UNIVERSITY OF VAASA

FACULTY OF BUSINESS STUDIES

ACCOUNTING AND FINANCE

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THE EFFECTS OF BANK CAPITAL ON BANK PERFORMANCE AND RISKINESS AROUND THE FINANCIAL CRISIS:

Empirical Evidence in European Region during 2005-2011

Master's Thesis

Accounting and Finance

Finance

VAASA 2015

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Year of Entering the University: 2012
Year of Completing the Thesis: 2015 Pages: 88

ABSTRACT

The main purpose of this paper is to examine the impacts of bank capital on bank profitability and riskiness around the period of financial crisis. The study applies fixed-effects panel regressions and uses bank-level data for 15 European countries over the period 2005-2011. The study also investigates this relationship for different bank categories (commercial, cooperative and other banks) as well as bank size (small, medium and large banks).

Overall, there is a significant and positive relationship between capital and bank profitability before and after the subprime crisis; however, no relationship is detected between them during financial crisis. In addition, there is strong empirical evidence that banks with higher capital level have lower return volatility and higher financial stability, especially prior to and after the crisis. Besides, there are two important conclusions reached after considering the capital effects in different bank categories and sizes. First, bank capital has the strongest positive impact on profitability of cooperative banks, followed by commercial banks and other banks. Second, large banks have the highest effect of capital on stability and earnings risk; meanwhile the risk of small banks is least impacted by capital level.

KEYWORDS: Bank capital, bank profitability, bank risk, financial crisis.

1. **INTRODUCTION**

The recent global financial crisis led to negative consequences and contributed significantly to recent global recession and European sovereign debt crisis. Since then there have been several debates raised to discuss about the causes for recent collapse of large financial institutions and a succession of banking crises in the United State and the European region. One of them was believed to be liquidity shortfall. Since there were over lending activities in banking system, however, banks did not establish a proper risk management and adequate capital provisions to absorb the losses resulting from their risky businesses. Therefore, global regulators are in process of imposing new capital requirements with intention to increase capital level and improve its quality to help banking firms survive in the liquidity crisis. Not until now bank capital has been raised its important role in the banking system as a cushion to absorb bank's losses to keep banks avoid becoming insolvent or being bailout with public funds. In addition, the key role of bank capital served as a buffer against unexpected losses is also recognized by Berger and Udell (1994). They also imply further that as the higher uncertainties are, the larger bank capital is raised. Moreover, Berger, Herring and Szegö (1995) also state the aim of requiring capital from regulators and other uninsured creditors of banks is to protect themselves against the costs of financial distress, agency problems, and the reduction in market discipline caused by the safety net. According to Berger et al. (1995), all government actions designed to enhance the safety and soundness of the banking system other than the regulation and enforcement of capital requirements.

Furthermore, in response to recent global financial crisis, the Basel Committee on Banking Supervision (BCBS) suggests updating the guidelines for capital and banking regulations. Basel III proposes many new capital, leverage and liquidity standards to strengthen regulation, supervision, and risk management in the banking sector. The capital standard and new capital buffers will require banks to hold more capital and a higher quality of capital than under current Basel II rules. The European Union has already implemented the Basel II accord via the EU Capital Requirements Directives, and many European banks have already reported their capital adequacy ratios according to the new system. All credit institutions in the EU adopted Basel II at the beginning of 2008.

Theoretically, raising capital is costly for the banks because the amount of capital affects the return for the equity holders of the banks. Additionally, bank managers respond negatively to the request of improving bank capitalization. Their reason is that

such regulation restricts their investment opportunities, which will reduce bank profitability and lead to ultimate banking failure (Koehn & Santomero 1980). Besides, the issue related to the effect of bank capital on bank performance has been discussed in several empirical studies. As documented by Holmstrom and Tirole (1997), higher capital mechanically implies a higher probability of survival. They also indicated that there is a positive association between bank capital and its profitability, meaning the higher capital could enhance return on equity. However, the theories on the disciplining role of demandable debt suggest that banks with high level of leverage (low capital level) would have better loan quality; thereby they are less likely to default and being acquired (Calomiris and Kahn 1991).

