports results in the third stage which investigates the impact of speeds of adjustment toward liquidity target (as an indicator of active bank liquidity management) on banks' financial performance. This stage achieves the final objective of the study. Finally, section 4.7 reports additional tests to support the findings of this study.

4.2 Descriptive Statistics

Table 4.1 depicts descriptive statistics of both dependent and independent variable used in the study. The numbers of observations are presented in the table where it varies from variable to another because the study uses an unbalance panel data.

NSFR has 1.0894 mean, meaning that on average, ASEAN's banks have NSFR above the required (NSFR = 1), with 0.4450 standard deviation, 0.1339 minimum value and 2.4606 maximum value. SHORT variable's mean was 0.3381, with 0.1695 standard deviation, 0.0685 minimum value and 0.8802 maximum value.

Turning to bank specific explanatory variables, the mean of banks' total assets was USD 18,800 billion, with USD37,800 billion as standard deviation, USD339,000 billion for largest bank in the sample and USD2,261 billion for smallest bank. Banks' equity ratios varied from 4.07% to 86.74% with 17.52% as mean and 14.62% standard deviation. The highest ratio of loan loss provision (as indicator for the decreasing of assets quality) was at 32.76% while the lowest was at 0.11%, 4.56% as mean and 5.07% standard deviation. Furthermore, the mean of growth plan for ASEAN bank (GROWTH) was 16.70% with 19.14% standard deviation, -16.91% minimum and 117.4% maximum. In terms of the level of funding cost, the highest level was at 15.38% while 0.69% was the lowest, 4.66% mean and 2.86% as standard deviation. ASEAN banks, on average, have shown on average profitability rates of 6.26% & 0.75% for return on equity (ROE) and return on assets (ROA) respectively with standard deviation at 11.82% & 2.07% for ROE and ROA respectively.

For ASEAN banks' profitability, the minimum values were - 59.08% and -13.46% while the maximum were 29.64% & 3.70% for ROE and ROA respectively.

Turning to the country specific variables, the 6-ASEAN countries' economies grew at 4.64% on average over the last 20 years. The highest level of GDP was 15.24% and the extreme decrease was at 13.13%. Interest rate spreads were as follows: 4.04% mean, 2.18 standard deviation, - 6.91% was the minimum value while 7.6808% was the maximum value.

Regarding the estimated liquidity target ratios, ASEAN banks were found having target of NSFR and short term liquidity ratio (SHORT) on average at 1.49 and 64.17% respectively, fairly higher than observed (actual) NSFR ratio and almost two times the actual SHORT ratio. The descriptive statistics for other selected variables are presented in table 4.1.

ASEAN banks have often maintained actual ratios of NSFR and SHORT lower than the estimated target ratios as their mean values of ABOVE dummy variable revealed (only 0.1366 for ABOVE (NSFR) and 0.0641 for ABOVE(SHORT) with standard deviation at 0.3435 & 0.2450 respectively). In contrast, actual ratios of the other alternative liquidity measurements were often lower than their estimated target ratios: (0.7840, 0.8288, 0.9549, 0.8816 mean values for ABOVE(LTA), ABOVE(DTA), ABOVE(RSF), ABOVE(ASF) respectively).

The variation of observed -actual- and estimated target ratios discussed above has been reflected on the amounts and directions of the distance between liquidity actual and target

ratios as the mean values of the variable reveal. Since SHORT and ASF had pretty spaced actual and target ratios, their distance from the target ratio were higher (their mean values were: 0.3057 & -0.4178 respectively). The other variability measures are available in table 4.1.

Finally, the estimated speeds of adjustment λ reveal that ASEAN banks quickly adjust their short-term liquidity holdings as expected (mean of λ SHORT is 0.5637 with 0.1187 standard deviation, 0.1489 minimum and 0.7971 maximum λ). The mean value of NSFR's speed of adjustment was lower at 0.1614 which reflects the nature of NSFR as long-term liquidity measurement. The minimum λ NSFR is -0.2229 and 0.5919 is the maximum. The mean values of the others as follows: 0.0707, 0.4440, 0.1917, and 0.0990 for λ LTA, λ DTA, λ RSF, and λ ASF respectively. Regarding to the multicollinearity problems, the correlation matrix presented in table 4.2 shows that there is no multicollinearity issue among the explanatory variables where the all variables do not exceed 0.5 except the proxies of one variables which are not used together in one regression (proxies of liquidity or proxies of profitability).

Table 4. 1
Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max	Definition
NSFR	1,248	1.0894	0.4450	0.1339	2.4606	Available stable funding (ASF) divided by required stable funding (RSF)
SHORT	1,184	0.3381	0.1695	0.0685	0.8802	Liquid assets divided by deposits and short term debt
LTA	1,238	0.6429	0.1484	0.2170	0.8903	Loans to Total Assets
DTA	1,235	0.7340	0.1348	0.0840	0.9170	Deposits to Total Assets
RSF	1,245	0.6812	0.1101	0.3222	0.8405	Required stable funding to Total Assets
ASF	1,248	0.7298	0.2567	0.0697	0.9595	Available stable funding to Total Assets
TA	1,248	18,800,000	37,800,000	2,261	339,000,000	Total assets (USD millions)
lnASSETS	1,248	15.2758	1.9968	10.4070	19.1797	Natural logarithm of assets
EQUITY	1,246	0.1752	0.1462	0.0407	0.8674	Equity to total assets
LLRR	1,130	0.0456	0.0507	0.0011	0.3276	Loan loss reserves divided by gross loans
GROWTHPLAN	1,073	0.1670	0.1914	-0.1691	1.1740	The average growth of assets over the next 2 years
FUNDCOST	1,239	0.0466	0.0286	0.0069	0.1538	Interest rate expenses divided by total liabilities
GDP	1,740	0.0464	0.0381	-0.1313	0.1524	Annual real GDP growth
IRS	1,731	4.0392	2.1800	-6.9125	7.6808	Lending rate minus deposit rate
ROE	1,246	0.0626	0.1182	-0.5908	0.2964	Return on equity
ROA	1,247	0.0075	0.0207	-0.1346	0.0370	Return on assets

