The Relationship between Liquidity Risk and Performance: An Empirical Study of Banks in Europe 2005-2010

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Abstract

Recent financial shocks have generated a lot of debates over the issue of liquidity risk and strategies to mitigate its effects on financial institutions, particularly banks as majors’ players in the funding liquidity markets. The topic is controversial as contradictory views from different researchers have not reached any consensus. With this at hand, the purpose of this research is to investigate whether there is any relationship between liquidity risk and banks performance in the Eurozone area during the periods 2005-2010.

We have selected a sample of 12 banks from the EUROSTOXX index based on their market capitalization from different countries in the Eurozone. We explored their websites for an apprehension of their half year financial reports from 2005-2010. For a clearer understanding of the analysis, we have used loan to assets, loan to deposit and cash position as liquidity risk ratios, and for measuring banks performance we have used Return on Assets, Return on Equity, Net Profit Margin and Net Interest Margin as profitability ratios while Debt to Asset and Debt Leverage were used as stability (Risk & Solvency) ratios. Descriptive statistics were performed to explain the behavioral pattern of liquidity position for each bank and their performance ratios.

We have used the regression analysis to test for the dependency and correlation. We applied the test-statistics to estimate the coefficients to find out if there exists any relationship between liquidity risk indicators and bank performance measures with results significant at the 5% level. We equally used F-test as a combined tests statistics to analyze the variance with results significant at the 5% level.

Results reveal that there is potential statistical evidence to infer that there is a linear relationship between Debt Leverage, Debt to Asset and liquidity risk indicators, contrary to the results of bank profitability ratios which F-values disclose mixed effect relationship with some ratios positively related to liquidity risk indicators while others displaying a negative relationship.

Based on this mixed effect relationship, we cannot firmly conclude that there exist a relationship between liquidity risk indicators and bank performance measures.
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List of Abbreviations.

ANL: Available Net Liquidity
BIS: Bank of International Settlements.
BCBS: Basel Committee of Banking Supervision
ECB: European Central Bank.
EU: European Union.
DIF: Deposit Insurance Fund.
DNS: Deferred Net Settlement.
IAS: International Accounting Standards.
GAAP: Generally Accepted Accounting Principles.
LLR: Lender of Last Resort.
LLR: License Liability Rating.
NSFR: Net Stable Funding Ratio.
RTGS: Real Time Gross Settlement.
VAR: Value at Risk.
Chapter 1 Introduction

This chapter presents the background of this thesis aiming to understand the impact of liquidity risk on performance of banks before and during crisis in Europe. It is structured by discussion of problems, knowledge gap, research questions and purpose. At the end of this chapter, limitations, disposition and definitions will be presented.

1.1 Background

In recent years, European banking system has become progressively integrated and liberalized on the path to greater product and service deregulation. (Altunbas, Carbo, Gardener & Molyneux (2007, p. 49-50) outlines that progressive process of financial integration has enhanced competition and emphasized needs of improved efficiency within the banking sector, which leads to an incentive of greater bank risk taking and eventual exposure; adversely, regulators have tried to offset these incentives by giving capital adequacy a more prominent role in the banking regulatory process. As a result, most European banks act cautiously to boast their capitalization due to pressures from both regulatory and market sides.

Bank liquidity refers to the bank’s ability to match its deposit withdrawals and pay off liabilities as they become due. Toby (2006, p. 56, 57) argues that some depositors write cheques while others make lodgement, which implies under normal conditions with appropriate contingency planning, net deposit withdrawal or the issuance of loan commitment poses few liquidity problems for banks due to fund availability or excess reserve that are adequate to meet unanticipated needs.

Banks are often concerned to be within the centre of systemic risks. With the tremor of the financial meltdown still reverberating around the world, changes to the regulatory landscape are firmly underway to secure the path to stability. But while these regulatory reforms still on the blueprint; one particular issue has caused serious influences within the banking industry, which is called liquidity risk. (Ford 2009, p. 45) points out that back to when liquidity was abundant in the economy, banks were less concerned where liquidity was coming from, and loans to investors was simply upon presentation of the cash flow statement. Banks were required only to put their liquidity gap actively into time lines such as overnight, one month, two months, which was reported to the central bank on quarterly basis.

The turbulence in the credits and funding markets since the summer 2007 is a sufficient evidence that liquidity risk management in the banking system has been less effective than expected. According to the Financial Stability Review (FRS 2008), investors appear to have acquired risks, which they did not fully understand that major financial institutions were not able to manage these risks so much as transferring them into their own business lines resulting in an unintended concentration of risks on their own balance sheet.
The turmoil demonstrated the great importance of effective liquidity risk management practices and high liquidity buffers may contribute to ensure institutional and systemic resilience in the face of shocks. According to Molitor (2008, p.7), improvements such as strengthening prudential oversight of capital, enhancing transparency and valuation in financial reports, changes in the role, employment of credit rating agencies and robust arrangement for dealing with stress testing will help stabilize the financial system.

The Euro system framework requires banks to hold a certain level of reserve in their current account with the Central Bank, according to the ECB report, this requirement has to fulfil on average during maintenance period of approximate one month. In pre-turmoil years, banks were indifferent as to the days on which they actually held reserve of the central bank, liquidity on one day was a quasi-perfect substitute for liquidity with another day. Thus, the aggregate demand of central liquidity was smooth over time, hence achieving an automatic stabilization of money market interest rate.

The global financial crisis has reinforced the pre-existing beliefs in the weaknesses of the Basel 2 accord. Moosa (2010, p.95) argues that capital based regulation and the Basel style capital regulation cannot deal with financial crisis and more attentions should be anchored to liquidity and leverage. The accord is criticized in view of what happened during the crisis for allowing the use of bank internal models to determine capital charges for boosting procyclicality of the banking industry for reliance on rating agencies and for being an exclusionary, discriminatory and a one size fits of all approaches.

During the financial crisis, the EU spent more than 3 trillion Euros for their banks bailout plan against different financial risks. Around 2.3 trillion went to financial guarantee schemes, 300billions for recapitalization schemes and around 400 billion went for other rescue and restructuring programs until April 2009 according to Bloomberg report. For commercial banks in Europe, Anglo Irish Bank bailout was over 29 billion also with other two Irish banks needed huge bailout funds from the government such as AIB and Irish Nationwide, other commercial banks in Greece, Portugal, Italy and Spain also faced the same situation and required billions of Euros for their bailout. After this incidence, EU finally realized the consequences of inefficient liquidity risk management if proper attention is not paid on liquidity issues.

The Euro zone operational framework has been the most difficult test since the turmoil started. According to the European Central Bank (ECB 2009) report, turnover declined substantially and spread between interest rate on secured and unsecured lending went up to an unprecedented level. As a result, banks with liquidity needs could no longer rely on interbank market from funding, while other banks kept large liquidity buffers in their current accounts with the central bank and make use of the deposit facility.

“Widespread concern over bank funding following regulatory changes in Europe have been dissipated, but there will be wide variation in the bank performance over the coming years as funding cost are set to diverge to a much larger degree than has been
the case”. According to the Financial News\textsuperscript{1}, European banking sector is currently 20\% undervalued with top banks still have about 1.4 trillion euro of senior wholesale funding due in 2011-2013, meaning that a further capital market shock could affect bank’s activities and profitability.

1.2 Problem discussion

After introducing the background of this study, we move to further discuss some of the research problems which have been outlined in connection to this study.

Banks offer a menu of contracts to depositors and loans to firms which are intended to suit with expected liquidity needs of agent. In the study of impacts of liquidity constraints on bank lending policy, Webb (2000, p.70,71) points out that in an advent of poor information of liquidity risk management from a bank, depositors of fund will choose to withdraw a greater portion or even all of their deposits, causing liquidity shortfall, which banks will be unable to generate sufficient financing to embark on profitable projects and consequently affect performance ratios such as assets turnover and return on equity.

Another study on impacts of liquidity risk on performance, by Greubing&Bratonovic (2003,p.168) reveals that liquidity risk management lies at the core centre of confidence in the banking system that banks are highly leveraged institutions with a ratio of assets to core (Tier 1) capital within the region of 20:1 as such the importance of liquidity transcends the individual institution, which implies that liquidity short fall at a single institution can have severe system wide repercussion.

Moreover a research on the determinants of commercial banks interest margins and profitability by Demirguc&Huizinga (1999, p.4) reveals that disparities in the banks activities mix also have implications on banks performance. Banks that rely largely on depositors for funding are less profitable hence low assets utilizations. Also, banks with more highly liquid assets in their balance sheets hence have low interest margin.

Recent research related to liquidity risk management reckons that managing liquidity risk requires banks to have sufficient liquidity to meet up with depositors and investors demand of funds. That bank creates liquidity by transforming illiquid loans into demand deposit which is given to investors in the forms of credits lines and loans commitment to invest in the markets of securities hence creating markets liquidity. Ford (2009, p.46, 47) argues that stress testing in analyzing the future possibility of liquidity exposure, management oversight and contingency planning will help to mitigate the liquidity risk and ensure stability in the system.

\textsuperscript{1} www.efinanncenews.com
1.3 Knowledge gap

Most studies we found focused on the management aspect of liquidity risk and possible strategies to mitigate its impact on the financial system. So far, little research has been done on the implications of liquidity risk indicators on banks performance in Europe particularly in the period before and during the financial crash. It clearly appears that the impact of liquidity risk is increasing and that shareholders are concerned by its relationship with financial performance. There is a need for more knowledge about this relationship in order to help both bankers and investors to analyse the risk.

In this study we have used 12 banks holding majority of the banking section assets within the Euro STOXX indexes as such contribution of this research will provide empirical evidence of the impact of liquidity risk on bank performance. In future other researchers could build on our findings in performing similar studies within the Euro framework with larger sample and using different time horizon.

1.4 Research question

Given that despite all the efforts devoted to mitigate the liquidity risk, the overall economic and financial situation is still fraught with risk of future possible instability, it therefore becomes imperative that we ask this question:

What is the impact of liquidity risk on performance of banks before and during crisis in Europe?

1.5 Purpose of the study and contribution

The primordial purpose of this study is to provide empirical evidence on the impact of liquidity risk on performance of banks before and during crisis in Europe.

Given that the recent financial turmoil has been attributed to defective liquidity risk management practices by financial institutions, the target groups we expect this study to benefit are:

- Regulatory authorities and policymakers
- Investors
- Other interested parties.

Ideally, banks are responsible for sound management of liquidity risk, this study will help listed banks to establish a more robust liquidity risk management framework that ensures it maintains sufficient liquidity position, high quality liquid assets to withstand a range of stress events, it will equally provide an insight for bank management for a better understanding of the liquidity risk variables that could impact on performance measurement.
As for the supervisors and policymakers, this study will help to assess the adequacy of both bank liquidity risk management framework and its liquidity position and take prompt action if the bank is deficient in either area in order to protect depositors and to limit damage in the system.

Given that investors (stockholders and bonds holders) usually exhibit great interest in the management of their portfolio, this study will serve as a benchmark in understanding the different liquidity risk ratios and how they can affect their investment in periods of high liquidity and liquidity runs.

Others interested parties (customers) will grasp an understanding of what constitute bank liquidity risk management and the implication of their day to day transaction on the bank profitability during normal period and in time of liquidity runs.

1.6 Limitations

The aim of this research is to investigate the impact of liquidity risk on bank performance in Europe, knowing that Europe is a continent, the geographical area that we esteem necessary to limit this study will be mostly Euro Union. Given that liquidity markets horizon is wide with many markets participants actively taking part, we will limit this study only with public traded banks within EURO STOXX\(^2\) super sector indices represented EU listed banks as the main financial intermediaries between lenders and borrowers and the central banks as the main regulatory authority.

Since this index is built up with the largest capital banks in EU, which implies it cannot be well represented with liquidity risk management methods with large amount of EU listed banks, but it should be a concrete evidence for impacts on performance from whole listed banks sector of EU, since impacts from liquidity risk of those largest banks are much more significant than smaller banks.

At last, with different financial reporting style (IFRS mostly) and qualifications (qualifications of information disclosure) from different banks, not all listed banks from STOXX index can be applied within this study, we select banks with clear liquidity risk information disclosure, which can be used to common ratio approaches base on the study, even these ratios approaches may not be the best for liquidity or performance measurement with each single listed company. The study will cover a 6 years period, during which we will establish a relationship between liquidity risk ratios and performance measurement in normal period and in time of crisis.

\(^2\) To represent the largest Euro zone companies in each of the 19 super sectors as defined by the Industry Classification Benchmark (ICB). It covers Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain, which Derived from the Euro zone subset of the STOXX Europe 600 Index, which comprises the 600 largest European stocks by free float market capitalization.
1.7 Disposition

This section provides a holistic view of the thesis. It comprises six chapters; the first chapter introduces the background of this study followed with the problem statement, research question and purpose of the study. Chapter 2 discusses the choice of this study, different philosophical assumptions associated to this study, the research approach research strategy and the research design. Chapter 3 presents theoretical background and related studies in conjunction to liquidity risk and banks performance. Chapter 4 presents the data collection and analysis. Chapter 5 presents the results of all empirical findings. Chapter 6 provides a discussion of analysis, recommendations, theoretical and practical contributions, truth criteria and limitations and suggestions for future studies.

1.8 Selected definitions

Liquidity: Kroszner (2008, p.161) defines liquidity as the ability to fund increase in marketable securities and meet obligations as they become due.

Liquidity risk: the Banque de France Financial stability Report (BFFSR,p.47) refers to liquidity risk as the inability of the bank to manage its liquidity position in order to cover mismatch between future cash outflow and cash inflow.

Liquidity risk management: VandersVossen&Vaness (2010,p.3) defines liquidity risk management as the ability of bank to own sufficient liquidity or cash to meet up with unexpected demand from depositors so that bank can continue to perform its duties.

Demand and Terms deposit: demand deposit can be referred to as an account from which withdrawal can be made at any time without prior notice to the bank. During deposit term, banks and depositors agree on predetermining a date for the deposit to be withdrawn. (Diamond&Rajan (2005, p.616) finds out that by issuing demand deposit in large quantity, the bank ties it collection to the loan it has made.

Credit lines& Terms loans: Agarwal et,al (2006,p.3) refers to credits lines as variable rate debts in which the bank commit to provide a fixed amount to the borrower who pays interest only on the sum drawn against commitment, while term loan is to finance long term investment with a fixed and variable rate.

Central bank liquidity: the European Central Bank (ECB 2009) defines central bank liquidity as the flow of monetary base from the central bank to the financial system.

Liquidity market: the BFFSR (2008) defines liquidity market as the bank ability to carry on large transactions in a way that adjusts portfolio and risk without disruption in the basic underlying price.
Liquidity funding: the Basel committee on banking defines funding liquidity as the ability of banks to meet their liabilities, unwind or settle their position as they become due.

Capital adequacy: according to Mui et,al (2010,p.3) capital adequacy is referred as the ability to raise capital level in view of ensuring that sufficient liquidity position is maintained during stress periods.

Monetary policy: according to the Economic Times “Monetary policy is a tool used by the central bank to manage money supply in the economy in order to achieve desirable growth”.
Chapter 2 Methodology

Here we will discuss reasons of doing this study and preconceptions, the research philosophy that underpins this study to be investigated and the appropriate approach used in answering the research question, the research strategy & design, secondary data and criticism of secondary data. This will provide a better understanding of the progress with this thesis and the approach for designing the theoretical framework.

2.1 Choice of study and preconceptions

Taking into consideration that this is a master level thesis and that we are preparing the final examination of business studies at Umea University, we believe to have acquired in-depth knowledge within the field of business and administration specifically in finance. Prior knowledge in the research area has enhanced the interpretation of information and contributes to deeper understanding of this subject. However our career prospects and the present financial meltdown that is still reverberating around the business globe motivated the choice of this study. Holding strong that we are not a European citizen and coupled with the fact that we are not in possession of any prior professional experiences in banking; we believe that sample selection, data collection, analysis and interpretation of results will not contain any biasness in this study.