In addition, the relationship between capital and risk has recently become a cause for concern. Previous studies focusing on the association between capital and risk have mixed results. Some studies find positive relationship between capital and risk, namely regulators encourage banks to increase their capital commensurably with the amount of risk taken, which refers to "regulatory hypothesis" (Berger 1995). When investigating the effect of bank capital on bank's risk-taking, Furlong and Keeley (1989) argue that increasing the required capital level would reduce the incentive for banks to increase portfolio risk levels due to reducing the value of the deposit insurance put option. Consequently, this relationship implies that more stringent capital will reduce moral hazard and the probability of bank failure. Nevertheless, a negative relationship between capital and risk may refer to the "moral hazard hypothesis" whereby banks gave incentives to exploit existing flat deposit insurance schemes. Van Roy (2005) shows that the prudent capital regulation stimulates banks to raise their capital reserves; thereby declining their credit risk. Therefore, it can be inferred from Van Roy's finding that there is a negative relationship between raising banks' capital adequacy and their risk, as a result higher capital reserves driving the banks out of insolvent situation.

1.1 Purpose of the Study

This study examines the effects of bank capital on the bank's profitability and riskiness around financial crisis period with empirical evidences in European region from 2005-2011. This analysis intends to determine whether higher bank capital level can help enhance the level of profitability but reduce risk exposure that banks take around the crisis. Moreover, this paper will identify and empirically examine several observable bank characteristics that may be effective indicators of a bank's susceptibility to the

financial crisis. The empirical testing is conducted using data on all types of banks (commercial banks, cooperative banks and other financial institutions) operating in 15 European countries spanning from 2005-2011. Bank-specific data are obtained from the BankScope databases that include the balance sheet, income statement as well as key financial ratios of researched European banks. Other factors relating to country specific data such as GDP growth rate, inflation rate, unemployment rate and ratio of public debt-to-GDP as well as factors relating to financial market specific-indicators such as banking concentration level are collected from World Bank database. The seven-year period provides an appropriate time frame for the investigation since it covers the two-year period of the subprime lending crisis (2007-2008). This period is categorized by turmoil in financial markets due to shortfall of liquidity supply resulting in substantial losses in banks' capital. Therefore, the research period allows a thorough robustness analysis covering pre-crisis (2005-2006), during crisis (2007-2008) and post-crisis period (2009-2011).

This paper intentionally contributes to existing empirical analyses in several ways. First, the existing literatures have drawn a lot of attention on US or European cases in several periods, though the empirical evidences under the impacts of recent financial crisis have not earned enough discussions. Thus the purpose of this study is to examine European banks with the latest and wider range of panel data in 15 EU countries from 2005-2011. Second, most academic studies usually investigate the impact of bank capital on bank risk or bank earnings solely and in individual country like the United States, Japan or Canada. Whilst this study focuses on testing the effect of bank capital on different important factors of bank activities regarding to bank profitability, and bank risk during the period of financial crisis in European region. Third, this study classifies full sample into sub-panels according to bank's size and then considers the effects of different factors on the relationship between bank capital, profitability and risk. Fourth, previous research usually samples commercial banks and hardly considers other specializations. This paper examines overall banking system, including commercial banks, cooperative banks and other bank's categories since banks of different ownership characteristics differ in their attitudes to managing capital, profitability and risks.