Table 4. 1 ***(continued)***
Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max	Definition
TR (NSFR)	1,162	1.4936	0.1484	1.0533	2.5082	Estimated target NSFR
TR (SHORT)	1,162	0.6417	0.0658	0.4293	0.8917	Estimated target SHORT
TR (LTA)	1,162	0.5265	0.0548	0.2914	0.7111	Estimated target LTA
TR (DTA)	1,162	0.6315	0.0531	0.4187	0.7986	Estimated target DTA
TR (RSF)	1,162	0.4165	0.0416	0.2667	0.6763	Estimated target RSF
TR (ASF)	1,162	0.3185	0.0502	0.1069	0.5957	Estimated target ASF
λ NSFR	1,071	0.1614	0.1171	-0.2229	0.5919	Estimated NSFR adjustment speed
λ SHORT	1,026	0.5637	0.1187	0.1489	0.7971	Estimated SHORT adjustment speed
λ LTA	1,063	0.0707	0.0434	-0.1205	0.1967	Estimated LTA adjustment speed
λ DTA	1,059	0.4440	0.0818	0.1115	0.5787	Estimated DTA adjustment speed
λ RSF	1,069	0.1917	0.0533	0.0233	0.3646	Estimated RSF adjustment speed
λ ASF	1,071	0.0990	0.0420	-0.0071	0.2495	Estimated ASF adjustment speed

Table 4. 1 ***(continued)***
Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max	Definition
ABOVE(NSFR)	1,157	0.1366	0.3435	0	1	=1 if NSFR actual ratio is higher than target ratio
ABOVE(SHORT)	1,108	0.0641	0.2450	0	1	=1 if SHORT actual ratio is higher than target ratio
ABOVE(LTA)	1,148	0.7840	0.4117	0	1	=1 if LTA actual ratio is higher than target ratio
ABOVE(DTA)	1,145	0.8288	0.3768	0	1	=1 if DTA actual ratio is higher than target ratio
ABOVE(RSF)	1,154	0.9549	0.2075	0	1	=1 if RSF actual ratio is higher than target ratio
ABOVE(ASF)	1,157	0.8816	0.3232	0	1	=1 if ASR actual ratio is higher than target ratio
GAP(NSFR)	1,157	0.3961	0.4321	-1.0689	2.0678	TR (NSFR) minus NSFR
GAP(SHORT)	1,108	0.3057	0.1763	-0.3535	0.7272	TR (SHORT) minus SHORT
GAP(LTA)	1,148	-0.1168	0.1554	-0.4461	0.4008	TR (LTA) minus LTA
GAP(DTA)	1,145	-0.1047	0.1494	-0.3972	0.6350	TR (DTA) minus DTA
GAP(RSF)	1,154	-0.2659	0.1161	-0.5274	0.2427	TR (RSF) minus RSF
GAP(ASF)	1,157	-0.4178	0.2530	-0.8140	0.4272	TR (ASF) minus ASF

Table 4. 2
Correlation Matrix

	NSFR	SHORT	LTA	DTA	INASSETS	EQUITY	LLRR	GROWTH	FUNDCOST	GDP	IRS	ROE	ROA	RSF	ASF
NSFR	1														
SHORT	0.5028	1													
LTA	-0.486	-0.884	1												
DTA	0.3283	-0.123	-0.031	1											
lnASSETS	-0.12	-0.1	0.1409	-0.114	1										
EQUITY	0.0013	0.2546	-0.005	-0.623	-0.178	1									
LLRR	0.116	0.2273	-0.343	-0.154	-0.151	0.1186	1								
GROWTH	-0.04	0.0168	0.0578	-0.009	-0.265	0.1106	-0.105	1							
FUNDCOST	0.1163	0.1364	-0.159	0.1805	-0.58	-0.023	0.111	0.1252	1						
GDP	-0.064	0.0167	0.0028	-0.111	-0.009	0.0594	-0.169	-0.002	-0.281	1					
IRS	0.2376	-0.013	0.0362	0.1316	-0.216	0.06	-0.139	0.058	-0.028	0.256	1				
ROE	0.0754	0.1346	-0.072	-0.003	0.0835	-0.001	-0.328	0.0588	-0.195	0.2269	0.0646	1			
ROA	0.0868	0.1409	-0.022	-0.155	0.0994	0.2138	-0.425	-0.064	-0.299	0.3196	0.235	0.7415	1		
RSF	-0.456	-0.846	0.7924	-0.13	0.0655	0.037	-0.1	-0.024	-0.182	-0.033	0.0179	-0.17	-0.107	1	
ASF	0.816	0.0544	-0.078	0.3607	-0.118	-0.006	0.0068	-0.046	0.0229	-0.1	0.2873	0.0319	0.0805	0.0631	1

4.3 The Estimated Liquidity Targets

The first stage of this study's model is to examine whether ASEAN banks do have liquidity targets, if so, how quickly they adjust their liquidity toward target levels? And what are the determinants of these liquidity targets? The answers of these questions are obtained by estimating equation (8) (given in the third chapter) using GMM estimation technique. Table 4.3 displays the results of equation (8) for the two proxies of bank liquidity: NSFR and short-term liquidity ratio (SHORT).

Starting with the diagnostic tests of the regression, table 4.3 reports Arellano-Bond test for zero autocorrelation in first-differenced errors, AR1 and AR2 examine the null hypothesis of error terms autocorrelation in the first order and the second order respectively. Since differenced form of the equation is used, so by construction error term is probably serially correlated at level 1 (AR1). AR2 detects the autocorrelation in levels, so it is the most important. Table 4.3 shows that the p-values of AR2 for both regressions (NSFR & SHORT) suggest that there is no autocorrelation and the error terms are not serially correlated at levels, accordingly, the null hypothesis cannot be rejected. Table 4.3 also reports Wald chi2 test, p-value for both regressions is less than 0.01, accordingly, the null hypothesis (which states that all coefficients of the determinants of liquidity target are jointly equal to zero) is rejected.