2.2 Research philosophy

This section is designed to provide the readers with knowledge about the authors’ point of view and position with respect to fundamental questions regarding the extent to which knowledge is viewed and the nature of reality. Saunders & al (2009, p.108) notes that the research philosophy chosen contains important assumptions about the manner in which the world is viewed. These assumptions will support the research strategy and method of data collection.

However, social science research is based on two research philosophies (ontology and epistemology) that are undistinguishable from each other. Ontology is concerned with the nature of reality and raises questions of the assumptions that researchers have about the way the world operates and commitment held on certain views. Saunders et, al (2009, p.110) mentions two distinct characteristics that constitute aspect of ontology, which are objectivism and subjectivism. The underlying argument that supports objectivism is that social entities exist in reality external to social actors concerned about their existence. On the other hand, subjectivism argues that social phenomena are the resultant from the perception and consequent actions of those social actors concerned with their existences.

According to Saunders & al (2009, p.110-116), epistemology is focused on what constitutes acceptable knowledge in a field of study. Core aspects that constitute epistemology include positivism and interpretivism. Positivism view argues that only
knowledge built on real facts or resources is considered as real knowledge. This implies that only phenomena which can be observed lead to the generation of credible data. With the interpretivism, it is assumed that knowledge is built on the feelings and attitudes that cannot be seen. It stresses on the necessity for researcher to understand the difference between human beings with their roles as social constructs and how reality depends on people’s interpretation of their social world.

In this study, the authors are confronted to the positivism stance of what constitutes acceptable knowledge and the objectivism approach when it comes to nature of reality. Since liquidity issues involve a chain of objective management that begins from the central bank to commercial banks governed by some regulations, which are interconnected to each other with different classes of management reporting to their hierarchy, we decide to adhere to the objectivism stance. In addition, this study require the authors to generate theory, which could lead to hypotheses testing and subsequent design of strategy as well as collection of data to test the hypotheses, we find it important to adhere with the positivist view, which emphasizes on the application of existing theories to develop hypotheses and it will be tested at the end, confirmed or rejected based on the results from later analysis.

2.3 Research approach

Social science research involves the application of theories and the extent to which these are explicitly outlined at the beginning of the research, will determine the approach that best suit the study under investigation. Saunders et, al (2009, p 124,126) points out two fundamental approaches that are widely used in social science research, which are deductive and inductive approach. With the deductive approach, theories and hypothesis are developed and a research strategy is designed to test hypotheses. On the other hand, inductive approach owes to the fact that data collection will lead to the development of theories based on the result from the data analysis.

However, in this study we have selected the deductive approach to be the most suitable. Since we are investigating the impact of liquidity risk on banks performance, this approach will help to establish the causal relationship between variables, which are liquidity risk ratios and performance measurement that will be subjected for analysis in order to accept or reject the hypotheses that we have developed.

2.4 Research strategy

Business and management research strategies can be categorized into two methods: qualitative and quantitative. The qualitative approach is based on non-numerical narratives that are often associated with subjectivism and interpretivism paradigms. McEvoy & Richards (2006, p.67) argues that qualitative methods place much emphasis upon the manner in which the world is socially constructed and understood. It incorporates a wide range of philosophical perspective that embeds symbolic interactionism, phenomenology, ethnomethodology and hermeneutics. The Research
strategies include focus group; unstructured interview ethnographic and case study research are typically related to this method.

Quantitative methods on the other hand, embody standardized measures and statistical techniques which usually are associated with positivism and objectivism assumptions. Saunders et.al (2009, p.144) outlines that quantitative research method allows for large amount of data to be collected which can be analysed using descriptive and inferential statistics, which can further be used to establish causal relationship between variables and to produce models of theses relationship. Subjects are chosen using simple random sampling techniques which aim at eliminating biasness and generalization are made from the sample to a wider population. Associated with the quantitative method is the survey strategy.

In conjunction with this study, the research strategy that will be applied is quantitative method, which is an empirical study that requires authors to generate theories and develop hypotheses that will be subject for testing. Also, we will employ the deductive approach to answer the research question mentioned above in the introductory chapter, which implies a large amount of data need to be collected from a sampling of banks and further tested to confirm or reject our hypotheses.

2.5 Research design.

A research design provides a framework for the collection and analysis of data. Bryman & Bell (2011, p.40,41) argue that the choice of a given research design provide decision about the priority being given to a range of dimension of the research. It represents a structure that serves as guideline for the methods used to collect data and the analysis of the subsequent data. The research design is vital in both descriptive and explanatory research and it is not tied to a particular set of data.

According to Saunders et, al (2009,p.136), it is the research design that determines the choice of method to be used .in compliance with this study, research design of this paper is aimed at defining which sector in the economy we intend to study, source of data, the method used to collect data and the analysis of data. However, since the purpose of this study is to answer the question of what is the impact of liquidity risk on bank performance in Europe, the researchers will employ quantitative data from websites of top listed banks in Europe. Based on their half year financial reports, data will be analysed by establishing a relationship between liquidity risk variables and performance measurement variables.
2.6 Selection of theories

Since in this study, authors discussed a deductive approach, it is extremely important to generate appropriate theories as they set the guideline for the development of hypotheses.

“The word liquidity has so many facets that is always counter-productive to use it without further and closer definition” by Charles Goodhart (BdF 2008).

The theory of liquidity transcends from the central bank liquidity to the market liquidity and finally to the funding liquidity. The first, deals with the liquidity supplied by the central bank, the second related to the ability to trade in the interbank market and the third related to the ability of bank to fund their positions (ECB 2009). The CB’s liquidity strategy determines the monetary stance, which implies that it decides on the level of operational target (policy rate) and uses its monetary policy instruments (open market operation) to influence the liquidity in the money market so that interbank lending rate aligns to the operational policy rate set by the operational monetary stance.

The theories selected for this study are based mainly on two major objectives:

- Firstly, it will present the liquidity management policy and strategy by the European Central Bank and establish a linkage of liquidity issues between central bank and commercial banks.
- Secondly, it will explore the liquidity risk management in commercial bank, the Basel accord regarding regulatory capital requirement and the related ratios to liquidity issues in the banking section performance in pre-crisis and during crisis.

Nevertheless, most of the articles used in this thesis are scientific articles, which come from the database Business Source Premier at the library of Umea University. Only few articles were found by Google Scholar, which original source was confirmed in the database. Hard copies of books were accessed at the library through the site. Emerald full texts along with other eBooks were found. However, we found a large volume of articles on liquidity issues but we had to restrict my selection to articles that we esteem particularly relevant, interesting and reliable to the subjects we intent to investigate. As such we used several combinations of keys words such as liquidity management, liquidity risk, liquidity risk management, liquidity risk in banks, risk management and bank performance, performance ratios and analysis, the European Central Bank and monetary policy, the Basel accords.

This choice of articles were published in well reputable scientific journals, which ensure a high reliability and credibility of this study and offer optimal toolkit for data collection and empirical analysis for answering the research question.
2.7 Secondary data and sources

In order to efficiently carry out a scholarly work, it is important to decide on how to collect data. Generally there are two types of data: primary and secondary data. Primary data are raw data that can be collected using questionnaire and structured interview where standardized questions are asked to all interviewees. One of the biggest pullbacks with this method is usually delay in the research process as a result of dependency on others for information. Secondary data on the other hand are existing data that can be retrieved from existing literature; internet, books, magazine, and newspaper depending on the subject area one intend to investigate.

In light with this study of the relationship of liquidity risk and banks performance in Europe, we will use the secondary data; reason being that adequate information concerning banking market prices as well as their statement of financial position can be quoted easily from their websites. We start by identifying the largest publicly traded banks in the Euro zone, based on their market capitalization and locations, since large bank groups hold a large majority of banking system assets and they are more actively engaged in commitment lending than small retail banks.

The numerical data such as ratios that will be obtained by computing the respective variables concerned with the liquidity ratios and performance measurement in the financial reports of bank constitute the empirical inputs for testing hypotheses. We will explore the websites of the banks and quoted investors relations, where we will be able to access their half a year financial reports.

2.8 Criticism of sources of secondary data.

The majority of the scholarly articles being used have all been peer previewed and published in reputable journal, which provide a high quality of credibility of this study. Nevertheless, there is always the possibility that the authors of the scientific articles might influence the content of their work with own perception of the matter concern which could have a negative effect on the objectivity. Best (1970) argues that secondary source of data are usually of limited worth, because errors might result in the course of passing information from one person to another. Being aware of this risk, this study stands to keep objective side of the information with authors’ endeavour.

Similarly, the data used to test the hypotheses comes from the banks financial reports, whose content and transparency are governed by highly established rules and regulations thus a strong evidence of credibility of their reports as a source, but shall be notified that these rules and regulations does not cover all the risks of incorrect information given that there might be some beautifications in their reports in order to attract potential investors.
Chapter 3 Theoretical Framework

The theoretical framework is divided into four parts. As this research is still ongoing and developing after financial crisis, we found that it is necessary to make it breakdown for providing a more structured chapter. The first part includes a deeper understanding of liquidity and liquidity management. In the second one, we analyse specific issues related to liquidity risk and liquidity risk management. In the third section, we will present existing practices on how to implement these issues into liquidity risk management, with measurements or indicators. The chapter ends with how to measure bank’s performance concern with liquidity issues.

3.1 Theoretical introduction

This part aims to provide a deeper knowledge and understanding on liquidity and liquidity management in central bank. It is necessary to understand the liquidity management in central bank before looking how it could be implemented into banking section regulations.

3.1.1 Liquidity

According to the financial stability review from Banque de France (2008), liquidity is defined as the ease with which value can be realized from the sales of assets. Value can be realized by using credit worthiness to acquire funds from external markets or through the sales of assets in the market place. Also liquidity can be easily understood as a measure of how likely a bank will meet its short or long term obligations, such as will a bank able to settle its liabilities on time?

From the market point of view, liquidity means:

- The degree of which an asset or security can be bought or sold in the market without affecting their prices. Hereby, assets which can be bought or sold easily are known as liquid assets.

- The ability to change assets to cash easily is called "marketability".

Expected and unexpected obligations can be met with liquidity issues during daily business operations, while business should be operated uninterrupted. With insufficient cash resources, business operating can be damaged; more importantly, it could be confronted to severe financial distress of whole economy with serious liquidity constrain in banking system. Therefore, liquidity could be a vital element of financial management and must be managed with caution.
3.1.2 Liquidity elements and theory of management in ECB

According to the ECB (2001), short term money market rates play a very important role in the transmission of monetary policy. The CB guides short term money market rates by signalling its monetary policy and managing the liquidity situation in the money market.

As suggested by Poole (1986), payment uncertainties are a necessary condition for a demand for working balances. For instance, theoretically, a world made by perfectly efficient banks, interbank markets and payment systems without relevant uncertainty regarding to payment flows would arise, in which there would be no demand for working balances. In contrast, reserve requirements are settled by the CB and there are two fundamentally different approaches needs to be differentiated in the liquidity management practice of CB with depending on which of these two factors dominates the demand of reserves. The Euro system and the Bank of England provide extreme examples:

In the Euro zone, banks have to fulfil reserve requirements on average over a reserve maintenance period of a month. The aggregate reserve requirements are substantial; it was around EUR 130 billion in 2003. Short term fluctuations of actual reserves from the banking system rarely push the actual reserves on any days since the introduction of the euro in 1999. In such a framework, the logic of the ECB’s liquidity management in the money market has been described for instance by Binseil & Seitz (2001, p.11) as: “The ECB attempts to provide liquidity through its open market operations in a way that, after taking into account the effects of autonomous liquidity factors, counterparties can fulfil their reserve requirements”. If the ECB provides more(less) liquidity than this benchmark, then counterparties need to use on aggregate the deposit (marginal lending) facility.

According to ECB (2002, pp. 41,54), the demand and supply of liquidity are the interaction between the Euro system’s monetary policy operations; and the euro area. Credit institutions can be illustrated by the consolidated balance sheet of Euro system, which is published on a weekly basis. Also quoted from Binseil (2000, p.4): “CB liquidity management refers to the shortest end of implementation of monetary policy, and assumes that the only channel of “communication” between the macro-economy and liquidity management is the operational target rate of the CB”. For the ECB, liquidity management takes place within a framework of operation, and the choice of the operational framework is from the preceded of existence of environments. A theory of liquidity management has clearly distinguished between these different categories. While the theory outlined in this section concentrated on the liquidity management problem, but it is worth listing the main elements of the operational framework briefly from the bank’s consolidated balance. There are mainly two elements of the environment affecting the optimal choice of the operational framework and the liquidity management strategy in ECB (2002, pp. 51,54)
The concept of a liquidity management strategy of the CB refers to the implementation of monetary policy (Binseil, 2000, p.5). It reflects the idea that there are some systematic elements for each liquidity management approach and if all these systematic components related to the liquidity management decisions of the CB to specific “information”, then variables are defined as the strategy, and the residual component of the actual liquidity management behaviour should be non-correlated (orthogonal) to those information variables. Specifically, the liquidity management strategy of a CB consists of several interrelated sub-elements, namely:

- The liquidity provision through open market operations;
- The choice of instruments and procedures in the different open market operations (e.g. outright versus reverse operations, fixed versus variable rate tenders, etc.);
- Further elements of the information policy (e.g. publishing or not autonomous factor forecasts).

What should the CB follow when specifying its implementation of monetary policy (operational framework and liquidity management strategy), as the function of all relevant environmental parameters? The “Framework Report” by the European Monetary Institute (1997, p. 14) discussed the reason and general principles that should guide both selections of the operational framework and liquidity management strategy. The discussion in the Framework Report may be summarized in the following three aims: The operational framework and the liquidity management strategy, should aim at:

- Enabling to control short term interest rates;
- Allowing to be able to give signals of monetary policy intentions (and therefore to influence other rates along the yield curve);
- Generating simple, transparent and cost-efficient arrangements, which include a preference for a low frequency of monetary policy operations.

### 3.2 Problem with liquidity risk and liquidity risk management

This part will build a bridge between liquidity issues from central bank to commercial banks and discuss issues that are common within liquidity risk and liquidity risk management. Mostly why and how could managing liquidity risks in the banking section. The discussion takes it one step closer to fully understand the complexity of liquidity issues and how CB could and commercial banks can play their role for their liquidity risk management solutions. At the end, it will present several calculations and ratios concerned with liquidity ratio in single banks within the liquidity risk management framework.
3.2.1 Regulation of commercial banks’ liquidity by central bank

After a general discussion of why banks need liquid reserves since financial and inter-bank markets may sometimes be insufficient to cover their short term financing needs from last section, another question should be asked “why regulation is needed? Liquidity regulations can be justified in such ways, since they are a complement to the Licensee Liability Rating (LLR) facility. Regulations limit the need for emergency liquidity assistance when an individual bank is in trouble; meanwhile, it is also helpful during banking crises or case of economic shocks, since it limits the need for a generalized bailout. It is especially to the case of the commitment problem from governments who typically feel inclined to interference ex-post during a banking crisis. For limit this government intendency, liquidity requirements should be conditioned on the bank’s exposure to economic shocks (Rochet, 2004, p.93). In further study, Rochet again (2008) indicates that uniform liquidity requirements could be replaced by more flexible systems, where the liquidity requirement maybe more or less stringent according to the bank’s solvency and / or to simple measures of bank’s exposure to several types of macroeconomic shocks, deducted for example from VAR(value at risk) calculations under different scenarios.