1.2 Structure of the Study

The first chapter provides background information on the topic and introduces purposes and potential contributions of this study. The second chapter presents the previous

researches relevant to this paper which are the main theories and empirical evidence underlying the relationship between the bank capital and bank performance as well as bank risk. The third chapter provides a generic background about the European banking system before and during the financial crisis. In addition, next chapter explains the concept and measurement method relating to bank capital, bank performance and bank risk. Chapter five and six present the empirical part of the paper. The empirical hypothesis, data and methodology used in the study are presented in chapter five. In addition, the research problem is specified more closely by forming hypotheses based on previous research and theoretical considerations. The empirical results of this study are presented and discussed in chapter six. The chapter seven concludes the paper with some general conclusions.

2. LITERATURE REVIEW

The aim of this chapter is to briefly and critically review the previous empirical research in the area relating to association between bank capital and different dimensions of bank performance. Even though there have been remarkable empirical evidences about bank capital and bank performance in different individual countries, there are few researches covered the period before and during financial crisis in European region. Besides, most of these studies have focused on only one dimension of bank performance such as either of bank's profitability, bank resilience or bank's risk taking; they seldom are researched in different dimensions at the same time. This chapter begins with the reviewing mixed results about the relationship between bank capital and bank performance. Then the previous literature on how banks capital affects bank's risk taking will be summarized.

2.1 Bank Capital and Bank Performance

Berger and Bouwman (2013) examine the effects of bank capital on three dimensions of bank performance such as probability of survival, profitability and market share during normal and crisis time in the United States. The data used in their studies include all banks in the United States from 1984:Q1 to 2009:Q4, which covers two banking crises and three market crises in the period of 25 years. Their empirical results support the hypothesis that higher pre-crisis capital increases the probability of bank survival and their market share for banks of all sizes during banking crises. In addition, capital also increases profitability for all but medium-size bank during crisis. Another, noticeable finding is that small banks benefit in all respects from higher capital during market crises and normal time as well. For large and medium banks, higher capital improves only profitability during market crises and only market share during normal time.

Altunbas, Carbo, Gardener and Molyneux (2007) investigate the relationship between capital, risk and efficiency for a large sample of European banks between 1992 and 2000. They use data on banks operating in 15 European countries with bank-specific data obtained from the BankScope database. They adopt Zellner's Seemingly Unrelated Regression (SUR) approach, which allows for simultaneity between bank's risk, capital and efficiency while also controlling for important other bank and country-specific factors. Their empirical evidence shows a negative association between bank capital and risk in inefficient European banks, meaning that they hold more capital and take less risk, which is opposite to the evidence in the United States. In addition, another finding

shows the positive relationship between risk on level of capital and liquidity, possibly indicating regulators' preference for capital as a means of restricting risk-taking activities. Moreover, according to their empirical results, there are no major differences in the relationship between capital, risk and efficiency for different bank specification such as commercial, saving banks but cooperative banks.

Beltratti and Stulz (2012) investigate the bank characteristics contributing to the poor performance of banks during the credit crisis. Their empirical hypothesis tests whether the banks' specific factors before crisis related to their poor performance during crisis. Their study focuses on sample of 164 large financial institutions across the world with assets in excess of $10 billion at the end of 2006, excluding non-public traded banks during period from July 2007 to December 2008. They use bank's buy-and-hold stock returns to measure the bank performance. The empirical results show that large banks with more Tier 1 capital, more deposits, and less funding fragility will perform better. In addition, it is documented in their study that the performance of large banks during the crisis is negatively related to their performance in 2006. Besides, there is no systematic evidence that stronger regulation lead to better performance of banks during crisis; however, banks from countries that imposed more restrictions on banks in 2006 perform better during the crisis.

Akhigbe, Madura and Marciniak (2012) examine the relationship between the bank capital level prior to the 2007-2009 financial crises, and the exposure of bank stock price and stock volatility during the crisis. Their sample consists of 288 U.S publicly traded banks with their financial statements consistently available during the period from 2005 to December 2008. They use the bank's buy-and-hold return over the financial crisis (from April 2007 to December 2008) as a measure of stock price performance. They apply the weighted least squares model to determine whether the stock price performance during the crisis is related to several indicators such as bank capital, bank size, proportion of marketable securities to assets, ratio of loan loss provision to total assets, concentration in real estate loans, banks' growth opportunities, etc. Their most important finding is that banks with a higher level of capital experience greater shocks during the financial crisis. Furthermore, banks that are more profitable and experienced strong upward stock price momentum before the crisis are more resilient to shocks during the crisis.