To answer the first question of this study, the coefficient of the lagged dependent variables ($AR_{i,t-1}$) are indicating the speed of adjusting the dependent variables (which are the proxies for bank liquidity holding ratios), and the significance of the coefficients confirm

the existence of bank liquidity targets among ASEAN banks. As reported in table 4.3, coefficients of the lagged dependent variable $(AR_{i,t-1})$ for both proxies are significant at 1%. The average estimated liquidity target for NSFR is 1.4936, and it is 0.6417 for short-term liquidity ratio (SHORT). Both are higher than the average value of 1.0894 for NSFR, 0.3381 for SHORT in the row data.

For the second question of this study, the adjustment speeds are calculated by subtracting the estimated coefficient δ_0 from 1 ($\lambda = 1 - \delta_0$). The findings reveal that ASEAN banks adjust their NSFR quicker than their SHORT, maybe because of the high value of estimated target or due to the lower importance given by banks to short-term liquidity ratio comparing to NSFR that is more difficult to adjust and then, banks pay more attention to adjust NSFR than SHORT which can be adjusted easier. The adjustment speed for NSFR is 0.406 as reported in the table 4.3, meaning that ASEAN banks close 40.6% of the gap between their observed value of NSFR and their target NSFR within one year. At this rate of adjustment and assuming that all other conditions are unchanged; it would take 4.42 years[1] to close 90% of the estimated NSFR gap. Table 4.3 also shows that SHORT's adjustment speed is 0.366, meaning that ASEAN banks close 36.6% of the estimated SHORT gap (SHORT distance from its target) in the course of a year. At this rate of adjustment and assuming that all other conditions are unchanged; it would take around 5 years[2] to close 90% of the estimated SHORT gap.

[1] Following DeYoung and Jang (2016) it is calculated using: $(1 - 0.406)^x = 0.10$
[2] Following DeYoung and Jang (2016) it is calculated using: $(1 - 0.366)^x = 0.10$

The NSFR's estimated adjustment speed of ASEAN banks (40.6%) is so far higher than the 13.31% NSFR's estimated adjustment speed of US banks found by (DeYoung & Jang, 2016). That means ASEAN banks are more active in managing their liquidity than US banks. Regarding to SHORT's estimated speed of adjustment, (to the best of the researcher knowledge) there is no previous study has estimated the speed of adjustment by using the short-term liquidity ratio. Based on the findings reported and discussed above, the first two hypotheses H1a and H1b are accepted.

4.4 Determinants of Liquidity Targets

This section presents and discusses the empirical findings of the model that examine the impact of bank and country specific factors on the banks' liquidity targets. Table 4.3 shows that the relationship between bank size and the target NSFR. The coefficient reported indicates that the liquidity of bank in the long-term horizon is positively related with the bank' size, while it is negatively related with the target SHORT (which represents the liquidity of bank in the short-term horizon). Both are significant at 10% level. These results reveal that ASEAN large banks more likely are setting higher NSFR and lower SHORT as the coefficients are 0.0247 and -0.0128 for NSFR and SHORT respectively. Based on the annual data, a doubling of bank size leads NSFR target to increase by an estimated 2.27%[3] while SHORT target decreases by an estimated 3.8%[4].

[3] (0.0247/1.0894) yields this result.
[4] (0.0128/0.3381) yields this result.

This positive relationship found between bank size and the target NSFR contrasts the findings of DeYoung and Jang (2016) who found a negative relationship, while the negative relationship between bank size and the target SHORT is consist with their findings and other studies such as (Cucinelli, 2013; Kashyap, Rajan, & Stein, 2002; Kashyap & Stein, 1995, 2000; Singh & Sharma, 2016). Based on these results, hypotheses H2a H2b are accepted.

In terms of the bank capital, Table 4.3 shows that bank capital is negatively associated with the NSFR target at 1% statistical significance level. On the other hand, the relationship between bank capital and the SHORT target was found insignificant. This implied that banks are setting lower NSFR targets as equity capital increase. Having a coefficient of (-0.246) and based on the annual data, a one percent (100 basis point) increase in the equity to assets ratio is associated with an estimated 0.2258%5 (22.58 basis point) decrease in NSFR. Although equity is one of the elements that consists the numerator of NSFR, but it seems that banks tend to have more long term and illiquid asset when they maintain higher proportion of equity. These result also contrasts with (DeYoung & Jang, 2016), but it is in line a theoretical view states that high level of capitalization enhance banks' ability to manage risks leading to maintain lower liquidity holdings (Bhattacharya & Thakor, 1993; Repullo, 2004; von Thadden, 2004). Thus, hypotheses H3a is accepted while H3b is rejected.

Furthermore, Table 4.3 shows that asset quality (measured by the Loan Loss Reserve Ratio (LLRR) has consistently negative and significant relationship with target liquidity for both

[5] (0.0247/1.0894) yields this result.

proxies NSFR and SHORT. It is significant at 5% for NSFR and at 10% for SHORT. This implied that banks with high level of LLRR (which indicates the deterioration of asset quality) more likely are setting higher liquidity targets of NSFR and SHORT. Based on the annual data, a one percent (100 basis point) increase in the LLRR ratio is associated with an estimated 0.4323%6 (43.23 basis point) increase in NSFR and an estimated 0.5472%7 (54.72 basis point) increase in SHORT. These results are in line with Roman and Sargu (2015) and Vodová (2011) who found a negative link between bank liquidity and its assets quality. Based on the findings mentioned above, hypotheses H4a and H4b are accepted.

Table 4.3 also shows that bank growth plan (GROWTH) has consistently positive significant relationship with target liquidity for both proxies NSFR and SHORT. It is significant at 10% and 5% level for NSFR and SHORT, respectively. These results implied that ASEAN banks that have growth plan are setting higher liquidity targets of NSFR and SHORT. Based on the annual data, a one percent (100 basis point) increase in bank growth plan (GROWTH) is associated with an estimated 0.0896%[8] (8.96 basis point) increase in NSFR and an estimated 0.1822%[9] (18.22 basis point) increase in SHORT. Based on the findings, hypothesis H5a and H5b are accepted.

Additionally, Table 4.3 shows that bank cost of fund has a positive significant relationship with target liquidity of NSFR at 1% degree of significance, but the relationship with SHORT was found insignificant. This implied that ASEAN banks with high level of fund

[6] (0.471/1.0894) yields this result.
[7] (0.185/0.3381) yields this result.
[8] (0.0976/1.0894) yields this result.
[9] (0.0616/0.3381) yields this result.

cost more likely are setting higher liquidity targets of NSFR. Based on these results, hypothesis H6a is accepted but H6b is rejected.