From the study of Holmstrom & Tirole (1998), it shows that the private solution can be sufficient if there are no aggregate shocks. However a purely private solution is likely to be relatively complex for implementation. It would consist in requiring banks to build pools of liquidity and to sign multilateral commitments from credit lines, specifying clearly the conditions under which an illiquid bank would be allowed to draw on its credit line? By contrast, CB’s emergency liquidity assistance is probably simpler to be organized, but may be intended to forbearance under political pressure. However, some form of government intervention is needed due to the possibility of economic shocks in any case. The issue here is to avoid excessive intervention, such as ex-post bailouts of insolvent banks.

Finally, it should be noticed that systemic risk in payment systems and inter-bank markets could be eliminated altogether if the CB decided to insure inter-bank transactions and payments finality against credit risk. This system was implicitly in place in many countries during most of the last century. Thus the only logical explanation for the recent movement towards RTGSs and limitation of LLR interventions is that banking authorities want to promote peer monitoring by banks. However, Rochet & Tirole (1996) shows that the effective implementation of peer monitoring among banks may be difficult, due to commitment problems by governments. Liquidity requirements may be a useful way to mitigate these commitment problems.

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3 Lender-of-last-resort
3.2.2 Liquidity risk

After the financial crisis in 2007, liquidity risk has been widely discussed worldwide since most of the banks and corporations have suffered during this crisis badly especially with the liquidity constriction. For this reason, liquidity risk again has been put on the table of whole banking section.

Liquidity risk as one of the major risk from bank, it arises if the cushion provided by the liquid assets is not sufficient to cover its obligation. In such a situation, bank has to fund their liquidity requirements from market. However, conditions of funding through market highly relied on liquidity in the market and borrowing institution. Accordingly, shortage of liquidity from an institution may have to undertake transaction with heavy cost resulting in a loss of earning or it could result in bankruptcy if it is unable to undertake transaction even at current market prices for the worst case.

In finance, liquidity risk may not be seen as isolated since all financial risks are not mutually exclusive and liquidity risk often caused by other financial risks such as credit risk, market risk, etc. For instance, a bank increases its credit risk through assets may increase its liquidity risk as well. Similarly, a large loan default can adversely impact a bank’s liquidity position. It will be discussed more in the next section.

Liquidity and solvency are the heavenly twins of banking (Charles, 2008 p.1), frequently indistinguishable. An illiquid bank can rapidly become insolvent, and an insolvent bank illiquid. When the Basel Committee on banking supervision was first founded in 1975, the Chairman, George Blunder tried to underpin the capital and liquidity adequacy performance of the main international commercial banks. It turned prior downwards trend of bank’s capital ratios back up. Later on, the idea of liquidity risk management was brought to Basel Committee in the 1980s, but it failed to reach an agreement after all. In the note of Tim Congdon (2007) mentioned that liquidity assets were typically 30 percent of British clearing banks’ total assets, and these largely consisted of T-bills and short term government debt and it is about 0.5 percent of traditional liquidity assets in the asset account of commercial banks right now.

3.2.3 Sources of liquidity risks in banks

For a better understanding of these problems, we need to take a close look of the sources of liquidity risk in banks. On the liability side, there is obviously a large uncertainty on the amount of withdrawals of deposits or the renewal of rolled-over inter-bank loans. This is especially so when the bank is under suspicion of insolvency, when there is an aggregate liquidity shortage or when the economy suffers from a macroeconomic shock.

On the assets side, there is also some uncertainty on the volume of new requests for loans that a bank will receive in the future. For sure, the bank could refuse to grant these new loans, but it would lead to the loss of profit opportunities. It could also be detrimental to the borrowing firm if it is credit rationed, and more general to the
economy as a whole: it needs to be clear that banks are unique providers of liquidity to small and medium size enterprises, which constitute and important fraction of the private sector. This credit rationing would be especially costly if the firm is forced to close down, possibly resulting in additional losses for the bank itself.

Off-balance sheet operations are a third source of liquidity risk for banks. For example, credit lines and other commitments. Furthermore, the formidable positions taken by banks on derivative markets can generate huge liquidity needs during crisis period (Rochet, 2008).

The last source of liquidity risk comes from large payment of inter-banks, for which CB facilitate the use of RTGSs over DNSs (deferred net settlement), since they are less liable to systemic risk. However, RGTSs are highly liquid and can only function correctly if banks hold sufficient amount of collateral with its credit lines, either from the CB or other participants. The failure of large sample of participants with a large value from payment system could lead a big disruption to the financial system. Even a liquidity shortage due to a temporary shut off in the payment activity of large bank which could have dramatic consequences. This creates a “too big to fail” issue since it is likely that CB would be forced to intervene in such a situation. To avoid or simply to mitigate such problems, ex-ante regulation of the liquidity of large participants in RTGSs seems warranted.

3.2.4 Instruments for liquidity risk management

Unlike 50 years ago, banks can manage their liquidity by some other instruments beside cash reserves. The most important is still government securities, which can be used as collateral for borrowing stable liquidity most of the time. Also with marketable securities and inter-bank deposits, which can be sold easily in principle, but they could lose liquidity under adverse conditions. Besides, being aware of the impact of liquidity risk can help to enhance strong prudential measures. (Froot & Stein, 1998).

3.2.5 Market issues caused by liquidity management in reality

As banks’ role, to screen and monitor their borrowers creates an opaqueness of their assets as argued by Morgan (2002), these assets are difficult to evaluate by external analysts. The opaqueness generates possibilities of moral hazard, within the form of insufficient effort by banks for monitoring their operations. The corporate finance theory (Tirole, 2006,p.3,8) has shown that in such situation, liquidity needs are insufficiently covered by financial markets. Following by Rochet (2008), institutional arrangements can solve this market failure. For example, private contractual arrangements such as pools of liquidity accompanied with inter-bank credit lines commitments can be used to mitigate the inefficiency. It could be a substitute to emergency liquidity assistance by the CB for the case of the absence of aggregate shocks.
Moreover, opaqueness of banks’ assets also creates an externality between lenders on the inter-bank markets, payment system participants, or between uninsured depositors (Rochet, 2008). The decision to renew a short term inter-bank loan, a debit cap on a large value payment system or a wholesale deposit depends not only on fundamental uncertainty but also with strategic uncertainty. Such a consequence mentioned in the study by Freixas (2000), liquidity requirement can be a way to limit systemic risk with a strategic uncertainty on the risk of contagion on an inter-bank payment system. By using studies of Morris & Shin (1998), Rochet & Vives (2004), it shows that a combination of liquidity, solvency requirement and LLR (lender of last resort) interventions may prevent the occurrence of coordination failures on inter-bank markets when there are some large depositors decide to withdraw due to others behavior. In this case, the difficulty is how to decide the appropriate combination of these three instruments that minimizes the total costs of prevention of such coordination failure.

Finally, some of government intervention maybe needed in case of the last financial crisis such as recessions, devaluations, crashed stock market, etc as same as the disruptions in the payment system. If banks know they are likely to be bailed out in the crisis, they more likely to wait for a chance to take an exposure for such risks. From conclusion of Rochet (2004), ex ante regulation of liquidity of banks could be a way to mitigate this behavior.

### 3.2.6 Basel accords development

The Bank for International Settlements⁴ as the oldest international financial institution and remains the principal centre for international central bank cooperation, which "fosters international monetary and financial cooperation and serves as a bank for central banks".⁵ BIS fulfils its mandate by acting as:

- A forum to promote discussion and policy analysis among central banks and within the international financial community.
- A centre for economic and monetary research.
- A prime counterparty for central banks in their financial transactions.
- Agent or trustee in connection with international financial operations.

Since BIS has been working with all CBs and the ECB for the last decades within monetary and financial stability issue, the BIS accords become more and more important for whole EU banking industry. The Basel accords as the most significant accord for banking system have been widely accepted by banks of EU members.

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⁴ Members of 54 countries so far, Algeria, Argentina, Australia, Austria, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Canada, Chile, China, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Macedonia (FYR), Malaysia, Mexico, the Netherlands, New Zealand, Norway, the Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom and the United States, plus the European Central Bank.

⁵ [http://www.bis.org/](http://www.bis.org/)
Meanwhile, the risk management accords must be concerned within this study of liquidity risk management. Since the system knowledge of liquidity risk management has been developed only for recent decade, and its real application within the banking system are even shorter. With BIS, the first official liquidity risk management accords were brought forward with Basel accord 2, but not with specified calculations or requirement. In the paper published by BIS called Liquidity Risk Management and Supervisory Challenges, it points out that many banks had failed to take account of a number of basic principles of liquidity risk management with plentiful liquidity and they did not have a good framework, which can properly accounts for the liquidity risks from business lines. As a result, incentives at the business level were mismatched with the total risk tolerance of banking industry.

From the lessons learned from the financial turmoil, BIS has managed a fundamental guidance of operation practices for Liquidity management of banking organizations, such as be more awareness of importance of setup of liquidity risk tolerance; maintenance of an adequate level of liquidity(a cushion of liquid assets); identification and measurement of full liquidity risks during business operation including contingent liquidity risks; design and application of severe stress testing scenarios and most importantly for commercial banks which are under obligation to disclose their liquidity risk factors. Within BIS guidance, not only liquidity risk should be managed and supervised by CB or ECB in EU, but also individual commercial banks need to measure and manage their own liquidity risks carefully (BIS, 2005).

During the financial crisis, more and more discussions and investigations have been done by BIS and its members. Finally, the liquidity risk management issue came to next level on BIS’s agenda.

The new Basel 3 proposed (Basel committee, p.2) that raising up the quality, consistency and transparency of the capital; strengthened the risk coverage of capital framework especially for those counterparty credit exposures arising from banks’ derivatives, repo and securities financing transactions and provides incentives for both OCT derivative contracts movement and risk management of credit exposures; introduces a leverage ratio measurement; introduces a series of measures for reducing pro-cyclicality and promoting countercyclical buffers; recommends a global minimum liquidity standard for international banks as a longer term structural liquidity ratio.

Based on each specific proposal, the Basel Committee comes with clear explanation and concrete calculations or implementations. Committee firstly announced a series of measures to raise the quality, consistency and transparency of the regulatory capital base, particularly with Tier 1&2 capitals and it can help reduce the systemic risk from the banking sector overall. Secondly, Basel 3 reformed its requirements for the trading book and complex securitization exposures from the failure of capture major off balance sheet risk and derivative related exposure, which were key factors by causing the crisis.

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6 Tier I capital is core capital; this includes equity capital and disclosed reserves; Tier II capital is secondary bank capital that includes items such as undisclosed reserves, general loss reserves, subordinated term debt, and more.
Thirdly, Committee suggests of putting a floor under the build-up of leverage and by applying an additional safeguards against model risk and measurement error. Besides, Committee also introduces some other measurements and solutions in Basel Accords for banking sector reduces their systematic risk such as credit risk, liquidity risk, etc.

From the Basel Accord 3, it comes out with a few new measurements by considering some critical issues during last financial crisis, such as Liquidity coverage ratio (LCR). It focuses on asset liquidity to ensure banks always have 30 days liquidity cover for emergency situation (Basel Accord 3, 2010, p.3,31). It is defined as:

\[
LCR = \frac{(High\ Quality\ Asset)}{(30\ days\ net\ cash\ outflows)} \geq 100\%
\]

Additionally, the Basel 3 accords offers another measurement ratio known as Net Funding Ratio which ensure stable funding over a 1-year horizon, and both the LCR & the NSFR will be subject to an observation period and will include a review clause to address any unintended consequences. Moreover, some measurements of Basel 3 are reformed from the Basel 2 Accords as a better solution and others are specifically created to protect banking sector from financial crisis.

\[
NSFR = \frac{(Available\ Stable\ Funding)}{(Required\ Stable\ Funding)} \geq 100\%
\]

For listed commercial banks in EU, these two liquidity risk measurement will be applied within framework structure of liquidity risk management before 2020 based on their recent financial statement.

3.2.7 IFRS standard

Since most of listed banks in EU adhere to the IFRS accounting standards but not GAAP. Other than Basel accords, it will be also important for banking groups to prepare their accounts in accordance with IFRS liquidity risk disclosure rules. The new IFRS 7 (2007) requires liquidity risk managers from listed bank to provide more financial information of bank’s liquidity risk after 2007, compare to which stated in IAS 32. It indicates that financial information disclosure should not only help investors to know bank’s financial position and performance, but also with extent of risks arising from financial instruments during reporting period and how managers handle them.

With IFRS7, it requires a maturity analysis for financial liabilities to be presented in bank’s financial report to show their remaining contractual maturities, and it is manager’s responsibility to prescribe how they manage those liquidity risks. At the

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7 High quality assets can include things with a low correlation to risky assets, listed in active stable markets, with market makers and low concentration of buyers and sellers; i.e. easily convertible to cash in stressed markets (e.g. cash, central bank reserves, marketable claims on sovereigns, central banks, the BIS, IMF etc., and government debt issued in the currency of the country of operation)

8 The stated objective of IAS 32 is to establish principles for presenting financial instruments as liabilities or equity and for offsetting financial assets and liabilities
same time, it encourages disclosure of contractual maturities of financial assets as well even without requirement from IFRS7 standards.

Table 1: of contractual maturity analysis for financial liabilities (borrowing).

<table>
<thead>
<tr>
<th>Contractual maturity</th>
<th>Demand €m</th>
<th>Up to 3 months €m</th>
<th>3-12 months €m</th>
<th>1-5 years €m</th>
<th>Over 5 years €m</th>
<th>Total €m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposits from banks</td>
<td>359</td>
<td>37,892</td>
<td>433</td>
<td>2,487</td>
<td>85</td>
<td>41,236</td>
</tr>
<tr>
<td>Customer accounts</td>
<td>32,077</td>
<td>17,913</td>
<td>10,683</td>
<td>4,869</td>
<td>922</td>
<td>66,371</td>
</tr>
<tr>
<td>Debt securities in issue</td>
<td>-</td>
<td>4,260</td>
<td>3,850</td>
<td>15,480</td>
<td>7,750</td>
<td>32,073</td>
</tr>
<tr>
<td>Subordinated liabilities</td>
<td>-</td>
<td>176</td>
<td>138</td>
<td>1,190</td>
<td>3,651</td>
<td>5,141</td>
</tr>
<tr>
<td>Contingent liabilities</td>
<td>2,116</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2,116</td>
</tr>
<tr>
<td>Commitments</td>
<td>16,940</td>
<td>-</td>
<td>-</td>
<td>6,601</td>
<td>-</td>
<td>23,541</td>
</tr>
<tr>
<td>Total</td>
<td>51,792</td>
<td>60,883</td>
<td>15,399</td>
<td>30,410</td>
<td>11,964</td>
<td>170,478</td>
</tr>
</tbody>
</table>

Source: Guidance of contractual maturity analysis. 2007, IFRS 7

Figure 1: Sample of ANL analysis 2010 from Commerzbank.

3.2.8 Liquidity risk ratios

Besides internal liquidity measurement from inside of bank’s risk management purpose, there are also some external liquidity measurements for the purpose of analysis bank’s liquidity risk management from marketing point of view since internal daily data from bank are not easily accessed for investors and analysts.

From previous section, we present some ratios such as current and cash flow ratio or from Basel accords recommended with LCR and NFSR. Besides these most popular ratios, there are still different models and ratios that measures liquidity risk as well. And here we will briefly present other liquidity ratios which could be of benefit to this study.
Unlikely normal firms, according to Erik Banks (2005, p.143,146) financial institutions applies different liquidity ratios that are calibrated to their operations; they are based on slightly different definitions even though they measure liquidity risk as indicated in the Formulae Table 2.

Some important measures of liquidity of financial institution are based on the liability account as they rely on the state of unsecured funding for bringing liquidity and credits for clients. Within the figure below, such as borrowing ratios measure a bank’s need to support their business with volatile borrowings and the degree of cash and equivalents can be used to repay short noticed money. With higher borrowing ratios mean a larger amount turnover of deposit or volatile funding with its total plan, which create much liquidity pressure.