In addition, Avery and Berger (1990) provide an empirical analysis of new 1992 bank standard of risk-based capital, using bank data in the US from 1982 to 1989. This new

RBC standards indicates some bank activities which are inherently more risky than others should be capitalized at higher level. They investigate the relationship between future bank performance and the risk-based capital relative risk-weights. Their empirical method is regressing five bank performance measures such as bank failure, nonperforming loan, charge-offs and earnings level as well as earnings variability on the lagged proportions of bank portfolios in each of the risk categories defined by the RBC standard. Their results show that banks with higher ratios of risk-weighted assets have poorer predicted performance. Besides, similar tests of the informational value of different capital standards suggest that both old and new capital standards have independent information in predicting future bank performance problems.

Furthermore, the role of capital as a buffer to absorb shocks to earnings has been recognized in several studies (e.g. Demirguc-Kunt, Detragiache and Merrouche 2010; Berger and Udell 1994). It is documented that higher capital increases the probability of the bank's survival. In addition, there is another set of theories that focuses on the incentive effects of capital. According to Holmstrom and Tirole (1997), higher bank capital induces higher levels of borrower monitoring by the bank, thereby reducing the probability of default or otherwise improving the bank's survival. In contrast, a different strand of the theoretical literature suggests that banks with higher capital may experience lower survival probability. Calomiris and Kahn (1991) show that a capital structure with sufficiently lower equity leads to more effective monitoring of bank managers by informed depositors and hence a smaller likelihood of bad investment decisions. This suggests that a bank with higher capital may face a higher probability of bad loans and hence loan default, which may result in a lower survival probability.

Several papers examine the association between the bank capital and the bank liquidity. Horvath, Seidler and Weil (2012) provide an empirical research of the relation between capital and liquidity creation. They use data for all Czech banks during the period from 2000 to 2010 and adopt Granger-causality framework to test their empirical hypotheses. Their results indicate that capital negatively Granger-causes liquidity creation for small banks. This finding implies that Basel III Accords might lead to reduced liquidity creation by introducing tighter capital requirements; also greater liquidity creation may hamper bank solvency. In addition, they also observe that liquidity creation Granger-cause a reduction in capital. Briefly, the paper refers a trade-off relationship between the benefits of financial stability induced by stronger capital requirements and the benefits of increased liquidity creation.

The previous researches offer conflicting predictions about how capital should affect bank profitability. According to Holmstrom and Tirole (1997), high bank capital increases the total surplus generated in the bank-borrower relationship. Assuming that banks keep a large enough portion of the surplus, higher capital will lead to higher bank profitability. Moreover, if the ratio of the surplus generated by high- versus low-capital banks is higher during crises, it follows that high capital banks will be able to improve their profitability during crises relative to low-capital banks. Likewise, Berger (1995) examines the capital-earnings relationship by employing annual data from 1983-1989 of every insured U.S commercial banks. They run the regression of the capital-asset ratio (CAR) and after-tax return on equity (ROE) on three years of lag CAR and ROE and a number of control variables, including dummies for every bank and time period in the sample. Their empirical evidences suggest that there is a strong positive relationship between capital and earnings for the U.S banks in the 1980s and that each variable positively Granger-causes the other. Consequently, show that higher capital is followed by higher earnings over the next few years. Besides, the finding supports the expected bankruptcy cost by implying: (1) the earnings increased following the a capital increase comes mainly from reduced interest rates on uninsured funds and (2) Granger-causality is the strongest for riskiest banks, who stand to get the most reduction in risk and thus the most increase in earnings from raising capital.