For the country-specific factors, Table 4.3 shows that the coefficient of GDP that represents the economic condition is insignificant with target liquidity of both NSFR and SHORT, while interest rate spread (IRS), in turn, is found to have a positive impact on the target of NSFR at 1% degree of significance, but the relationship with SHORT was found insignificant. These findings implied that ASEAN banks tend to maintain higher level of NSFR when interest rate spread goes up. Based on the annual data, a one percent (100 basis point) increase interest rate spread (IRS) is associated with an estimated 0.0186%10 (1.86 basis point) increase in NSFR. These results is in line with Acharya and Naqvi (2012) and Gatev and Strahan (2006). Based on these findings, hypothesis H7a, H7b, and H8b are rejected, while H8a is accepted.

[10] (0.0203/1.0894) yields this result.

Table 4. 3

Adjustment Speed and Determinants of Target Liquidity

	NSFR	SHORT
$AR_{i,t-1}$	0.594***	0.634***
	(16.14)	(20.06)
$\ln ASSETS_{i,t-1}$	0.0247*	-0.0128*
	(1.75)	(-1.89)
$EQUITY_{i,t-1}$	-0.246***	-0.0125
	(-4.21)	(-0.43)
$LLRR_{i,t-1}$	0.471**	0.185*
	(2.25)	(1.69)
$GROWTH_{i,t-1}$	0.0976*	0.0616**
	(1.90)	(2.34)
$FUNDCOST_{i,t-1}$	1.252***	-0.152
	(2.58)	(-0.65)
$GDP_{i,t-1}$	-0.102	0.0882
	(-0.41)	(0.79)
$IRS_{i,t-1}$	0.0203***	-0.00199
	(2.74)	(-0.58)
CONSTANT	-0.0541	0.317***
	(-0.22)	(2.62)
Target ratios	1.493607	0.641666
Actual ratios	**1.089374**	**0.338095**
λ (adjustment speed)	0.406***	0.366***
	(16.14)	(20.06)
AR 1	-4.8935***	-4.5253***
AR2	.80838	.36265
Wald chi2	355.72***	572.74***
N	975	929

Partial adjustment model for NSFR and short-term liquidity ratio (SHORT), using annual data cover 20 years (1996-2015) for ASEAN-6 countries. The table displays results of equation (8) using GMM estimation method. All variables are winsorized at the 1st and 99th percentiles. $AR_{i,t-1}$ is the lagged DV. lnASSETS is the natural logarithm of total assets. EQUITY is the total equity to total assets. LLRR is the ratio of loan loss reserves to gross loans. GROWTH is the average growth of assets over the next two years. FUNDCOST is the ratio of interest rate expenses to total liabilities. GDP is the annual growth of GDP. IRS is the interest rate spread (lending rate minus deposit rate). Coefficients marks ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

4.5 Determinants of Liquidity Adjustment Speed

In this section, the findings of the second stage are reported and discussed. This stage is to achieve the fourth objective which is examining the determinants of ASEAN banks' liquidity adjustment speed after calculating the individual speed of adjustment for each bank at each year using the outcome of the first stage (as explained in chapter 3). The results in this stage are obtained by estimating equation (11) using OLS estimation technique. Table 4.4 displays the results of equation (11) for the two proxies of bank liquidity (NSFR and short-term liquidity ratio (SHORT)).

Starting with the diagnostic tests of the regression, table 4.4 reports F-stat test whereas the null hypothesis states that all coefficients of the determinants of speed of adjustment are jointly equal to zero. Table 4.4 shows that the P-value for both regressions are less than 0.01 and significant at 1% level. This means that the null hypothesis is rejected which confirms the overall validity of regressions. Table 4.4 also reports R-squared that was 0.1052 in NSFR regression and 0.1344 in SHORT regression. This result suggests that 10.52% of the changes in banks' speed of adjustment for NSFR, and 13.44% of the changes in banks' speed of adjustment for SHORT are explained by variables used in this model.

Table 4.4 also shows that the mean values of bank specific estimated speed of adjustment λ which is 16.1% for NSFR and 56.4% for SHORT. Regarding the mean value of estimated speeds of adjustment, for the SHORT it seems to be somewhat consistent with the constrained adjustment speed calculated in GMM regression (first stage) as an average for

all banks in the sample, while for NSFR it is much lower than the constrained adjustment speed calculated in GMM regression (first stage).

Table 4.4 reports that the relationship between liquidity distance from target level and bank specific adjustment speed is consistently positive and statistically significant at 1% for both NSFR and SHORT. This means that 1% increase in liquidity distance from target level (GAP) increases bank specific liquidity speed of adjustment by an estimated 1.5%[11] for NSFR, and by 1.01%[12] for SHORT. Thus, the hypothesis of H9a and H9b are accepted. Regarding the bank size, it is found that the impact of bank size on speed of adjustment speed is negatively significant for SHORT but it is insignificant for NSFR as presented in table 4.4. This implied that larger banks have slightly slower speed of adjustment as a doubling of asset size is associated with a 4.08%[13] reduction speed of adjusting SHORT's. Based on these results, the developed hypothesis H10b is accepted but H10a is rejected.

Regarding the impact of the economic condition on banks' speed of adjusting toward their liquidity, a negative relationship was found for both proxies. it is found that the coefficient of NSFR is significant at 10% significant level and at 5% for SHORT. This implied that an increase of real GDP growth by 1% would lead bank specific liquidity speed of adjustment to decreases by an estimated 2.94%[14] for NSFR, and 0.88%[15] for SHORT. These results support the two hypotheses H11a and H11b. the dummy variable that captures the impact

[11] (0.241/0.161) yields this result.
[12] (0.570/0.564) yields this result.
[13] (0.0230/0.564) yields this result.
[14] (0.474/0.161) yields this result.
[15] (0.497/0.564) yields this result.

of being above the liquidity target on speed of adjustment is found insignificant for the two proxies, this mean that hypotheses H12b and H12a are rejected. Lastly, table 4.4 reports that stresses of financial crises negatively influence banks' speed of adjustment for both proxies (NSFR and SHORT). This means that the two hypotheses H13a and H13b are accepted.