The loan to deposit ratio within the figure shows that the degree of banks can support their lending through deposits.

The cash ratios are also very important for banks, which indicate how well banks can match their short term obligations without curtailing credit business. The general idea of cash ratios is that the higher ratio the more liquid assets with bank’s portfolio. Next with the securities firm sector of matched book ratio shows the degree of leveraged position of firm matched with. The higher the ratio is, the more liability mismatched with liquidity management.

Table 2 Formulae for Liquidity ratio of financial institutions

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrowing Ratio 1 = Total Deposits / Total Funds</td>
<td></td>
</tr>
<tr>
<td>Borrowing Ratio 2 = Volatile Funds / (Cash+ Marketable Securities)</td>
<td></td>
</tr>
<tr>
<td>Borrowing Ratio 3 = (Volatile Funds - Current Assets) / (Total Assets- Current Assets)</td>
<td></td>
</tr>
<tr>
<td>Loan to Deposit Ratio = Total Loan / Total Deposits</td>
<td></td>
</tr>
<tr>
<td>Cash Liquidity Ratio 1 = Cash / Total Assets</td>
<td></td>
</tr>
<tr>
<td>Cash Liquidity Ratio 2 = (Cash+Short-term investments+Funds sold) / Total Assets</td>
<td></td>
</tr>
<tr>
<td>Cash Liquidity Ratio 3 = Marketable Securities / Surrenderable Liabilities</td>
<td></td>
</tr>
<tr>
<td>Cash Liquidity Ratio 4 = 30-day Saleable Assets / Surrenderable Liabilities</td>
<td></td>
</tr>
<tr>
<td>Matched Book Ratio = Repurchase Agreements / Reverse Repurchase Agreements</td>
<td></td>
</tr>
</tbody>
</table>

Source: Liquidity Risk: Managing Asset and Funding Risk from Erik Banks, (2005, p.146)

3.3 Performance of banks

In this stud, we will establish a connection between liquidity risk and bank’s performance as the part 3 focuses on the discussion of how to define and measure bank’s performance from the view of its financial reports
3.3.1 Definition of bank’s performance

A general measure of how well a bank generates revenues from its capital. It also shows a bank’s overall financial health over a period of time, and it helps to compare different banks across the banking industry at the same time.

As an individual bank, it would be important to start with its income statement for better understanding of how well it is operating, which describe the sources from income and expenses representing its profitability.

- Operating income is the income which is from bank’s ongoing operation. Mostly, it comes from bank’s interest with its assets, particularly loans. Meanwhile, noninterest income comes from partly service charges on deposit accounts, but mostly comes from the off-balance-sheet activities that create fees or profits for the bank.
- Operating expenses are expenses incurred as a result of bank’s ongoing operations. Mostly, it is the interest payment for its liabilities, particularly with its deposits. Meanwhile, noninterest expenses cover the cost of its business running such as salaries, rent, equipment and cost of computer services, etc. Besides, an item named provision for loan losses played an important role within the financial crisis. When a bank has a bad debt or expected bad debt in the future, it needs to be written as a loss.

3.3.2 Measurement of bank’s performance

The bank’s performance generally can be recognized as its stability and profitability. The stability refers to its risk factors and profitability refers to its financial return. After risk and return theory created by Bowman (1980), more and more studies used different accounting ratios to measure risk and return within corporate finance, which is concentrated on risk and return relationship between accounting variables (Nickel & Rodriguez, 2002) from firm’s financial report. For example, researchers by using return on asset (ROA), return on equity (ROE) and Net profit margins (Miller & Bromiley, 1990; Nickel & Rodriguez, 2002) to measure their financial returns. However, (Nickel & Rodriguez, 2002) points out some limitations by using mean-variance relationships for measuring of risk and return. They criticized that somehow variance is measured historically when it should be measured as expectation. Thus, another market-based measure of risk and return, which based on the stock price of the firm, is used to measure financial performance since it reflects the expectation of firm’s future performance (Dubofsky & Varadarajan, 1987). As a result, stock return can be seen as an effective substitute for accounting based measurement of performance. Some studies also showed that researchers tend to employ multiple measures of performance for better understanding of the relationship between risks and return (Dubofsky & Varadarajan, 1987; Kim & Gu, 2003).
With a better understanding of the relationships between risk and return, researchers started to examine both of them at the same time to evaluate firm’s performance. Some of risk adjusted performance measures was created for this matter, such as Sharpe ratio, the Treynor Index and the Jensen index. Sharpe ratio measures the excess return (risk premium) per unit of risk in an investment portfolio (Sharpe, 1994). It has principal advantage of directly computable from observed series of returns without additional information from source of profitability. Unlikely, The Treynor Index measures the performance of a portfolio based on the return earned per unit with its Beta (systematic) risk (Kim & Gu, 2003), which ignores any unsystematic at present. Finally, Jensen Index employs the SML (security market line) as its benchmark to test if a portfolio produced an abnormal return compare to whole capital market (Haugen, 1997). It also called alpha value measurement and does not measure with unsystematic risk as Treynor index.

Besides all these popular researchers’ study with methods of performance analysis, ECB recently published a paper of “How to measure bank performance” in 2009. According to this paper, the reasonable approaches for measuring bank’s performance should require with a deeper analysis of how banks run their business and applied with their stress testing result, even more with supervisors on consistency between business strategy and their performance, which common ratios like ROE does not applied due to short term profitability orientation. It suggested that an unbiased performance analysis framework needs to go further and provide with a more sophisticated assessment by using bank’s business based data and qualitative information, which required enhanced disclosure and improved market discipline both towards the supervisors and public.

This ECB paper investigates bank’s performance and its “capacity to generate sustainable profitability”. With a long term stable good performance, earning, efficiency, risk taking and leverage together should be concerned by bank’s manager. And these factors can be presented with stakeholders’ overall interest. However, different stakeholders could be interested with different measurements from traditional, economic and market based9 point of view applied by academics or practitioners. For example, commonly used traditional ROE measure is one of the internal performance measures for shareholders value (return of shareholder investment); on the other hand P/E ratio is the market based measure for analysis financial results of the bank over its share price.

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9 Traditional performance measures are similar to those applied in other industries, with return on assets (RoA), return on equity (RoE) or cost-to-income ratio being the most widely used. In addition, given the importance of the intermediation function for banks, net interest margin is typically monitored. The economic measures of performance take into account the development of shareholder value creation and aim at assessing, for any given fiscal year, the economic results generated by a company from its economic assets (as part of its balance sheet). These measures mainly focus on efficiency as a central element of performance, but generally have high levels of information requirements. Market-based measures of performance characterize the way the capital markets value the activity of any given company, compared with its estimated accounting or economic value. The most commonly used metrics include:
According ECB’s research (ECB, 2010, p.10,12), different stakeholders of a bank see its performance from different angles, which depositors are more likely concerned with bank’s long term ability to insure their savings, equity holders are more likely looking for bank’s profit generation and debt holders will pay more attention to how this bank can repay its obligation.

Table 3: Indicator preferences ranking by category from ECB 2010.

<table>
<thead>
<tr>
<th>Category of Indicators</th>
<th>Type</th>
<th>Bank analysts</th>
<th>Consultants</th>
<th>Rating agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue and cost</strong></td>
<td>Net interest income metrics</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- including after the deduction of impairment charges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- net interest income/interest-bearing assets</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Share of key income sources</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>- Share of trading income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>Return on tangible equity</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost-to-income</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Cost-to-income including impairments</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Return on risk-weighted assets</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Return on equity (RoE)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Return on assets (RoA)</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Market-based</strong></td>
<td>Price-to-tangible equity (P/TE)</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Credit default swap (CDS)</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Price-to-earnings (P/E)</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Senior debt spread</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Distance to default (DD)</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Credit risk</strong></td>
<td>Impairment charges as a percentage of total loans</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Coverage ratio</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Non-performing loans (NPLs) ratio</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>- Net NPLs/regulatory own funds</td>
<td>3</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Beyond Roe - How to measure bank performance from ECB working paper 2010.

As indicated in figure 2 ECB\(^\text{10}\), analysts are usually concerned with efficiency, asset quality and capital adequacy as major elements of measuring bank, but do not rely on liquidity indicators, market based indicators of credit risk and so on. Bank consultants place efficiency indicators (traditional and capital adjusted) for their major measures and also tend to consider liquidity indicators at second hand. Concerning the rating agencies, they follow a more general approach with their objective of assigning grades of overall assessment to banks.

\(^{10}\) ECB’s preference indicator ranking form based on their questionnaire from bank analysts, consultants and rating agencies. They are Universal banks (UniCredit, JP Morgan), Investment banks (Morgan Stanley), Commercial banks (Bank of Valetta), Securities companies (Cheuvreux, KBW), Oliver Wyman, McKinsey, Fitch Ratings, Moody’s Investor Services and Mr Sam Theodore.
3.4 Liquidity risk and bank performance.

While several studies are underway to uncover the relationship that exists between liquidity risk and bank performance, there have been a lot of controversial debates of previous studies upon this topic. Some researchers find that there is a significant positive relationship between the two variables while others find a negative correlation.

Dietrich & Wanzenried. (2011, p.8,324) studies determinants of bank profitability before and during the crisis of banks in Switzerland and finds that banks with a relatively high loan rate have higher net interest margin which explains a positive effect of liquidity on profitability, while increase in net funding cost lower bank profitability. Also, the Net interest Income share also affect bank profitability positively given that banks that heavily depend on interest income are less profitable than banks whose income interest are diversified. The empirical results of their study shows that larger bank have a significantly lower interest margin during the crisis than medium and small size banks.

Another study of the determinants of bank margins in the European banking by Valverde & Fernandez. (2007, p. 2055, 2058) reveals that higher loan to deposit ratios and loan to total assets seem to be positively and significantly related to performance. These conventional approaches to bank margin and indicators of liquidity risk enables banks to diversify its portfolio through investment in traditional and non-traditional business boast revenues and increase market power. However, non-traditional businesses which include non-interest income may fill the gap that results from stronger competition in the traditional segment of loan and deposits.

In the same line, Dietrich et.al (2004, p.2, 18) supports that internal factors such as bank liquidity indicators, total expenditures and funds invested in securities are highly correlated with its profitability. Similarly other determinants such as customers deposit into current account, capital adequacy and reserves and the ratio of interest sharing between bank and depositors can play a vital role on its performance.

More so, the previous study of Bourke (1989, p.66, 76) points to that liquidity ratios, notably loan to assets, loan to deposits and cash ratios which contains data that are inherent in banks’ financial statement can affect profitability positively. As opposed to capital based return, their finding reveals that liquidity ratios and interest margin are positively related to bank profitability

In contrast to the above of mentioned studies, Kosmidou et.al (2005, p.9, 15) argues that Net interest margin is one of the most important determinants of bank performance measurement showing profitability of bank’s interest –earnings –business, but is negatively related to liquidity indicators. It can however be significant only in the presence of external factors such as inflations, macroeconomic policies and economic growth. In a similar study of determinants of bank profitability in Greece during the
periods of financial integration, (Kosmidou; 2008, p.155) it is found that when considering banks internal characteristics such as liquidity risk, there is a significantly negative association between liquidity and Return on Assets. This do however become positive and insignificant when macroeconomics and others financial structure are taken into consideration.

Another study of determinants of European banking profitability also shows a significant negative effect between liquidity ratios and bank profitability. (Molyneux & Thornton; 1992, p. 1175) their study shows a weak inverse relationship between liquidity ratios and profitability as liquidity particularly those impose by regulatory authorities represent a cost to the bank.

Finally, in a related study by Demirguc et, al. (2003, p.10), he applies liquidity as indicator to check for disparity in bank assets and reveals that bank with high level of liquid assets in cash and government guarantee bond receives low interest income than bank with less liquid assets. If the depository markets tend to be very competitive as the case with large banks in Europe, then liquidity is negatively associated with net interest margin.

3.5 Summary and propositions.

In this section we have reviewed related literature and studies relevant to this research. The review mainly outlined general issues relating to liquidity management, liquidity risk and profitability of listed banks in Europe. We have critically looked at the notion of liquidity and point out that liquidity is an elusive concept of paramount importance for the well-functioning of the banking industry. It transcends from the central bank liquidity to the market liquidity which if proper measures are not taken to mitigate its effects, it could result in a wide spread systemic risk and market failure.

Discussion on liquidity risk and liquidity risk management reveals that liquidity risk is one of the major risks associated with bank transactions which arises when the cushion provided by the liquid assets cannot possibly cover its obligations. With this in effect liquidity risk management require that sound operational framework and liquidity management strategy by banks coupled with stress testing, contingency planning and management overnight in mitigating its effects and ensure stability in the system.

Moreover, it was found that the slate of bank performance lays not only on its profitability but also it solvency and stability. Given that investors generally have different perception of bank performance it therefore implies that for a reasonable approach in measuring bank performance will require deeper analysis on how banks run their business taking into consideration key factors such as profitability, liquidity, risk and solvency.

Finally, the recent financial crash and the panic of possible future shock in the financial system particularly in the banking sector have necessitated the study of the relationship between liquidity risk and bank performance. Although, some scholars find a positive
relationship other find a negative effect. Based on these contradicting results we then set out the following hypotheses:

Hypothesis 1: There is no relationship between liquidity risk and banks profitability.

Hypothesis 2: There is no relationship between liquidity risk and banks stability.
4. Practical Research Method

In this chapter, we present data collection method; explore the framework of study approach which leads to sample data that will be applied to test the hypothesis and statistical tests used in answering the research question.

4.1 Data collection method

4.1.1 Sample selection

In the Pillar 2 framework of the Basel Accords, banks are under obligation to design an internal capital adequacy, to measure, monitor and manage their capital buffer between their risk capital (demand) and available Capital (supply), Mui, Ozdemir & Geisinger (2010, p.3). Available capital most commonly measures the financial strength of banks while risk capital is capital held from debt-holders perspective to pursue risky investment opportunities.

As the study aims to provide some empirical evidence which would reflect the impact of liquidity risk on performance of listed banks, the researchers selected different samples of the largest listed banks based on their financial strength which is consistently made up of common shares and retained earnings. Also the authors tend to analyse EU listed banking section, which has one of the important banking indexes of EURO STOXX based on their total capital strength. This index combines with different 34 banks within different countries in EU. The weight of this index calculated credibly based on their total capital and their influences to whole EU banking market, since they own majority of the banking section assets and they are more involved in commitment lending. It is also well diversified with geographical location, which may reflect reasonable liquidity risk management impact patterns within performance of whole EU banking sector. All these mentioned above should be concrete debates why this study limits its sample space within one index. And in the appendix 2, it shows the form of lists of banks, trading ISIN, weight, capital and float factor

Secondly, accounting standards usually vary from one bank to another. For the purpose of this study, IFRS will be the only applied to the sample selection. In these 6 years, banks with GAAP accounting standards will be ruled out in the sample selection. With some case, if bank switches its accounting standard but not adjusted with new IFRS with their old financial reports, this bank will not be selected as well. During these report reading, we found that quality of bank’s IFRS adoption are not equal. Some of them applied GAAP as their standards before 2005, and their new IFRS reports in 2006 with adjustment have many mismatches and misunderstandings compare to the banks which have been using IFRS for years.
Finally, with the unprecedented growth of merger and acquisition situation during 2005 to 2010, only banks with adjusted financial statements have been selected as sample for this study.

30
4.1.2 Data collection

It was sourced from websites of the listed banks, through the section of investor relations we were able to track with their quarter or half year financial review and annual financial report. Since most banks balance sheets do not share clear information of current assets or liabilities (short term borrowing and lending), we had to identify those elements from notes to their statements.

There are total 12 different banks from STOXX indices that constitute sample of this study:

Table 4: Sample banks list.