Goddard, Liu, Molyneux and Wilson (2010) examine the determinants and convergence of bank profitability in eight European Union member countries from 1992-2007, using dynamic panel model. The sample includes all commercial, savings and cooperative banks from each of the eight countries. Each of estimation is carried out for the entire sample period and for two sub periods: (1) 1992-1998 the period immediately following the creation of the Single Market and (2) 1999-2007 the period immediately following of introduction of the single currency. The key finding is that the persistence of EU bank profitability was lower in 1992-2007 than it was in 1992-1998 in all eight countries. Also, an increase in the speed at which any excess profits earned in the short run were eliminated through competition through competition suggests there was an increase in the intensity of competition. Average profitability was higher for banks that were strongly capitalized, cost efficient and highly diversified.

Lee and Hsieh (2013) investigate the impacts of bank capital on profitability and risk by adopting the Generalized Method of Moments technique for dynamic panels using bank-level data for 42 Asian countries over the period from 1994 to 2008. They examine the overall banking system, including commercial banks, cooperative banks,

investment banks and others. Also, they adopt four proxies for profitability: return on assets (ROA), return on equities (ROE), net interest margin (NIM) and net interest revenue against average assets (NR) and three for risk: variance of ROA, variance of ROW and loan loss reserves (LLR) in order to find out the proxy for profitability and risk that is suitable for Asian countries. The empirical results indicate that the effect of increasing bank capital on profit (risk) is significantly positive (negative). It is also found that different profitability variables have different results on the persistence of profit. In addition, other noticeable empirical evidences are highlighted that investment banks the lowest and positive capital effect on profitability, whereas commercial banks reveal the highest reverse capital effect on risk. Besides, banks in low-income countries have a higher capital effect on profitability; banks in lower-middle income countries have the highest reserves capital effect on risk, while banks in high-income countries have the lowest values.

2.2 Bank Capital and Bank Risk

The majority of previous papers find a positive relationship between capital and risk adjustments, indicating that the banks which have built up higher capital, simultaneously also increased risk. Furlong and Keeley (1989) examine the relationship between the capital requirement levels with the bank's risk-taking behavior. They document that more stringent capital decreases the incentives for a value-maximizing bank to increase portfolio risk, thereby reducing the probability of bank failure. The reason is stated that the higher required capital reduces the value of the deposit insurance put option. In addition, Shrieves and Dahl (1992) state that there is a positive relationship between bank capital and bank risk under the actions of regulators and supervisors. According to this regulatory hypothesis regulators encourage banks to increase their capital commensurably with the amount of risk taken. Another motive of increasing capital when the amount of risk rises argued by Berger (1995) is partly due to efficient market monitoring from markets when capital positions are deemed inadequate. Furthermore, Blum (1998) also suggests that capital requirement may increase the bank's risk in a dynamic framework. The reason is that when raising the capital reserves today, the bank has fewer resources to generate profit for tomorrow. Therefore when raising equity is very costly, the bank has to involve in riskier business today to get higher profitability.

Jokipii and Milne (2011) examine the relationship between short-term capital buffer and portfolio risk adjustments. They use an unbalanced panel of US bank holding company (BHC) and commercial bank balance sheet data from 1986-2006. Their estimations show that the management of short term adjustments in capital and risk are dependent on the size of buffer. For banks with capital buffer approaching the minimum requirement, the relationship between adjustments in risk and capital are negative. That is the low capital banks either increase their buffer by reducing their risk or gamble for resurrection by taking more risk as a means to rebuild the buffer. In contrast, the relationship between capital and risk adjustment for well capitalized is positive, indicating that they maintain their target capital level by increasing (decreasing) risk when capital increase (decrease). Besides, their results also show that small buffer banks adjust to their target capital level faster than their better capitalized counterparts.