Table 4. 4

Adjustment Speed Estimation

	Δ NSFR	***Δ SHORT***
$GAP_{i,t-1}$	0.241***	0.570***
	-2.65	-7.39
$lnASSETS_{i,t-1} * GAP_{i,t-1}$	-0.00131	-0.0230***
	(-0.22)	(-5.21)
$GDP_{i,t-1} * GAP_{i,t-1}$	-0.474*	-0.497**
	(-1.85)	(-2.33)
$ABOVE_{i,t-1} * GAP_{i,t-1}$	0.00299	0.0606
	-0.04	-0.59
$CRISIS_{i,t-1} * GAP_{i,t-1}$	-0.111***	-0.0385*
	(-3.65)	(-1.86)
CONSTANT	-0.0615***	-0.0567***
	(-5.33)	(-8.44)
Mean estimated λ	0.161	0.564
N	1101	1041
F-stat	25.75***	32.15***
R-squared	0.1052	0.1344

Partial adjustment model for NSFR and short-term liquidity ratio (SHORT), using annual data cover 20 years (1996-2015) for ASEAN-6 countries. The table displays results of equation (11) using ordinary least squares (OLS) estimation method. All variables at are winsorized the 1st and 99th percentiles. GAP is the distance between actual and target ratios. lnASSETS is the natural logarithm of total assets. GDP is the annual growth of GDP. ABOVE =1 if ratio actual is higher than target ratio. CRISES =1 at 2008&2009. Coefficients marks ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

4.6 The Impact of Speeds of Adjustment on Banks' Financial Performance

In this section, the findings of the last stage is reported and discussed where the impact of speeds of adjustment on ASEAN banks' profitability is examined. Following DeYoung and Jang (2016), ordinary least squares (OLS) is used to answer the fifth objective of this study.

Tables 4.5 and 4.6 report the impact of speed of adjustment on banks' profitability represented by two proxies (ROE and ROA) for both NSFR and SHORT, respectively. P-values for all regressions are less than 0.01 and significant at 1% significance level. This means that the null hypotheses are rejected which confirms the overall validity of all regressions. For the NSFR, R-squared are 0.0947 to 0.1035 for the ROE model and ROA model, respectively. For the SHORT, R-squared are 0.1376 to 0.1335 for the ROE model and ROA model, respectively

For NSFR, Table 4.5 shows a consistently negative relationship between NSFR's speed of adjustment and banks' profitability in both models. The coefficient of λ NSFR is statistically significant at 1% for both profitability proxies (ROE and ROA). But the coefficients of λ^2 NSFR were found insignificant. Regarding the control variables, bank size was found positively significant at 5% level with the bank profitability for both models (ROE and ROA). On the other side, bank equity ratio and loan loss reserve ratio have found significantly negative with the bank's profitability where the coefficients of both bank equity ratio and loan loss reserve ratio are significant at 1% for both profitability proxies (ROE and ROA).

For the SHORT, table 4.6 shows a significant negative relationship between SHORT's speed of adjustment and banks' profitability in the two models (ROE and ROA). The coefficients of λ SHORT were statistically significant at 1% for both profitability proxies (ROE and ROA). On the flip side of coin, coefficients of λ^2 SHORT is only positively significant with ROA and insignificant with ROE. Regarding the control variables, bank size has a found positively significant with the bank profitability at 1% significant for both ROE and ROA. On the other side, bank equity ratio and loan loss reserve ratio have found negatively significant with the bank's profitability and the coefficients of bank equity ratio and loan loss reserve ratio are significant at 1% for both profitability proxies (ROE and ROA). Based on the findings reported on Tables 4.5 and 4.96, the two hypotheses H14a and H14b are accepted.

Table 4. 5

The Impact of NSFR's Speeds of Adjustment on Banks' Financial Performance

	ROE	**ROA**
λNSFR	-0.222***	-0.0326***
	(-3.10)	(-2.66)
λ^2NSFR	0.129	-0.0126
	(0.72)	(-0.41)
$\text{lnASSETS}_{i,t-1}$	0.00509**	0.000845**
	(2.40)	(2.32)
$\text{EQUITY}_{i,t-1}$	-0.111***	-0.0185***
	(-3.94)	(-3.82)
$\text{LLRR}_{i,t-1}$	-0.456***	-0.0748***
	(-6.27)	(-5.99)
CONSTANT	0.0535	0.00660
	(1.58)	(1.13)
F-stat	20.39***	22.49***
R-squared	0.0947	0.1035
Adjusted R-squared	0.0901	0.0989
N	980	980

Banks' profitability with respect to speed of adjustment for NSFR using annual data cover 20 years (1996-2015) for ASEAN-6 countries. The table displays results of equation (12) using ordinary least squares (OLS) estimation method. All variables at are winsorized the 1st and 99th percentiles. λNSFR is the estimated speed of adjustment for NSFR from stage 2. lnASSETS is the natural logarithm of total assets. EQUITY is the total equity to total assets. LLRR is the ratio of loan loss reserves to gross loans. Coefficients marks ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4. 6

The Impact of SHORT's Speeds of Adjustment on Banks' Financial Performance

	ROE	**ROA**
λSHORT	-0.686***	-0.162***
	(-2.77)	(-4.08)
λ^2SHORT	0.333	0.100***
	(1.47)	(2.76)
$\ln ASSETS_{i,t-1}$	0.0150***	0.00262***
	(5.94)	(6.44)
$EQUITY_{i,t-1}$	-0.208***	-0.0267***
	(-7.04)	(-5.62)
$LLRR_{i,t-1}$	-0.472***	-0.0814***
	(-6.29)	(-6.75)
CONSTANT	0.165**	0.0343***
	(2.18)	(2.83)
F-stat	30.25***	29.22***
R-squared	0.1376	0.1335
Adjusted R-squared	0.1331	0.1290
N	954	954

Banks' profitability with respect to speed of adjustment for short-term liquidity ratio (SHORT) using annual data cover 20 years (1996-2015) for ASEAN-6 countries. The table displays results of equation (12) using ordinary least squares (OLS) estimation method. All variables at are winsorized the 1st and 99th percentiles. λSHORT is the estimated speed of adjustment for short-term liquidity ratio (SHORT) from stage 2. lnASSETS is the natural logarithm of total assets. EQUITY is the total equity to total assets. LLRR is the ratio of loan loss reserves to gross loans. Coefficients marks ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

4.7 Robustness Tests

In this section, robustness tests are employed to confirm the findings of this study. In the first test, four different measurements (loans to assets ratio (LTA), Deposits to assets ratio (DTA), required stable funding to assets ratio (RSF) and available stable funding to assets ratio (ASF)) are used to provide more comprehensive analysis of bank liquidity management.