<table>
<thead>
<tr>
<th>Banks</th>
<th>ISIN</th>
<th>Weight</th>
<th>Mcap(Bil.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banco Santander (BS)</td>
<td>ES0113900137</td>
<td>18.93</td>
<td>69.14</td>
</tr>
<tr>
<td>BNP Paribas (BNP)</td>
<td>FR0000131104</td>
<td>14.11</td>
<td>51.52</td>
</tr>
<tr>
<td>BBVA</td>
<td>ES0113211835</td>
<td>10.54</td>
<td>38.50</td>
</tr>
<tr>
<td>GRP SOCIETE GENERALE (SG)</td>
<td>FR0000130809</td>
<td>9.29</td>
<td>33.92</td>
</tr>
<tr>
<td>UNICREDIT (UNI)</td>
<td>IT0000064845</td>
<td>7.88</td>
<td>28.78</td>
</tr>
<tr>
<td>Credit Agricole</td>
<td>FR0000045072</td>
<td>3.36</td>
<td>12.28</td>
</tr>
<tr>
<td>ERSTE GROUP BANK</td>
<td>AT0000652011</td>
<td>2.19</td>
<td>7.99</td>
</tr>
<tr>
<td>NATIONAL BANK OF GREECE (NBG)</td>
<td>GRS003013000</td>
<td>1.64</td>
<td>5.99</td>
</tr>
<tr>
<td>COMMERZBANK (COMM)</td>
<td>DE0008032004</td>
<td>1.32</td>
<td>4.82</td>
</tr>
<tr>
<td>BCO SABADELL (SAB)</td>
<td>ES0113860A34</td>
<td>1.18</td>
<td>4.49</td>
</tr>
<tr>
<td>BCO POPULAR ESPANOL (BPE)</td>
<td>ES0113790531</td>
<td>1.02</td>
<td>3.73</td>
</tr>
<tr>
<td>BCO COMERCIAL PORTUGUES (PORT)</td>
<td>PTBCP0AM0007</td>
<td>0.57</td>
<td>2.08</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>72.03</strong></td>
<td></td>
<td><strong>263.240</strong></td>
</tr>
</tbody>
</table>

Source: Banking indices of EURO STOXX, 2011.

With the selection, these sample banks covered a total weight of index about 72.03 and they hold overall market capital with amount of 263.24 billion Euro. In this case, their liquidity risk management and control must have a major influence to European liquidity market and strong impact to all listed banks in Europe.

The financial data we obtained from banks’ financial statements have been hand-collected and we employed excel and SPSS for calculating different financial ratios from period 2005-2010 respectively for comparison.

4.2 Study approach

In order to investigate the effect of liquidity risk on performance of listed banks in Europe, we begin by identifying the respective variables involved in this study.
There are many different approaches or ratios to measure liquidity risks and bank’s performances. For liquidity, we applied with common variables such as loans, deposits, cash receivables calculate with loan to deposit ratio, cash ratio and loan to asset ratio, which banks use the most with their daily liquidity risk management. For bank’s performance, Return to Assets, Return to Equity and Price Earnings ratios will be used.

4.2.1 Liquidity approaches

As we mentioned earlier, liquidity ratio shows the ability of bank to match its financial obligations within period to avoid default risk or financial distress in the future (Ross, Westerfield & Jaffe, 2005). Ratios will be applied to measure banks’ ability to meet its short term obligations, keep its cash position and collect interest receivables. With general perspective, the higher the liquidity position is, the greater its ability to cover periodical obligations and guarantee safety for both its customers and depositors. Approaches to liquidity risk include:

- Loan to deposit ratio is the most commonly used liquidity ratio by both banks and analyst. Basically, it measures the liquidity condition of the bank. For a listed bank, there are pressures from shareholders to see profit from bank’s operation. Generally, with higher LD ratio, the more likely the bank is relying on borrowed funds. If receivables from loans are delayed or withdrawals from deposit side exceeds new deposit significantly over a short term of period, bank will take more financial stress by having excessive loans and more risky to meet depositors’ obligations by selling an amount of loans at loss.

\[
\text{Loan to Deposits}^{11} = \frac{\text{Total Loans}}{\text{Total Deposits}}^{12}
\]

- Loan to Asset ratio is also an important ratio which measures the liquidity of a bank. It measure liquidity of the bank in terms of bank’s total assets. It shows the proportion of total assets of the bank has invested for loans. The higher LA ratio is the less liquidity of the bank and at the same time, higher potential profitability the bank can enjoy with exposure to liquidity risk.

\[
\text{Loan to Assets} = \frac{\text{Total Loans}}{\text{Total Assets}}
\]

---

11 Total loans include: loans to banks or credit institutions; customer net loans; lease or other loans; mortgages; loans to group companies and associates and trust account lending. Total deposits cover customer deposits, central bank deposits, banks and other credit institution deposits and other deposits.

12 In the financial report with IFRS standards, total loans will apply to items called loans and receivables due from customers and institutions; and total deposits called due to customers and banks. Both of them apply to Non-derivative stuffs with fixed or determinable cash flows that are not quoted in an active market. They are recognized on the date of contract signing, which normally coincides with the data of disbursement to the borrower or lender.
Finally, the cash position ratio measures how well banks can match their short term obligations without curtailing credit business. The higher the cash position ratio is the higher liquid for assets with bank’s portfolio.

\[ \text{Cash Position} = \frac{\text{Cash}}{\text{Total Assets}} \]

### 4.2.2 Bank’s performance approaches

With bank’s performance measurements, not only it needs to apply with bank’s profitability but also needs to show bank’s efficiency and stability (level of risk). In this study, we will employ measurements that can be easily located within the financial report or market data. Firstly, for efficiency and probability:

- One of the measures, the ROA is a basic and efficient measure of bank’s profitability, which concerns with its size relative to others. It also indicates the management ability to perform their job efficiently since it shows the ability to generate profit from bank’s assets. From its formula point of view, it measures net income after tax for each Euro invested in the assets of the bank. Basically, the higher ROA means better performance and vice-versa. Technically ROA can be raised by bank from either profit margin or assets turnover but not at the same time due to their trade-off.

\[ \text{ROA} = \frac{\text{Net Income after Tax}}{\text{Total Assets}} \]

- Although ROA shows good information of profitability of bank, but it is not what shareholders care the most. Shareholders of bank more concern with how much bank earned for their investment to equity measured by ROE, which shows the net income after tax per Euro from equity capital.

\[ \text{ROE} = \frac{\text{Net Income after Tax}}{\text{Total Shareholders’ Equity}} \]

- Another commonly tested measure is called the net interest margin which indicates the profit earned by the bank on its lending. It is calculated as the difference between gross interest income and expenses as a percentage of total assets. It helps bank to determine if or not it has been making wise investment decisions. From the manager point of view, how well he/she manages bank’s assets and liability also affected by the spread between the interest earned from its assets and costs from its liability, the spread here represents the net interest margin. Finally, according to Angbazo(1997), the NIM reflects both default and interest rate risk premium in the market.

\[ \text{NIM} = \frac{\text{Interest Income} - \text{Expenses}}{\text{average interest bearing assets}} \]

---

13 The average interest bearing assets is assets which earned interest income in time period, meanly loans and receivables in this study for showing the general ability of bank create interests from loans and receivables.
Net profit margin is also a measure that indicates how well a bank controls its cost, which shows how much of each Euro earned by the bank is translated into profit. It is a good method for internal comparison.

\[ \text{Net Profit Margin} = \frac{\text{Net Profit}}{\text{Revenue}} \]

Be noticed that data collections for Net income after tax, net interest income (interest income-expense) and revenue with half year report were adjusted to one year account from last half year report for easy comparative reason; other data were quoted as same as original report.

Follow by the bank stability (solvency and risk):

There are some ratios which measure general risk and solvency of the bank. They refer to debt or financial leverage of a bank. It indicates the degree for a bank reliance on debt financing to equity and shows the chance of a bank default risk on its debt contracts. The higher the ratio is the higher the probability for a bank unable to fulfil its debt contractual obligations (bankruptcy or financial distress). But from most banks’ financial statement, it shows that debt financing is very significant for banks not only for their borrowing but also with tax advantage. From Ross, et al. (2005), it can be created with conflict of interest between creditors and shareholders.

- The first basic ratio which measures stability is called debt leverage or Debt Equity ratio. It measures the degree of debt utilization for a bank. For its stability, debt leverage measures the degree of shareholders’ equity can cushion creditors’ claims with the financial shocks. The higher the ratio means the bank is more aggressive in financing its growth with debt and causes volatile earning from its extra interest expense. This volatile earning brings more risks for bank’s operation.

\[ \text{Debt Leverage} = \frac{\text{Total Debt}}{\text{Shareholders’ Equity}} \]

- There is another ratio called debt to assets ratio and it shows the amount of total debt bank used to financing its total assets. Usually, analyst calls it as financial strength for a bank. It gives analyst information of the solvency and the degree of bank to get additional financing for potential beneficial investment opportunities. However, higher ratio means also more exposure to risk.

\[ \text{Debt to Asset ratio} = \frac{\text{Total Debt}}{\text{Total Assets}} \]
5. Empirical Findings and Analysis

The following chapter presents the results and discussion of data collected with content analysis for this study. We have used two statistical approaches in this study. Firstly, the descriptive statistics to provide an overview of the data observed, followed by the inferential statistic to actually test the stated hypothesis. The chapter will end with analysis of results providing a link between theory and the empirical findings. The hypotheses made from the previous chapters are:

Hypothesis 1: There is no relationship between liquidity risk and bank profitability.

Hypothesis 2: There is no relationship between liquidity risk and bank stability.

5.1 Descriptive statistics
The aim of this section is to analyse with descriptive tools the sample of banks and the data collected in order to better understand their meaning

5.1.1 Loan to Deposit ratio
For bank’s liquidity structure analysis, loan to deposit ratio shows the level of pressure bank has to meet its general obligations to its depositors. In this study, loans and deposits are from both private customers and other banks and financial institutions. Normally, total loans of bank should be little less than total deposits; otherwise bank needs to borrow extra money in debt security market with higher interest rate charges. Since the lendings (due from customers and banks) are generally higher than borrowings (due to customers and banks) in this study, it indicates that bank’s interest rate of receivables must be more than payable to debt security borrowing. On the other hand, if this ratio is much lower than 1, it indicates that normally bank has no enough interest receivables from its business lines and has to face the stress of match up with depositors’ obligations.

Be noticed with an extreme case, commercial bank in EU is not separated in investment bank and retail bank. With lower loan to deposit ratio, it shows either lower level of loans of the bank, or higher level of capitals in the financial assets by holding extra credit and market risk
Observation of the figure 2 above indicates that the L-D ratio was more volatile before 2008 than ever and it comes to the very narrow interval from 0.82 to 1.18 at the end of 2010, which was doubled around 2007. Based on average level of the L-D ratio, there are two banks holding the highest level of loans above the average level, which are Bco Popular Espanol and Bco Sabadell, while the NBG hold the lowest level of loan. The tick black lines indicates that the L-D ratio increase substantially from 2005- 2008 and later dropped during the last two years.

Table 5: Mean and S.D of L-D Ratio

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>BS</th>
<th>BNP</th>
<th>BBVA</th>
<th>SG</th>
<th>UNI</th>
<th>ERSTE</th>
<th>NBG</th>
<th>COMM</th>
<th>SAB</th>
<th>BPE</th>
<th>PORT</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.1101</td>
<td>1.368</td>
<td>0.979</td>
<td>1.066</td>
<td>1.011</td>
<td>1.235</td>
<td>0.966</td>
<td>1.207</td>
<td>1.545</td>
<td>1.531</td>
<td>1.389</td>
<td>1.132</td>
<td></td>
</tr>
<tr>
<td>S.D</td>
<td>0.0500</td>
<td>0.175</td>
<td>0.040</td>
<td>0.046</td>
<td>0.052</td>
<td>0.1250</td>
<td>0.038</td>
<td>0.075</td>
<td>0.113</td>
<td>0.2450</td>
<td>0.283</td>
<td>0.104</td>
<td>0.040</td>
</tr>
</tbody>
</table>

The above table shows bank loan to deposit position with their estimated mean and standard deviation. BPE and Sabadell keeps very high liquidity position with their mean greater than the average while BNP and BBVA maintain control of receivables and payable to customers at a relatively fair value.

5.1.2 Loan to Assets ratio

This ratio is a good supplement for L-D ratio, which indicates the proportion of total assets a bank has invested for loans. Theoretically, the higher ratio it is, the higher profits are generated from banks loan investments but also with higher exposure to liquidity risks.

Another indicator shows the degree of liquidity risk at level of structure, L-A ratio shows the basic concept of which bank is bearing higher liquidity risk within research period. In this case, the Bank of Popular Espanol, Sabadell and Portugues hold higher level of liquidity risk with all sample banks and BNP, on the other hand showed
surprising low level of L-D ratio. By tracing back to its financial statements, the reason for BNP of holding comparatively lower liquidity risk is due to its great amount of financial assets which almost doubled the average level of other sample banks.

![Figure 3: Loans to Assets Ratio](image)

Within the time period from 2005 to 2010, it also showed clearly that interval of L-A ratio has narrowed down.

Additionally the average mean and standard deviation of the 12 banks shows that total loans to assets ratio increased quickly from 2005 to 2007 to about 14.3% and then kept relative stable position in the last two years.

By applying average loans to assets ratio as base line in this case, we observe that only 3 banks stay below the average level which are ERSTE, SG and NBG while the remaining 9 stand over the average levels. This situation can reasonably be explained by the fact that banks with different level of total assets also have different strategies of their investment portfolio.

<table>
<thead>
<tr>
<th>L-A</th>
<th>CA</th>
<th>BS</th>
<th>BNP</th>
<th>BBVA</th>
<th>SG</th>
<th>UNI</th>
<th>ERSTE</th>
<th>NBG</th>
<th>COMM</th>
<th>SAB</th>
<th>BPE</th>
<th>PORT</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.43</td>
<td>0.636</td>
<td>0.316</td>
<td>0.662</td>
<td>0.39</td>
<td>0.657</td>
<td>0.668</td>
<td>0.636</td>
<td>0.562</td>
<td>0.833</td>
<td>0.874</td>
<td>0.804</td>
<td>0.500</td>
</tr>
<tr>
<td>S.D</td>
<td>0.02</td>
<td>0.032</td>
<td>0.038</td>
<td>0.025</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.063</td>
<td>0.033</td>
<td>0.039</td>
<td>0.051</td>
<td>0.027</td>
<td>0.017</td>
</tr>
</tbody>
</table>

By checking the table of average level of L-A ratio above, it shows liquidity risk exposures from all these sample banks. Besides, three banks hold highest level of L-A ratio, moreover the Bank of National Greece and Popular Espanol both have relatively higher volatility of their loans to total assets level, it maybe for the reason of their loan
business are not as stable as other banks are, either growing or declining too fast within this period. As a result, it could be more difficult for their managers to control liquidity risks due to unstable estimation.

### 5.1.3 The Cash Position Ratio

As one of the most important short term liquidity risk indicator for commercial banks, cash position ratio here shows the confidence of bank match up obligations to all depositors within time delay. Cash is the most liquid asset hold by the bank, but does not create any interest or earnings at the same time. A bank could keep its cash account match with obligation from liquidity exposure by estimating the liquidity gap between loans and deposits.

![Cash Ratio Graph](image)

**Figure 4**: Cash Position Ratio.

The figure of cash ratio shows the Bank of National Greece has the highest average cash level; BBVA and Erste group also hold bigger proportion of cash than others. Bank of Santander is a special case that hold higher amount of cash for every subsequent years.

From the average level of cash position, it was quite stable before 2\textsuperscript{nd} quarter of 2007, the average level rose from 1.15% within 2years and the half while the last 3 years the cash position stood at 2.22% indicating that banks were reluctant to issue loan and to pursue risky investment opportunities.