Rime (2001) examines the Swiss banks' capital and risk behavior. The author adopts a simultaneous equation approach to analyze adjustments in risk and capital by Swiss banks as they approach the minimum regulatory capital level. The sample includes 4 big banks, 24 cantonal banks and 125 regional banks in existence from 1989 to 1995, which represents 82% of total assets in the Swiss banking system. He estimates the system of equations using a three-stage least squared procedure in order to take account of the simultaneity of banks' adjustments in capital and risk to get estimates that are asymptotically more efficient than under two-stage least squares. The empirical evidences show that Swiss banks close to the minimum regulatory capital requirements tend to increase their ratio of capital to risk-weighted assets. Moreover, another remarkable finding is that there is a positive and significant relationship between changes in risk and changes in the ratio of capital to total assets but no significant relationship between changes in risk and changes in the ratio of capital to risk-weighted assets.

Konishi and Yasuda (2004) empirically investigate the relationship between bank risk and some quantifiable factors that may affect bank risk taking behavior at the commercial banks. They use panel data of Japanese regional banks covering the period from 1990 to 1999. The sample banks include 54 regional banks listed on the Tokyo Stock Exchange (TSE). They use five alternative capital market risk measures: total risk, firm-specific risk, systematic risk, market risk and interest rate risk. Also the insolvency risk measure is used as Z-score, a statistic indicating the probability of bankruptcy. The empirical results show that the implementation of the capital adequacy requirements reduces risk taking at the commercial banks as desires of regulatory

authorities. An alternative interpretation may be that the collapse of the bubble economy in late 1980s and the subsequent bad loans problem completely change the risk taking behavior of banks, since banks are more resilient to taking more risky assets.

Baselga-Pascual, Trujillo-Ponce and Cardone-Riportella (2013) analyze empirically bank-specific and macroeconomic determinants of bank risk for a large sample of commercial banks operating in the European Union using a dynamic panel data. They use sample of 155 commercial banks operating in 14 European countries over the period from 2005-2011, which consider the impact of on-going financial and economic crisis on the Eurozone banking system. They adopt the generalized method of moment (GMM) estimator in order to control for unobserved heterogeneity and endogeneity. They proxy bank risk using two complementary metrics: Non-performing loans rate (credit risk) and Z-score (bank risk). Their empirical evidences indicate that capitalization, profitability and efficiency and liquidity are negatively and significant related to banks risk. In addition, less competitive market, lower interest rate, higher inflation rates and falling GDP increase bank risk.

Jeitschko and Jeung (2005) provide a theoretical framework to investigate the relationship between a bank's capitalization and risk-taking behavior by incorporating the incentives of the deposit insurer, the shareholder and the manager. The deposit insurer who is interested in protecting the deposit insurance fund has the most conservative policy toward risk-taking. The shareholder who benefits from risk shifting associated with deposit insurance subsidy has an incentive to increase the risk level beyond its optimal level. The manager who stands to lose his private benefits of control in case of bankruptcy is generally more conservative in determine asset risk than the shareholders. In addition, it is shown that a bank's risk can be either negatively or positively related to capitalization, depending on the relative force of the three in determining assets risk and risk-turn characteristics of bank's assets choice set.

Iannotta, Nocera and Sironi (2007) study the effect of ownership structure on performance and risk in the European banking industry with a sample of 181 large banks during the 1999-2004 periods. They compare the performance within mutual banks (MBs), privately-owned stock banks (POBs), and government-owned banks (GOBs) in terms of profitability, cost efficiency and risk, controlling for ownership concentration. They proxy ratio of operating profit total earnings assets, ratio of operating income to total earnings assets and ratio of operating cost to total earnings assets as bank performance measurement. They also incorporate dummies variables for

ownership structure characteristics, year and countries. Also, a set of control variables such as the size, level of loan and deposit as well as liquidity and capital of banks is also included in the model. Their findings indicate that private banks are more profitable than both mutual and public sector banks. In addition, as far as profit is concerned, bank's size, loans, capital and loan loss all exhibit significantly positive coefficient, while both bank's liquidity and deposits are not significant. Their results concerning risk indicate that public sector banks have poorer loan quality and higher insolvency risk than other types of banks. In addition, mutual banks have better loan quality and lower assets risk than both private and public sector banks.