Table 4.1 depicts descriptive statistics of these liquidity proxies as follows: 0.6429 mean, 0.1484 standard deviation, 0.2170 minimum value and 0. 8903maximum value for loans to assets ratio (LTA). 0.7340 mean, 0.1348 standard deviation, 0.0840minimum value and 0. 9170 maximum value for deposits to assets ratio (DTA). 0.6812 mean, 0.1101 standard deviation, 0.3222 minimum value and 0. 8405 maximum value for required stable funding to assets ratio (RSF). 0.7298 mean, 0.2567 standard deviation, 0.0697 minimum value and 0.9595 maximum value for available stable funding to assets ratio (ASF). The mean values of these proxies' estimated target ratio (LTA, DTA, RSF, ASF) were quite lower than their actual value with: 0.5267, 0.6315, 0.4165 and 0.3185 respectively. Regarding to the gap between actual and target ratios, these measurements had the following mean values: GAP(NSFR) 0.3961, 0.3057, GAP(LTA) -0.1168, GAP(DTA) -0.1047, GAP(RSF) -0.2659.

Table 4.7 presents the results of examining the determinants and the adjustment speeds of each measurement. The results show that p-values of AR2 for all regressions and this implies that there is no autocorrelation and the error terms are not serially correlated at

levels. Accordingly, the null hypotheses cannot be rejected. Table 4.7 also reports the Wald chi2 test where the p-value in all regressions are less than 0.01. Accordingly, the null hypotheses (which states that all coefficients of the determinants of liquidity target are jointly equal to zero) are rejected. Based on Table 4.7, the coefficients of the lagged dependent variable $(AR_{i,t-1})$ for all proxies used are significant at 1% which confirms the existence of bank liquidity targets among ASEAN banks. This confirms that our results found are maintained and robust. As reported in table 4.7, the average estimated liquidity targets are as follows: 52.65% for LTA, 63.15% for DTA, 41.65% for RSF, and 31.85% for ASF. All these ratios are consistent with the ratios of NSFR and SHORT where these ratios are lower the actual ratio (the mean values that are taken from row data) (64.29% for LTA, 73.40% for DTA, 68.12% for RSF, and 72.98% for ASF).

These adjustment speed for these four alternative measurements of liquidity (52.65% for LTA, 63.15% for DTA, 41.65% for RSF, and 31.85% for ASF) imply that generally ASEAN banks adjust their target ratios.

Regarding the determinants of liquidity targets, table 4.7 shows that the results found by using the four measurements are almost similar to the findings found for the NSFR and SHORT. These results are supporting the findings found for the NSFR and SHORT where only the GDP variable was insignificant in all models. The other variables have found significantly related with the four alternative measurements and this in line with the findings of NSFR and SHORT measures.

Table 4. 7

Adjustment Speed and Determinants of Target Liquidity (Robustness tests for four different measurements)

	LTA	**DTA**	**RSF**	**ASF**
$AR_{i,t-1}$	0.702***	0.555***	0.610***	0.613***
	(19.49)	(14.46)	(15.74)	(13.58)
$\text{lnASSETS}_{i,t-1}$	0.00796	0.0134**	-0.00679*	-0.00445
	(1.60)	(2.52)	(-1.73)	(-0.62)
$\text{EQUITY}_{i,t-1}$	0.00361	0.0789***	0.0265	-0.118***
	(0.17)	(3.23)	(1.59)	(-3.94)
$\text{LLRR}_{i,t-1}$	-0.138*	-0.0255	-0.0699	0.0203
	(-1.83)	(-0.29)	(-1.13)	(0.19)
$\text{GROWTH}_{i,t-1}$	-0.0316*	-0.0190	-0.0595***	0.0236
	(-1.68)	(-1.00)	(-4.04)	(0.88)
$\text{FUNDCOST}_{i,t-1}$	-0.00880	0.378**	-0.227*	0.0920
	(-0.05)	(2.00)	(-1.70)	(0.36)
$\text{GDP}_{i,t-1}$	0.134	-0.130	0.0000924	-0.182
	(1.57)	(-1.50)	(0.00)	(-1.40)
$\text{IRS}_{i,t-1}$	0.00394	0.00803***	-0.00728***	0.00389
	(1.54)	(2.60)	(-3.62)	(0.96)
_cons	0.0569	0.0678	0.424***	0.372***
	(0.64)	(0.68)	(5.71)	(2.93)
Target ratios	0.526511	0.6315246	0.416495	0.31849
Actual ratios	**0.642934**	**0.7339772**	**0.681221**	**0.729752**
	0.298***	0.445***	0.39***	0.387***
λ (adjustment speed)	-19.49	-14.46	-15.74	-13.58
AR 1	-5.0408***	-2.2375**	-4.3225***	-4.2978***
AR2	1.3352	1.3904	0.77664	0.21908
Wald chi2	634.13***	280.50***	319.67***	223.30***
N	973	965	972	975

Partial adjustment model for the alternative liquidity measurements, using annual data cover 20 years (1996-2015) for ASEAN-6 countries. The table displays results of equation (8) using GMM estimation method. All variables are winsorized at the 1st and 99th percentiles. LTA is the ratio of loans to total assets. DTA is the ratio of deposits to total assets. RSF is the ratio of required stable funding to total assets. ASF is the ratio of Available stable funding to total assets. $AR_{i,t-1}$ is the lagged DV. lnASSETS is the natural logarithm of total assets. EQUITY is the total equity to total assets. LLRR is the ratio of loan loss reserves to gross loans. GROWTH is the average growth of assets over the next two years. FUNDCOST is the ratio of interest rate expenses to total liabilities. GDP is the annual growth of GDP. IRS is the interest rate spread (lending rate minus deposit rate). Coefficients marks ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