<table>
<thead>
<tr>
<th>Cash</th>
<th>CA</th>
<th>BS</th>
<th>BNP</th>
<th>BBVA</th>
<th>SG</th>
<th>UNI</th>
<th>NBG</th>
<th>COMM</th>
<th>SAB</th>
<th>SAB</th>
<th>BPE</th>
<th>PORT</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.0140</td>
<td>0.0320</td>
<td>0.014</td>
<td>0.034</td>
<td>0.011</td>
<td>0.01</td>
<td>0.049004</td>
<td>0.01</td>
<td>0.03</td>
<td>0.0150</td>
<td>0.014</td>
<td>0.0190</td>
<td>0.018</td>
</tr>
<tr>
<td>S.D</td>
<td>0.0080</td>
<td>0.0150</td>
<td>0.008</td>
<td>0.006</td>
<td>0.0020</td>
<td>0.009</td>
<td>0.007</td>
<td>0.008</td>
<td>0.0050</td>
<td>0.006</td>
<td>0.003</td>
<td>0.006</td>
<td></td>
</tr>
</tbody>
</table>
5.2 Descriptive statistics for performance ratios

5.2.1 Return on assets and return on equity.

ROA and ROE are fundamental measures of bank performance. They serve as basic indicators to investors to measure managerial efficiency. Return of Asset represents the net earnings per unit of a given assets and shows the ease at which a bank can convert its assets, into net earnings. Higher ratio implies that greater ability and better performance. While ROE is the net earning per Euro equity capital, the greater the ratio the higher the performance.

Figure 5: Return on Equity.

Figure 6: Return on Assets
As shown in the figure 5&6 above, ROE and ROA were much higher before 2008 especially with the National Bank of Greece and BBVA showing the highest level of returns while Commerzbank sustained a relatively low level of return till 2010. Between 2005-2010, the returns dropped from 49.5% to 33.4% and increase fairly around the first half of 2007. It went down in 2009 and rise around the financial year 2010. At the same time 6 banks shows returns average around the base line while Commerzbank showed a negative returns.

<table>
<thead>
<tr>
<th>Table 8 Mean and S.D of ROE and ROA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROE&amp;A CA BS BNP BBVA SG UNI ERSTE NBG COMM SAB BPE PORT AVE</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>S.D</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>S.D</td>
</tr>
</tbody>
</table>

### 5.2.2 Net Profit Margin

With Net profit Margin, it is a general comparative solution for bank’s profits and cost control. Unlike ROE and ROA, NPM shows the comparative results within the bank itself but not with other banks. From the figure 7 below, it shows that profitability of most banks declined after first half of 2007 and among 12 samples. Commerzbank has the lowest average NPM as same as the ROE and ROA; NBG, BS and BBVA hold comparatively high NPM as they did with ROE and ROA.

Figure 7 of Net Profit Margin
The average net profit margin line compares the European banking (listed banks) industry itself, which indicates that the average cost of bank’s investment and business lines increased at about 40% at the end of 2007 to 2010, since the average NPM dropped from 25% from 2007 to 14.8% in 2010. For a possible explanation, lending business in EU could be either bearing with too many bad loans or falling in earnings in their investment portfolio or both happened at same time.

Table 9: Mean and S.D of NPM.

<table>
<thead>
<tr>
<th>NPM</th>
<th>CA</th>
<th>BS</th>
<th>BNP</th>
<th>BBVA</th>
<th>SG</th>
<th>UNI</th>
<th>ERSTE</th>
<th>NBG</th>
<th>COMM</th>
<th>SAB</th>
<th>BPE</th>
<th>PORT</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.168</td>
<td>0.288</td>
<td>0.218</td>
<td>0.1310</td>
<td>0.152</td>
<td>0.265</td>
<td>0.039</td>
<td>0.31</td>
<td>0.293</td>
<td>0.186</td>
<td>0.2037</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.D</td>
<td>0.124</td>
<td>0.057</td>
<td>0.063</td>
<td>0.059</td>
<td>0.0770</td>
<td>0.078</td>
<td>0.036</td>
<td>0.102</td>
<td>0.231</td>
<td>0.1190</td>
<td>0.098</td>
<td>0.0615</td>
<td></td>
</tr>
</tbody>
</table>

5.2.3 Net Interest Margin

NIM is also one of the indicators of performance showing the profit banks generate from core business and intraday transaction with customers. In this study we have used total loans to customers and others banks as earnings assets of NIM for purpose of comparison.

Figure 8: Net Interest Margin.

From the figure 8 shown below, the National bank of Greece holds the highest average NIM above others banks; the average NIM ratio of 12 banks increased during the last 3 years from 2007 -2010.

Also from the table 11 below, it shows the same growth of net interest income as NIM which represents an increase from 5529 to 10993 within 6 years. Moreover, from each
period before and after 2007, there was an upsurge in NIM respectively. As a result, the net interest incomes even grow up much faster during the crisis than before.

Table 10 Mean and S.D of NIM

<table>
<thead>
<tr>
<th>NIM</th>
<th>CA</th>
<th>BS</th>
<th>BNP</th>
<th>BBVA</th>
<th>SG</th>
<th>ERSTE</th>
<th>NBG</th>
<th>COMM</th>
<th>SAB</th>
<th>BPE</th>
<th>PORT</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.019</td>
<td>0.03</td>
<td>0.025</td>
<td>0.034</td>
<td>0.016</td>
<td>0.029</td>
<td>0.033</td>
<td>0.055</td>
<td>0.013</td>
<td>0.022</td>
<td>0.026</td>
<td>0.021</td>
</tr>
<tr>
<td>S.D</td>
<td>0.002</td>
<td>0.006</td>
<td>0.004</td>
<td>0.003</td>
<td>0.007</td>
<td>0.007</td>
<td>0.003</td>
<td>0.005</td>
<td>0.002</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Be noticed, it doesn’t include specific daily information of loans’ amount and period with data collection in this study, the presumption about connection between loans from 05-07 with interest profits from 07-10 do not have a concrete improvement since we do not know precisely how long would loans from 05-07 can be effective to later interest income with information from general financial report. But for sure, they are related on general theoretical level.

5.2.4 Debt Leverage Ratio

For a better understanding of bank performance, the debt leverage ratio represents one of the important indicators of risk and solvency. It shows the structure of bank capital and its financing channel in the markets.

Figure 9: Debt leverage.
As in the debt leverage figure above, the trend of overall D-L ratio declined from 05-07 to 08-10, which means banks were financing their capitals with less proportion of debts and more of equities. Theoretically, it indicates these banks tried to cut their extra interest expense by using their cushions from equity financing to creditors’ claim of the financial distress.

The average debt leverage of 12 banks decreased within the last 6 years, from 22.7 of% in 2005 to 18.5 of 2010. Based on yearly analysis, it decreased with 4% from 05-07 and 15% from 07-10, which proved the cushion effect of equity for financial distress which banks tend to employ more equities than debts debt during the crisis for overcoming their financial problems.

The table 12 shows the average debt leverage of all listed banks during last 6 years. By checking with individual bank, there are only 3 banks which hold higher debt levels than the average in their balance sheets, which are Credit Agricole, Societe Generale and Commerzbank.

<table>
<thead>
<tr>
<th>D-L</th>
<th>CA</th>
<th>BS</th>
<th>BNP</th>
<th>BBVA</th>
<th>SG</th>
<th>UNI</th>
<th>ERSTE</th>
<th>NBG</th>
<th>COMM</th>
<th>SAB</th>
<th>BPE</th>
<th>PORT</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.D</td>
<td>1.882</td>
<td>0.897</td>
<td>3.04</td>
<td>2.54</td>
<td>4.32</td>
<td>2.35</td>
<td>3.795</td>
<td>1.98</td>
<td>4.82</td>
<td>1.11</td>
<td>0.63</td>
<td>1.87</td>
<td>1.87</td>
</tr>
</tbody>
</table>

5.2.5 Debt to Asset Ratio

D-A ratio is also one of ratios for testing bank’s financial strength. As same as the debt leverage, it shows the financial risk from bank’s debt financing as well as same as its potential earnings from investment opportunities. The figure below has very similar results like that of D-L ratio shown above. NBG’s D-A ratio again becomes the lowest in these banks.

At the same time, the average D-A ratio shows similar characters as Debt leverage ratio. The amount of debt held by banks fell to a lower level from approximately 94% to 92.8% at the end of 2010. And it fell down much faster after 2007 than earlier.
5.3 Statistical Analysis

After a descriptive presentation of the different liquidity risk and bank performance ratios, we move to the statistical tests that we have employed in this study to test the hypotheses.

5.3.1 Dependence and correlation

In statistics, dependence shows any statistical relationship between two sets of data and correlation refers to any of common statistical relationships involving dependence. The statistical test applied in this case is the Regression Analysis it can be used to analyse different variables by finding out their correlations and dependency.

To check for the coefficient for a linear relationship between liquidity risk indicators and bank performance measures, t-tests will be employed. If the value of $|t|$ is greater than 1.96 we reject the null hypothesis that this variable is equal to zero at the 5% significance level. If $|t|$ is greater than 1.69 we reject the null hypothesis implying that the variable is equal to zero at the 10% significance level.

For further analysis of the combined tests statistics to check for variance, the F-test will be used. If the value of $F<0.05$ then we can say with 95% confidence that there is...
significant positive relationship between liquidity risk indicators and bank performance measures, while a value greater than 0.05 implies that it will be consistent with our null hypothesis. In this study we have selected liquidity indicators as the independent variable which are those variables which the banks’ management can exert control over. They include:

- Loan to Deposit Ratio (LtDR)
- Loan to Assets Ratio (LtAR)
- Cash Position Ratio (CPR)

On the other side, bank performance ratios are independent from management control they include:

- Return on Asset (ROA)
- Return on Equity (ROE)
- Net Interest Margin (NIM)
- Net Profit Margin (NPM)

For stability
- Debt Leverage (DL)
- Debt to Asset. (DtA)

### 5.3.2 Regression analysis of bank performance and liquidity risk

To analyze the relationship between measures of liquidity risk and bank performance a more formal conditional analysis using regression models is performed. In the first regressions panel data models for the full sample is estimated. The model is specified as

\[
\text{Performance}_{it} = \alpha + \beta_1 \text{LtDR}_{it} + \beta_2 \text{LtAR}_{it} + \beta_3 \text{CPR}_{it} + \varepsilon_{it}
\]

where the different considered performance measures are ROA, ROE, NIM, NPM, DL, and DtA. The explanatory variables are Loan to Deposit Ratio (LtDR), Loan to Assets Ratio (LtAR), and Cash Position Ratio (CPR). The result of these regressions for the full sample for each of the considered performance measures are presented in Table 14.

<table>
<thead>
<tr>
<th></th>
<th>ROA</th>
<th>ROE</th>
<th>NPM</th>
<th>NIM</th>
<th>DL</th>
<th>DtA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.004</td>
<td>0.122</td>
<td>0.193</td>
<td>0.054</td>
<td>42.888</td>
<td>0.988</td>
</tr>
<tr>
<td>LtDR</td>
<td>-0.002</td>
<td>-0.049</td>
<td>0.018</td>
<td>-0.023</td>
<td>-4.293</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>(-0.543)</td>
<td>(-1.949)</td>
<td>(0.373)</td>
<td>(-1.905)</td>
<td>(-1.553)</td>
<td>(1.555)</td>
</tr>
<tr>
<td>LtAR</td>
<td>0.007</td>
<td>0.023</td>
<td>0.017</td>
<td>-0.019</td>
<td>-23.326</td>
<td>-0.112</td>
</tr>
<tr>
<td></td>
<td>(2.090)</td>
<td>(0.754)</td>
<td>(0.290)</td>
<td>(-1.341)</td>
<td>(-7.150)</td>
<td>(-7.168)</td>
</tr>
<tr>
<td>CPR</td>
<td>0.025</td>
<td>0.565</td>
<td>0.434</td>
<td>0.113</td>
<td>-167.640</td>
<td>-0.030</td>
</tr>
<tr>
<td></td>
<td>(0.605)</td>
<td>(1.593)</td>
<td>(0.528)</td>
<td>(0.664)</td>
<td>(-4.343)</td>
<td>(-1.65)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.040</td>
<td>0.046</td>
<td>0.007</td>
<td>0.055</td>
<td>0.449</td>
<td>0.289</td>
</tr>
<tr>
<td>$F$-value</td>
<td>1.951</td>
<td>2.268</td>
<td>0.309</td>
<td>2.695</td>
<td>38.095</td>
<td>18.982</td>
</tr>
</tbody>
</table>

Note: t-values in parenthesis
The results show that LtAR has a significant effect on ROA, with a t-value of 2.090 (greater than 1.96) and significant at the 5% level, thus indicating that there is a positive relationship between liquidity risk and bank performance.

For the ROE, the t-statistics provide us with a value of -1.949 for LtDR, which is negative and significant at the 10% level, but the combined test of the variance display F-value of 2.268 non-significant at the 5% level showing that there is a significant negative correlation between Return on Equity and Loan to Deposit Ratio.

The NIM is closely related to the LtDR, the t-test show a value of -1.905, negative and significant at the 10% level, while the F-value stands at 2.695 and significant at the 5% level, hence supporting evidence that there is significant negative relationship between Net interest Margin and Loan to Deposit Ratio.

We equally observe with the DL that there exist a significantly negative relationship with LtAR and CPR with their t-tests displaying values of -7.150 and -4.343 respectively all significant at the 5% level. The F-test show a value of 38.095, significant at the 5% level, which implies that greater variation in Debt leverage, can be explained by a proportionate high variation in Loan to Assets and Cash Position Ratio.

With the DtA, we equally observe that there is a significant negative correlation with LtAR. The t-test show a value of – 7.168 far above the rejection region and significant at the 5% level. The F-test also display a very high value of 18.982 and significant at the 5% level, indicating that greater variation in Debt to Asset can be explained by a high variation in Loan to Asset Ratio.

In sum, for the full sample using a regression panel data model we can conclude with the results that for the six performance measures only Return on Asset show a significant positive relationship with liquidity risk indicators, while Return on Equity, Net Profit Margin, Net Interest Margin, Debt Leverage and Debt to Asset show a negative and significant relationship.

To control for firm specific unobserved heterogeneity a fixed effects panel data model is also estimated including a control variable for the financial crises in 2008, i.e. a dummy taking the value one during 2008 and zero otherwise, dFin crises. This model is specified as

\[ Performance_{it} = \alpha + \beta_1LtDR_{it} + \beta_2LtAR_{it} + \beta_3CPR_{it} + \beta_4dFin\_crises + \sum_{j=1}^{11} \gamma_j dBank_j + \epsilon_{it}, \]

where dBank are dummy variables with the value one for each bank, zero otherwise. The results from these regressions are reported in Table 15.
Table 15: Estimation results fixed effects model.

<table>
<thead>
<tr>
<th></th>
<th>ROA</th>
<th>ROE</th>
<th>NPM</th>
<th>NIM</th>
<th>DL</th>
<th>DtA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.010</td>
<td>0.165</td>
<td>0.418</td>
<td>0.037</td>
<td>28.544</td>
<td>0.973</td>
</tr>
<tr>
<td></td>
<td>(2.073)</td>
<td>(4.169)</td>
<td>(5.839)</td>
<td>(1.780)</td>
<td>(9.423)</td>
<td>(47.829)</td>
</tr>
<tr>
<td>LtDR</td>
<td>-0.008</td>
<td>-0.109</td>
<td>-0.135</td>
<td>-0.019</td>
<td>2.169</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(-1.440)</td>
<td>(-2.567)</td>
<td>(-1.764)</td>
<td>(-0.844)</td>
<td>(0.670)</td>
<td>(0.271)</td>
</tr>
<tr>
<td>LtAR</td>
<td>-0.004</td>
<td>-0.024</td>
<td>-0.039</td>
<td>-0.007</td>
<td>4.252</td>
<td>-0.051</td>
</tr>
<tr>
<td></td>
<td>(-0.635)</td>
<td>(-0.512)</td>
<td>(-0.457)</td>
<td>(-0.289)</td>
<td>(1.168)</td>
<td>(-2.095)</td>
</tr>
<tr>
<td>CPR</td>
<td>-0.060</td>
<td>-0.605</td>
<td>-2.447</td>
<td>-0.021</td>
<td>-57.114</td>
<td>0.216</td>
</tr>
<tr>
<td></td>
<td>(-1.079)</td>
<td>(-1.362)</td>
<td>(-3.049)</td>
<td>(-0.090)</td>
<td>(-1.684)</td>
<td>(0.950)</td>
</tr>
<tr>
<td>dFin_crisises</td>
<td>-0.002</td>
<td>-0.006</td>
<td>-0.061</td>
<td>-0.001</td>
<td>1.615</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>(-1.069)</td>
<td>(-0.434)</td>
<td>(-2.254)</td>
<td>(-0.172)</td>
<td>(1.414)</td>
<td>(1.460)</td>
</tr>
<tr>
<td>$dBank_1$</td>
<td>0.014</td>
<td>0.165</td>
<td>0.252</td>
<td>0.019</td>
<td>-17.578</td>
<td>-0.021</td>
</tr>
<tr>
<td></td>
<td>(2.408)</td>
<td>(3.597)</td>
<td>(3.047)</td>
<td>(0.795)</td>
<td>(-5.032)</td>
<td>(-0.888)</td>
</tr>
<tr>
<td>$dBank_2$</td>
<td>-0.001</td>
<td>0.037</td>
<td>-0.138</td>
<td>0.036</td>
<td>13.502</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(-0.363)</td>
<td>(1.271)</td>
<td>(-2.642)</td>
<td>(2.393)</td>
<td>(6.101)</td>
<td>(0.365)</td>
</tr>
<tr>
<td>$dBank_3$</td>
<td>0.005</td>
<td>0.046</td>
<td>0.046</td>
<td>0.011</td>
<td>-3.208</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td>(0.140)</td>
<td>(1.546)</td>
<td>(0.873)</td>
<td>(0.754)</td>
<td>(-1.426)</td>
<td>(2.252)</td>
</tr>
<tr>
<td>$dBank_4$</td>
<td>0.011</td>
<td>0.122</td>
<td>0.121</td>
<td>0.008</td>
<td>-12.608</td>
<td>-0.006</td>
</tr>
<tr>
<td></td>
<td>(2.661)</td>
<td>(3.634)</td>
<td>(1.985)</td>
<td>(0.444)</td>
<td>(-4.912)</td>
<td>(-0.365)</td>
</tr>
<tr>
<td>$dBank_5$</td>
<td>0.002</td>
<td>0.020</td>
<td>-0.063</td>
<td>-0.004</td>
<td>-4.576</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.441)</td>
<td>(0.689)</td>
<td>(-1.229)</td>
<td>(-0.245)</td>
<td>(-2.113)</td>
<td>(-0.045)</td>
</tr>
<tr>
<td>$dBank_6$</td>
<td>0.004</td>
<td>0.013</td>
<td>-0.065</td>
<td>0.006</td>
<td>-16.271</td>
<td>-0.014</td>
</tr>
<tr>
<td></td>
<td>(1.041)</td>
<td>(0.424)</td>
<td>(-1.150)</td>
<td>(0.371)</td>
<td>(-6.762)</td>
<td>(-0.875)</td>
</tr>
<tr>
<td>$dBank_7$</td>
<td>0.015</td>
<td>0.073</td>
<td>0.002</td>
<td>0.022</td>
<td>-16.762</td>
<td>-0.056</td>
</tr>
<tr>
<td></td>
<td>(3.429)</td>
<td>(2.057)</td>
<td>(0.028)</td>
<td>(1.167)</td>
<td>(-6.160)</td>
<td>(-3.071)</td>
</tr>
<tr>
<td>$dBank_8$</td>
<td>0.008</td>
<td>0.044</td>
<td>-0.009</td>
<td>0.006</td>
<td>-15.877</td>
<td>-0.014</td>
</tr>
<tr>
<td></td>
<td>(1.875)</td>
<td>(1.244)</td>
<td>(-0.135)</td>
<td>(0.353)</td>
<td>(-5.902)</td>
<td>(-0.775)</td>
</tr>
<tr>
<td>$dBank_9$</td>
<td>0.011</td>
<td>0.112</td>
<td>0.127</td>
<td>0.019</td>
<td>-15.845</td>
<td>-0.041</td>
</tr>
<tr>
<td></td>
<td>(2.365)</td>
<td>(3.090)</td>
<td>(1.924)</td>
<td>(1.017)</td>
<td>(-5.700)</td>
<td>(-2.216)</td>
</tr>
<tr>
<td>$dBank_{10}$</td>
<td>0.007</td>
<td>0.039</td>
<td>-0.107</td>
<td>-0.002</td>
<td>2.370</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(1.619)</td>
<td>(1.128)</td>
<td>(-1.725)</td>
<td>(-0.093)</td>
<td>(0.904)</td>
<td>(0.914)</td>
</tr>
<tr>
<td>$dBank_{11}$</td>
<td>0.007</td>
<td>0.073</td>
<td>0.036</td>
<td>-0.005</td>
<td>-18.134</td>
<td>-0.024</td>
</tr>
<tr>
<td></td>
<td>(1.455)</td>
<td>(1.929)</td>
<td>(0.525)</td>
<td>(-0.272)</td>
<td>(-6.262)</td>
<td>(-1.254)</td>
</tr>
</tbody>
</table>

$R^2$  | 0.178 | 0.270 | 0.337 | 0.156 | 0.793 | 0.470 |
F-value | 1.853 | 3.152 | 4.336 | 1.573 | 32.625| 7.567 |

Note: t-values in parenthesis

The results from Table 15 indicate that banks may have different relationship especially when we include a control variable for the financial crisis. Interpreting the bank specific
results with the ROA, show that Banco Santander, with a t-value of 2.408, significantly positive at the 5% level, BBVA with a t-value of 2.661, significantly positive, Banco Commercial portuguesz with a t-value of 3.429 and National Bank of Greece sustaining a t-value of 2.365, which are far above the critical value of 1.96 and significant at the 5% level. Also the combinations of these tests provide us with the F-value of 1.853 significant at the 5% showing that Return of Asset of these banks is positive and significantly related to liquidity risk indicators.

Also, ROE, show Banco Santander with a t-value of 3.579, BBVA topping with 3.634, Banco Commercial Portuguese with 2.057, National Bank of Greece with 3.090 while Banco Sabadell maintaining the least with 1.929 and significant at the 5% level. Also the results from the F-test show a significant positive relationship between ROE and liquidity risk variables with value standing at 3.152 and significant at the 5% level.

Another dependant variable which explains how results may vary between banks is the NPM. However, looking at the reactions when a controllable variable of financial crisis is introduced, Banco Santander show a t-value of 3.047, positive and significant at the 5% level, BBVA with a t-value of 1.985, positive and significant at the 5% level and National Bank of Greece sustain a t-value of 1.924 which is positive and significant at the 10% level. On the other hand, Banco Popular Espagnol displays a value of -2.642, negative and significant at the 5% level. The combined tests of variance disclose the F-value over 4.336 and significant at 5% level. This shows that results may differ between banks, results with some banks show that NPM is positive and significantly related to liquidity ratios while with others banks, results show a negative and significant correlation.

The NIM is also one determinant variable that explains bank profitability. From the table, Bank Populaire Espagnole sustains a significantly positive value of 2.393, but the analysis of the variance disclose the result of the F-test with a value of 1.573 and non-significant at the 5% level showing that there is not sufficient evidence to infer that there exist a linear relationship between Net Interest margin and liquidity risk variables.

With the DL, it is very apparent that almost all the banks disclose the test-statistic far above the rejection region. We can observe that Banco Santander provides a value of -5.032 significantly negative, Banco Popular Espagnol topping the list with over 6.101 positive and significant, BBVA maintains a value of -4.912 negative and significant at the 5% level, Group Societe Generale with -2.113 negative and significant, Unicredit stands at -.6.762 also negative and significant, Banco Commercial Portuguesz display -6.160 while Erste Group ,National Bank of Greece and Banco Sabadell show -5.902, -5.700 and -6.262 respectively negative and significant at the 5% level. Further analysis of the variance reveals the F-value of 32.625 and significant at the 5% level. This also shows that the relationship between Debt Leverage and liquidity risk indicators may be different between banks especially when a variable of the financial crisis is introduced in the model.

Regarding the DtAR, results from the t-statistics provide us with BNP Paribas with a value of 2.252, positive and significant at the 5% level, Banco commercial Portugalz
standing at -3.071, negative and significant at the 5% level and National Bank of Greece with -2.216, negatively significant at the 5% level while the F-test also provides us with the value of 7.576 and significant at the 5%.

Following the results displayed in Table 15, we can conclude that when estimating a fixed effect panel data to control for firm specific heterogeneity including a control variable of the financial crisis, we observe that results are different for different banks, some banks display a positive significant relationship between performance measure and liquidity risk indicators while others reveal a significantly negative relationship.

To estimate bank specific relationships between performance measures and liquidity risk for each bank, i.e. to allow for bank specific parameters for the liquidity risks, interaction variables, interacting the bank dummies with the three liquidity measures, are also considered. The model with bank specific parameters is given by

$$Performance_{it} = \alpha + \sum_{j=1}^{12} \beta_j LtDR_{it} \times dBank_j + \sum_{j=1}^{12} \theta_j LtAR_{it} \times dBank_j + \sum_{j=1}^{12} \gamma_j CPR_{it} \times dBank_j + \varepsilon_{it}.$$  

This specification is similar to running separate regressions for each bank. The results from these regressions are given in Table 16. (See Appendix C).

Allowing for bank specific relationships between liquidity risk and bank performance, results show that there is no association between ROA and liquidity risk indicators with results of all the tests non-significant at 5% for all banks, while the F-test also confirm this non-correlation by providing us with a value of 0.711 and non-significant at the 5% level.

With ROE, the results provide us with the BBVA displaying a positive relationship between return on earning and liquidity risk indicators with a t-value of 2.121, significant at the 5% level, while for the rest of the banks no association was found. Then again proceeding with the analysis of variance we observe the results of F-test with a value of 1.599 and significant at the 5% level showing that BBVA Return on Equity is positively correlated to liquidity risk indicators.

The results of NPM show there exist a positive correlation between Net Profit Margin and LtAR of Credit Agricole with the test statistics displaying a value of 2.230, significant at the 5% level. Also there is linear relationship between Net Profit Margin and CPR of Banco Popular Espagnol given that the t-test statistics provide us with a value of 2.120, significant at the 5% level. The combined tests of coefficient display the F-test with a value of 2.217, significant at the 5% level, we can therefore infer that Credit agricole and Banco Popular Espagnol Net Profit Margin is positive and significantly related to liquidity risk variables.

More results on this table show that there is enough statistical evidence to infer that NIM is linearly related to dLtD and dLtA. This is explained by BNP Paribas with a t-
value of 1.788, significant at the 10%, while Bco Commercial Portuguese displaying a t-value of 2.732, Banco Sabadell with 2.008 and Banco popular Espagnol with 5.536, all significant at the 5% level. Also the CPR of Banco Popular Espagnol shows a t-value of -3.928 significant at the 5% level. Further analysis of the variance disclose the F-value of 2.197, significant at the 5% level, evidence supporting that these banks Net Interest Margin are positively related to liquidity risk indicators.

Another test of coefficients shows statistical evidence of a linear relationship between debt leverage and bank liquidity indicators. Results from the analysis disclose that Banco Commercial Portuguez DL is negatively related to dLtD with a t-value of -3.315, significant at the 5% level. With Bacon Popular Espagnol, we observe a positive relationship between DL and dLtA with a t-test displaying a value of 2.399, significant at the 5% level. Still with Banco Popular Espagnol, there is a negative relationship between DL and dCPR, the t-value stands at -2.140, significant at the 5% level, while with Banco Commercial Portugal, we observe a positive correlation between DL and dCPR with the value of t-test significant at 10% level. Also, results from the analysis of variance indicate that there exist a significant positive relationship between DL, dLtD, dLtA and dCPR with F-value of 9.327 and significant at the 5% level, hence supporting evidence against the hypothesis of no correlation of liquidity risk measures and bank stability.

Further statistical test of coefficient present us with the results showing a relationship between Debt to Asset and liquidity risk variables. With Banco Sabadell results from Debt to Assets show that there is a significant negative relationship between DtA and dLtD with the t-value of -2.197, significant at the 5% level. Still with Banco Sabadell we observe a positive linear relationship between DtA and dLtA, the t-test show a value of 2.027, significant at the 5%, while the correlation with dCPR show a t-value of 2.148, significant at the 5% level. We equally observe with Banco Commercial Portuguez that DtA is negatively related to dLtA with the results of t-test showing a value of -2.565, significant at the 5% level, and BNP Paribas results of Debt to Asset also show a significant negative relationship between DtA and dCPR with the t-value of -2.246, significant at the 5% level. The analysis of variance displays the F –value of 3.466, significant at the 5% level, rejecting strongly the hypothesis of no correlation of liquidity risk indicators and bank stability.

Following from the results of Table 16, we can conclude that when we apply the model with bank specific parameters for liquidity risk, interactions variables and bank dummies with the three liquidity measures, otherwise running separate regression for each bank, we observe that Return on Equity, Net Profit Margin and Net Interest Margin show a significant positive relationship with liquidity ratios, while Debt Leverage and Debt to Asset display a significant negative correlation.

To compare the relationship between measures of liquidity risk and bank performance before and after the financial crises in 2008, a dummy variable, dPostFin, taking the value one from 2008 onward, zero otherwise, is created. This is then used in the following model
The correlation between each liquidity measure and performance measure before the financial crises is then measured by $\beta_1, \beta_2$, and $\beta_3$, while the relationship during and after the financial crises is measured by $(\beta_1 + \beta_4)$ for LtDR, $(\beta_2 + \beta_5)$ for LtAR, and $(\beta_3 + \beta_6)$ for CPR. The results from these regressions are shown in Table 17.

Table 17: Estimation results. Financial Crisis Effects.

<table>
<thead>
<tr>
<th></th>
<th>ROA</th>
<th>ROE</th>
<th>NPM</th>
<th>NIM</th>
<th>DL</th>
<th>DtA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.002</td>
<td>0.112</td>
<td>0.185</td>
<td>0.053</td>
<td>43.029</td>
<td>0.987</td>
</tr>
<tr>
<td>LtDR</td>
<td>(0.750)</td>
<td>(4.832)</td>
<td>(4.326)</td>
<td>(4.371)</td>
<td>(16.838)</td>
<td>(74.604)</td>
</tr>
<tr>
<td>LtAR</td>
<td>(0.152)</td>
<td>(-0.120)</td>
<td>(2.461)</td>
<td>(-1.674)</td>
<td>(-2.590)</td>
<td>(1.270)</td>
</tr>
<tr>
<td>CPR</td>
<td>(1.283)</td>
<td>(-0.950)</td>
<td>(-0.751)</td>
<td>(-1.518)</td>
<td>(-3.738)</td>
<td>(-5.865)</td>
</tr>
<tr>
<td>Int_FinPosLtD</td>
<td>-7.326E-</td>
<td>-0.096</td>
<td>-0.206</td>
<td>-0.003</td>
<td>10.462</td>
<td>0.005</td>
</tr>
<tr>
<td>Int_FinPosLtA</td>
<td>(0.532)</td>
<td>(2.293)</td>
<td>(1.168)</td>
<td>(0.748)</td>
<td>(-4.634)</td>
<td>(0.050)</td>
</tr>
<tr>
<td>Int_FinPosCPR</td>
<td>-0.192</td>
<td>-1.568</td>
<td>-0.220</td>
<td>-0.306</td>
<td>204.379</td>
<td>-0.117</td>
</tr>
<tr>
<td></td>
<td>(-2.184)</td>
<td>(-2.270)</td>
<td>(-0.173)</td>
<td>(-0.843)</td>
<td>(2.675)</td>
<td>(-0.297)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.080</td>
<td>0.217</td>
<td>0.256</td>
<td>0.063</td>
<td>0.533</td>
<td>0.291</td>
</tr>
</tbody>
</table>

Note: t-values in parenthesis

The results show that the relationship between ROA and CPR has changed tremendously. We observed that before the financial crisis the result from the test statistics was positive and significant at the 5% level, while during and after financial crisis the test statistics provide us with a t-value standing at -2,184, hence indicating that the relationship between returns on assets and cash position ratio is significantly different during and after financial crisis. This could be as result of that during financial crisis bank were under obligations to boast their liquidity position to withstand shocks and as such were very reluctant in issuing loans which eventually result to less variation between return on assets and cash position during this period.