Another robustness test is made to confirm that the results regarding examining the determinants of ASEAN banks' liquidity adjustment speed are valid. Using OLS

estimation technique for the four alternative measures (LTA, DTA, RSF and ASF), the P-values as shown in Table 4.8 for all regressions are less than 0.01 and significant at 1% level. This means that the null hypotheses are rejected which confirm the overall validity of all regressions. Table 4.8 also reports that R-squared values were as follows: 0.098 for LTA, 0.1293 for DTA, 0.1597 for RSF, and 0.1094 for ASF. These are considered acceptable for all regression models

Table 4.8 show that the mean values of bank specific estimated speed of adjustment λ toward target ratio for the four proxies. This implies that ASEAN banks adjust their DTA faster than the other ratios. It is worthy to highlight that the mean values of estimated speeds of adjustment for LTA and DTA are consistent with the constrained adjustment speed calculated in GMM regressions (first stage) as an average for all banks in the sample, but the mean values of estimated speed of adjustment for RSF and ASF are much lower than the constrained adjustment speed calculated in GMM regressions (first stage). These results somehow are consistent with the findings of NSFR and SHORT measures.

Table 4. 8

Adjustment Speed Estimation (Robustness tests for four different measurements)

	Δ LTA	***Δ DTA***	***Δ RSF***	***Δ ASF***
$GAP_{i,t-1}$	0.238**	0.0108	0.526***	0.247*
	-2.31	-0.11	-4.72	-1.91
$lnASSETS_{i,t-1} * GAP_{i,t-1}$	-0.00368	0.0151**	-0.00661**	0.003
	(-0.62)	-2.4	(-2.19)	-0.65
$GDP_{i,t-1} * GAP_{i,t-1}$	-0.694**	0.839**	-0.501***	0.304
	(-2.14)	-2.02	(-2.95)	-0.86
$ABOVE_{i,t-1} * GAP_{i,t-1}$	-0.00573	-0.206***	-0.210*	-0.149
	(-0.11)	(-4.75)	(-1.92)	(-1.24)
$CRISIS_{i,t-1} * GAP_{i,t-1}$	0.0118	-0.0114	-0.0201	-0.0508**
	-0.38	(-0.32)	(-1.25)	(-2.15)
CONSTANT	0.0205***	0.00566	0.0508***	0.0679***
	-4.79	-1.42	-9.94	-4.73
Mean estimated λ	0.071	0.444	0.192	0.099
N	1091	1084	1097	1101
R-squared	0.098	0.1293	0.1597	0.1094

Partial adjustment model for LTA, DTA, RSF and ASF, using annual data cover 20 years (1996-2015) for ASEAN-6 countries. The table displays results of equation (11) using ordinary least squares (OLS) estimation method. All variables at are winsorized the 1st and 99th percentiles. GAP is the distance between actual and target ratios. lnASSETS is the natural logarithm of total assets. GDP is the annual growth of GDP. ABOVE =1 if ratio actual is higher than target ratio. CRISES =1 at 2008&2009. Coefficients marks ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The structure of this final chapter is organized as follows: Section 5.2 presents a summary of this study. Subsequently, in section 5.3, implications of the study are explained in relation to various parties concerned. Lastly, limitations of the study are discussed, leading to some suggestions and recommendations for future research.

5.2 Summary of the Study

The main aim of study is to examine whether ASEAN banks manage their liquidity or not. if so, how effective the liquidity risk has been managed. Two liquidity measurements were sed, the first one is NSFR which indicates banks' long-term liquidity buffer and the second one is the short-term liquidity ratio. A research framework consists of three stages in order to achieve the five objectives of this study.

The first stage uses partial adjustment model and GMM estimation in order to achieve the first three objectives of this study. The first objective is to examine whether ASEAN banks do have liquidity target ratios which can be observed through the lagged dependent variable that indicates banks' speed of adjusting liquidity ratios, the significance of lagged dependent variable's coefficient confirms the existence of bank liquidity targets. Results of partial adjustment model show that the coefficients of the lagged dependent variable $(AR_{i,t-1})$ for both liquidity proxies examined by the study are significant at 1%

significance level. The average estimated liquidity target for NSFR is 1.4936, and it is 0.6417 for short-term liquidity ratio (SHORT). These findings are in line with DeYoung and Jang (2016), they confirm that ASEAN banks do have liquidity targets.

The second objective is to estimate the speed of adjustment of ASEAN banks towards their liquidity target ratios. The findings reveal that ASEAN banks adjust their NSFR quicker than their SHORT, maybe because of the high value of estimated target or due to the lower importance given by banks to short-term liquidity ratio comparing to NSFR that is more difficult to adjust and then, banks pay more attention to adjust NSFR than SHORT which can be adjusted easier. The adjustment speed for NSFR is 0.406 and 0.366 for SHORT.

Third objective was also obtained using GMM estimation method. It aims to examine what are the determinants of banks' liquidity target ratios. A set of bank specific and macroeconomic factors are used in this study to examine their impact on banks' liquidity buffers. These factors are bank size, capital, assets quality, growth plan, cost of funding, economic condition, and interest rate spread. The results reveal that the liquidity of bank in the long-term horizon is positively related with the bank' size, while it is negatively related with the target SHORT (which represents the liquidity of bank in the short-term horizon).

Bank capital was found negatively related with NSFR target at 1% statistical significance level but the impact on SHORT target was found insignificant. This means that banks are setting lower NSFR targets as equity capital increase. Although equity is one of the elements that consists the numerator of NSFR, but it seems that banks tend to have more

long term and illiquid asset when they maintain higher proportion of equity. Results reveal that asset quality has consistently negative and significant relationship with target liquidity for both proxies NSFR and SHORT. On contrasts, bank growth plan (GROWTH) was found positively significant with target liquidity for both proxies NSFR and SHORT. The last bank specific character used in the model is the bank funding cost which was found positively related with the target liquidity of NSFR at 1% degree of significance, but the relationship with SHORT was found insignificant.