Like the ROA, similar reaction can be observed with the return on equity. Before the financial crisis, the results show a positive and significant relationship between ROE and cash position ratio, but during and after financial crisis, the relationship between ROE and CPR is negative and significant with a t-value of -2,270 and significant at the
5% level, indicating that the relationship between Return on Assets and Cash Position Ratio is significantly different during and after the financial crisis.

Moreover, results from NPM reveals that before the financial crisis there was a positive and significant relationship between NPM and LtD ratio, with a t-value standing at 2,461, significant at the 5% level. However, during and after financial crisis, results from the correlation between NPM and LtDR seem to have changed with a t-value of -3,504, significant at the 5% level.

The results from the DL show that before the financial crash, there was a negative and significant relationship between Debt Leverage and Loan to Deposit ratios. However, this relationship seem to have changed during and after the financial crisis for LtDR with a t-value of 2,974, significant at the 5% level indicating that the association between Debt Leverage and Loan to Deposit ratio has changed significantly. We also observed similar reaction with the Cash Position ratio. Before the financial crisis, the relationship between DL and CPR was negative and significant at the 5% level, but during and after the financial crisis, the relationship between DL and CPR seem to have changed significantly with a t-value of 2,675, significant at the 5% level.

Following the results from Table 17, we can conclude that when a dummy variable is introduced to compare the relationship between liquidity risk variables and bank performance measure before, during and after financial crisis, we observe a that ROA, ROE and NPM seem to have a positive and significant relationship with liquidity risk variables before the financial crisis, but during and after the financial crisis, the results seem to have changed to a significant negative relationship. Also, the Debt Leverage seems to have a negative and significant relationship with liquidity risk variables, however this relationship seem to have changed to a positively significant relationship during and after financial crisis.

### 5.4 Summary of Analysis

A concise review of the empirical findings reveals that during the period 2005-2007, there was an upsurge of liquidity flows in the banking markets. Banks were more flexible with their lending policies between themselves and with their customers. This explains the reason why the Loan to Deposit, Loan to Assets and the Cash Position Ratios increased tremendously during this period and only fall around the first quarter 2008 till 2010. Reason for this sudden decline could be as result of the recent financial crash that hits the European market making it difficult and expensive for banks to raise finance via interbanking lending. As such bank were under pressure to maintain their liquidity buffer and implement stringent liquidity risk management strategies which involves moral harzard and adverse selection of lenders to ensure stability in the system. Moreover, European banks profitability during these periods was not left untouched. Observations from the descriptive statistic show that averagely, ROE, ROA, NPM, and NIM increased to an unprecedented level between the first half 2005-2007 and later
dropped after this period. This upsurge in profitability could be as a result of banks engagement in commitment lending and others profitable investment opportunities.

Results from the regressions analysis indicate that there is evidence to infer that there is a significant positive relationship between liquidity risk indicators and bank stability. We observe that when using a panel data regression model to analyse the relationship between liquidity risk and bank performance, results from the F-test is statistically significant at 5% indicating that Debt Leverage and Debt to Asset are linearly related to Loan to Assets, Loan to Deposit and Cash Position Ratio. When a fixed effects panel data model is applied to control for firm unobserved heterogeneity with a control variable of the financial crisis, the F-value disclose that there exist potential evidence of a linear relationship between stability ratios and liquidity risk. This is the case with Banco Commercial portuguez, Banco Popular Espagnol, Group Socite Generale, Unicredit, National bank of Greece and Banco Sabadell. We also noticed similar effect with these banks when estimating bank specific relationship and when a dummy variable of the financial crisis is introduced, we observe that before the financial crisis, the relationship between stability ratios and liquidity risk indicators is negative and significant, but during and after financial crisis there seem to have changed to significant positive relationship. These results provide us with enough statistical evidence to reject the hypothesis of no relationship between liquidity risk and stability ratios

Conversely to the relationship between liquidity risk and bank stability, we observe that the regressions results show a mixed effects of the relationship between liquidity risk and bank profitability ratios. When testing for a full sample with the regression panel data model, we observe that Return on Asset and Net Interest Margin display a linear correlation with Loan to Deposit, Loan to Asset and Cash Position Ratio, while Return on Equity and Net Profit Margin disclose a negative correlation. Moreover, when a fixed effect model is applied with a control variable of the financial crisis, results show that Return on Asset, Return on Equity and Net Profit Margin are linearly related to liquidity risk indicators, while the Net Interest Margin displays a negative correlation. Similar results are also displayed when we use the model for bank specific parameters to estimated bank specific relationship between performance measure and liquidity risk. This is the case with Banco Santander, BBVA, Banco Popular Espagnol, Banco Commercial Portugal, BNP Paribas, Unicredit and National Bank of Greece. Also, before the financial crisis Return on Assets, Return on Equity and Net Profit Margin exhibit a positive and significant relationship but this relationship seem to have changed to a significant negative relationship during and after financial crisis.

Finally, considering that some results show a statistically significant relationship between liquidity risk and bank performance while others display a negative correlation, We therefore conclude that we cannot draw a firm conclusion of the relationship between liquidity risk and bank performance.
6. Conclusion

In this chapter we discuss results from the analysis and recommendation. This is followed by theoretical and practical contributions, truth criteria then limitations and suggestions for further research.

6.1 Discussion of results

In the management of bank liquidity risk it is important to take both liquidity issues and performance into consideration because even largest banks might face serious problem if liquidity risk management is defective. Bank liquidity risk management ties to its ability to meet up with unexpected demand of funds from depositors and borrowers. Failure to meet with these obligations might affect confidence and trust in the system and exposure to liquidity risk. With its prime aim of pursuing profitable investment opportunities in order to maximize return to its shareholders, reconciling its deposit-lending policies has been one of the greatest challenges faced by banks especially during the recent financial crisis.

The purpose of this study was to investigate the relationship between liquidity risk and performance of listed banks in the European Union from 2005 to 2010. We have studied a sample of 12 listed banks within the EURO STOXX index and have established a correlation between the liquidity indicators and performance measurement.

By reflecting on the research question presented in the introductory chapter “what is the impact of liquidity risk on performance of banks before and during crisis in Europe? We have examined the relationship between liquidity risk and banks performance, therefore we have studied the dependency and correlation of their variables.

Firstly, we have used descriptive statistic to provide an explanation of the behavioural pattern of the respective mean and standard deviation for each liquidity indicators and performance measures for the 12 sample listed banks in the EUROSTOXX index. Tables show that liquidity position of most of the banks were relatively low during the sub-period 2007, but followed by an upsurge in profitability and later dropped around the last half 2007 till 2010.

Secondly, inferential test statistic was used to test the hypothesis and to provide an answer to the research question. We applied the regression analysis with observe values significant at the 5% level. Results from the F-test show substantial evidence to infer that liquidity risk is positively related to bank stability and to reject the hypothesis of no correlation between liquidity risk and stability ratios, contrary to its profitability ratios which display mixed results of the F-values.

The empirical results of our study reveal a mixed effect relationship between liquidity risk and bank performance. We found that there is a significant positive relationship...
between Net Interest Margin and bank profitability, we also found that Return on Equity and Net Profit Margin are positively related to Loan to Asset, Loan to Deposit and Cash position Ratio. Similar relationship is exhibited in the study of Dietrich & Wanzenried. (2011); Valverde & Fernandez. (2007); Bourke (1989).

Moreover, we found a negative relationship between Net Interest Margin and bank profitability. Also, when we allowed for bank specific relationship between performance measures and liquidity risk, we observed that there is a significant negative relationship between Return on Asset and liquidity risk indicators. This relationship is similar with the one displayed in the study of Kosmidou et,al (2005); Kosmidou (2008); Molyneux & Thornton .(1992).

Based on these mixed effects relationship, we therefore conclude that we cannot draw a firm conclusion about the relationship between liquidity risk indicators and bank performance measures.

6.2 Recommendations

Results from the empirical findings and discussion present that liquidity risk is positively connected to both profitability and stability. Also given that investors are more concerned with profitability indicators than any others performance measure, we would recommend banks management to apply sound liquidity risk management practices geared toward increasing returns to shareholders.

6.3 Theoretical & Practical Contributions

The liquidity risk has been widely studied during last financial crisis with very contrasting view about how to manage bank’s liquidity risk since it has no single common solution for banking industry with many old methods failed during the crisis. As new solutions from ECB or BIS are still in the testing process such as LCR or NFSR methods started to be tested in some of banks in EU only from beginning of 2011.

For the most important reason, why liquidity risk management is not as popular as credit risk or market risk management in banks was because liquidity management is not as profitable or damaging to banks as credit and market risk are. And most of liquidity risk management studies are concentrated with market liquidity (interest rate spread), but not funding liquidity within the bank.

Within this study, it is apparent that liquidity position can also affect bank’s general performance as much as credit risk and market risk. Also during financial crisis, by holding an optimal level of loan (or controlling its liquidity risk with a certain level) can be also helpful for bank’s financial stress. It is indicated from this study significantly the relationship between liquidity ratio and profitability if bank keeps its liquidity level less volatile (for easy management purposes).
6.4 Truth Criteria

The truth criteria of this research are the critical analysis of the problem, processes and choices faced during the research. From the quantitative nature of this study the main aspects to be evaluated are reliability, validity, replication and generalization.

6.4.1 Reliability

The reliability criterion evaluates how careful a scientific study has been conducted regarding the selection of data and choices made of which methods to use when measuring the data. Bryman & Bell (2007, p.162) argue that reliability is concerned fundamentally with issues that deals with consistency in measure. A high degree of reliability is obtained if the same measurement when use repeatedly in different occasion provides same results. To ensure a degree of consistency in our study we used only listed traded banks within the EUROSTOXX index.

Also, data of this study have been collected from a sample of 12 publicly listed banks of the EURO STOXX index, based on their half year financial reports from 2005 to 2010. For publicly listed banks, it requires them to prepare their financial reports in accordance with International Financial Reporting Standards (IFRS), which strengthen the reliability aspect of the contents from financial reports and eventually of the data. Also, selection of data has a high reliability since the figures observed in bank’s financial reports are consistent and it will never be subject to any changes according to the regulation.

6.4.2 Validity

Bryman & Bell (2007, p.165) refers to validity as the issue of whether or not an indicator that is devised to measure a concept really measure it. This study aims to investigate the relationship between liquidity risk and performance of listed banks in the European Union. The data consists of figures, which were collected from the financial reports and used to compute different liquidity and performance ratios are well known accounting or financial ratios, thus strengthen the validity of the components and gives an accurate picture of the concept. We have also ensured in this study that the framework covers all key terms and relevant concepts relating to liquidity risk and performance measures. We therefore believe that this study has fulfilled the requirements of validity.

6.4.3 Generalizability

The level of generalizability determines how well results or findings can be generalized beyond the confines of the particular context, in which the research was conducted (Bryman & Bell (2007, p.169). Since we have chosen to limit this study only on publicly traded banks as sample selection for the reason they hold majority of assets in
banking industry and involved most in commitment lending. As a result, this study and its findings would not be appropriate for small banks in the EU. This paper can be used for further research to find any relationship between liquidity risk and banks performance in other publicly traded banks in the US, UK, Australia, Asia and Africa.

6.4.4 Replication

The replication of a study is often regarded by the social scientist as an important ingredient of their activities and confirm to the validity of the study. It has to do with the ease at which similar study could be carried over and again (Bryman & Bell (2007, p.171). We have tried to be explicit as thoroughly as possible concerning the replication of this research. A replication of this study should be fairly easy as we employed data from financial reports, which are consistent over time and with the use of some statistical methods, we tried to establish a correlation between two variables. If others researchers in the future would like to perform similar study by using same data and method as we applied, the results should be the same.

6.5 Limitations and suggestions for further research

Although this research contributes to the advancing of existing studies related to liquidity risk management, there have been some limitations:

- Firstly but most importantly, the data collected in this study are only from 2005 to 2010, which includes a quite different period of financial crisis. The impact has been tested here can only apply with normal pattern of listed banks in EU within this period.

- For a statistical analysis, the data has been collected here belong to a small sample space, which includes only 9 observations of different ratios. Some of them are not exactly followed by the normal distribution, which could affect the results negatively.

- The time gap between liquidity risk and bank’s performance in this study has been setup with half year due to the shortage of data. But in reality, liquidity risk today could have impacts to bank from 1 day to 5 years and this does not show in this analysis, which kind of impact liquidity risk has with a relative longer time period.

However, we would like to share some suggestions for future researchers on this area:

- Firstly, similar study could be carried out in the UK and US listed banks and their results compared with the empirical findings of this study.
Secondly, the period of analysis could be extended beyond 6 years after financial crisis, in order to have a better understanding of the relationship between liquidity risk and performance. Given that the overall financial situation is still fraught of possible future instability, we would suggest that a qualitative study should be performed to address same issue by exploring the behaviours of banks management and the perceptions of shareholders.

Finally some elaborate statistical tests could be used such as the GARCH Model, Simple Linear Regression, CHI-SQUARE TEST, DURBIN WATSON TEST and Time Series to provide a clearer and deeper understanding of the relationship between liquidity risk ratios and bank performance measures.
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Dissertation


Web Resources


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http://www.bankofengland.co.uk/publications/events/futureofpayments/regulation.pdf


Appendix B: EURO STOXX Banks Index.

<table>
<thead>
<tr>
<th>Company</th>
<th>ISIN</th>
<th>Weight (%)</th>
<th>MCap (EUR Bill.)</th>
<th>Float Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCO SANTANDER</td>
<td>ES0113900137</td>
<td>18.93</td>
<td>65.14</td>
<td>1.00</td>
</tr>
<tr>
<td>RPM PARIBAS</td>
<td>FR0000131104</td>
<td>14.11</td>
<td>51.59</td>
<td>0.83</td>
</tr>
<tr>
<td>DEUTSCHE BANK</td>
<td>DE000549000B</td>
<td>10.58</td>
<td>36.63</td>
<td>1.00</td>
</tr>
<tr>
<td>BCO BILBAO VIZCAYA ARGENTARIA</td>
<td>ES011321835</td>
<td>10.54</td>
<td>38.30</td>
<td>1.00</td>
</tr>
<tr>
<td>GRP SOCIETE GENERALE</td>
<td>FR0001250809</td>
<td>9.29</td>
<td>33.92</td>
<td>1.00</td>
</tr>
<tr>
<td>UNICREDIT</td>
<td>IT0000064854</td>
<td>7.68</td>
<td>28.78</td>
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Appendix C: Estimation results.

Table 16: Estimation results interacting effect model.

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