For the country-specific factors, results reveal that economic condition does not affect target liquidity either NSFR or SHORT. However, interest rate spread was found to have a positive impact on the target of NSFR at 1% degree of significance, but the relationship with SHORT was found insignificant. Table 5.1 summarizes the hypotheses testing results for first stage which achieves the first three objectives.

The second stage uses OLS estimation technique to achieve the fourth objective of the study which examines the determinants of ASEAN banks' liquidity adjustment speed after calculating the individual speed of adjustment for each bank at each year using the outcome of the first stage. Results of this stage reveal that liquidity distance from target level (GAP) positively affects bank specific adjustment speed (statistically significant at 1% for both NSFR and SHORT). Three factors were found negatively related with bank specific adjustment speed toward liquidity target. These factors are bank size, GDP growth, and financial crises. The coefficient of the dummy variable (when banks have NSFR and SHORT above the target levels) was found insignificant.

Table 5. 1

Hypotheses Testing Results for First Stage

H1a	ASEAN commercial banks converge towards NSFR	Accepted
H1b	ASEAN commercial banks converge towards SHORT	Accepted
H2a	bank size has a significant relationship with NSFR	Accepted
H2b	bank size has a significant relationship with short term liquidity ratio	Accepted
H3a	Bank capital has a significant relationship with NSFR	Accepted
H3b	Bank capital has a significant relationship with short term liquidity ratio	Rejected
H4a	Quality of bank assets has a significant relationship with NSFR	Accepted
H4b	Quality of bank assets has a significant relationship with short-term liquidity ratio	Accepted
H5a	Bank's growth plan has a significant relationship with NSFR	Accepted
H5b	Bank's growth plan has a significant relationship with the short-term liquidity ratio	Accepted
H6a	Bank's funding cost has a significant relationship with NSFR	Accepted
H6b	Bank's funding cost has a significant relationship with short-term liquidity ratio	Rejected
H7a	GDP real growth has a relationship with NSFR	Rejected
H7b	GDP real growth has a relationship with short-term liquidity ratio	Rejected
H8a	Interest rate spread has a significant relationship with NSFR	Accepted
H8b	Interest rate spread has a significant relationship with short-term liquidity ratio	Rejected

Finally, third stage achieves the fifth objective which investigates the impact of speeds of adjustment toward liquidity target (as an indicator of the effectiveness of bank liquidity management) on banks' financial performance. Interestingly, results of this stage suggest that liquidity's speeds of adjustment negatively affect banks' profitability. Table 5.2 summarizes the hypotheses testing results for second and third stages which achieve the fourth and fifth objectives.

Table 5. 2
Hypotheses Testing Results for Second and third Stages

H9a	Distance between liquidity actual ratio and target ratio has a significant relationship with NSFR's speed of adjustment	Accepted
H9b	Distance between liquidity actual ratio and target ratio has a significant relationship with short term liquidity ratio's speed of adjustment	Accepted
H10a	Bank size has a significant relationship with NSFR's speed of adjustment.	Rejected
H10b	Bank size has a significant relationship with short term liquidity ratio's speed of adjustment.	Accepted
H11a	GDP real growth has a significant relationship with NSFR's speed of adjustment.	Accepted
H11b	GDP real growth has a significant relationship with short term liquidity ratio's speed of adjustment.	Accepted
H12a	Banks that are operating above their targets quickly adjust their long-term liquidity targets.	Rejected
H12b	Banks that are operating above their targets quickly adjust their short-term liquidity targets.	Rejected
H13a	Stresses of financial crises have a significant relationship with NSFR's speed of adjustment.	Accepted
H13b	Stresses of financial crises have a significant relationship with short term liquidity ratio's speed of adjustment.	Accepted
H14a	NSFR's speed of adjustment has a significant relationship with bank's profitability	Accepted
H14b	SHORT's speed of adjustment has a significant relationship with bank's profitability	Accepted

5.3 Implications of the Study

Several implications can be provided as a result of this study. The implications are divided into theoretical and practical. For the theoretical implications, this study has contributed to the banking liquidity risk literature by providing results at the two levels of liquidity (long-term liquidity and short-term liquidity); and by providing cross-country evidence namely six-ASEAN countries. Importantly, this study makes a valuable contribution to the banking literature by estimating the speed of adjustment toward liquidity targets which is still largely untouched area of research. Another theoretical implication is the support this study provides to the proposition of being banks do manage their liquidity and have speed of adjustment.

In terms of practical implication, the results of this study provide empirical evidence about the factors that affect the speed of adjustment toward liquidity ratios among banks and how the speed of adjustment is influencing the banks' profitability. The empirical evidence suggests that adjusting liquidity has some cost that make the adjustment speed negatively links with banks' profitability. The findings of this study provide useful information for the policy makers in ASEAN countries to better understanding of ASEAN banks behavior of liquidity management which could help them to cope with challenges of enhancing the integration of ASEAN financial sectors as projected to be achieved at 2025.

In addition, it is important for banks managers to understand what are the factors that affect liquidity target and the speed of adjustment toward liquidity target, and more importantly to what extent adjusting liquidity buffers is costly.

5.4 Limitations and Recommendations for Future Studies

One of the limitations of this study is the data sampling especially with regards to the use of longer time period or the inclusion of all banks including unlisted banks that their data are not available in Thomson Reuters' database "DataStream" as such data provide a more robust model structure. Thus, it is recommended that future studies should include unlisted and foreign banks and extend to other developing regions.

Another issue is the differences among countries. Countries differ in term of economic, regulations, banking behavior and the degree of sophistication of financial sector. Therefore, it is suggested for future studies to consider these differences, and even to provide analysis for each country separately.

Another limitation is the inability to get detailed information in order to calculate the proposed NSFR and LCR (liquidity coverage ratio). Regarding historical data, this limitation cannot be resolved since the disclosure of such information was limited to bank insiders. However, NSFR can be calculated as approximation while LCR cannot be found using historical information. To avoid this problem, normal short-term liquidity ratio was used to examine bank short-term liquidity behavior.

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