Bessler and Kurmann (2014) investigate the relationship of different bank risk exposure in different economic environments under different bank capital regulations. Their sample consists of commercial banks in the EMU and the US between 1990 and 2011, which allows them to identify structural changes of risk exposures and their relative importance in the context of the pronounced changes in worldwide banking markets as well as the recent financial and sovereign debt crisis. In order to explain the commercial bank stock returns in the worlds' major banking sectors of the EMU and the US, they implement a multi-factor asset pricing framework. They focus on the ability of macroeconomic factors such as interest-rate risk, exchange rate risk, credit risk, sovereign risk and real estate risk to explain stock returns. Moreover, they utilize balance sheet characteristics to allow for detailed inferences on the determinants of banks' risk factor loadings and variance shares. The empirical findings indicate that banks' risk factors are multi-dimensional but well-reflected in stock prices. Sub-period analyses point towards the existence of pronounced time-variation in betas and variance shares. Changes in the banking business and in the crisis period are reflected in the form of dynamic risk exposures. Moreover, bank specific characteristics such as asset size and equity-to-asset ratios provide relevant information for identifying banks with economically significant exposures. Their results yield valuable implication into the dynamics underlying bank risk, the associated exposures and their reflection in equity prices.

3. GENERIC BACKGROUND

During the last decade, the European banking sector witnessed substantial changes as a result of regulatory developments, merger and acquisitions (M&As) wave, and increasing industry concentration. The regulatory environment was constantly changing with implementation of the Financial Sector Action Plan (FSAP), finalization of Basel II framework, as well as launching the Capital Requirement Directives (CRD) and the Markets in Financial Instruments Directive (MiFID) which boosted the efficiency and competitiveness of the financial sector. Additionally, in order to improve efficiency and profitability, there was common trend in the EU banking's sector that was trying to penetrate into new market and increasing their products range, leading to consolidations, mergers and acquisitions. Besides, there was widespread diversification of generating revenue into area such as insurance, pensions, mutual funds and various securities-related areas. Moreover, the creation of single financial market and the introduction of the Euro led to converged interest rates and market structures of member countries. Thus, this chapter is to provide generic background about the structural developments that took place in Western Europe from 2005-2011, elaborating on the general regulatory developments related to banking sector, as well as on the development in banking structures. The materials used in this section include the text book *The Economics of Money, Banking and Finance* of Howells and Bain (1998), *Introduction to Banking* of Casu, Girardone and Molyneux (2006), *The Banking Crisis Handbook* of Gregoriou (2010), *Modern Banking* of Heffernan (2005), and *Annual Report on EU Banking Structure* of European Central Bank (ECB) from 2004-2011.

3.1 Regulatory Development

According to Casu et al (2006:353), the primary objective of EU legislation has been to reduce the barriers to cross-border trade in the banking and financial services area in order to promote a more competitive and dynamic financial services industry. The liberalization of structural obstacles has been accompanied by financial deregulation through the reduction of direct government control. At the same time it has been associated with upgrades of prudential regulations as witnessed by the revision of Basel II rules. Table 1 shows the main regulatory measures that have had an impact on the European banking sector

Table 1: Regulatory measures affecting EU banking and financial sectors

Year		Regulation
1977	Fist Banking Directive.	Harmonized rules for bank licensing. Established EU-wide supervisor arrangements
1988	Basel Capital Adequacy Regulation (Basel I).	Minimum capital adequacy requirement for banks (8% ratio). Capital definition: Tier 1 (equity); Tier 2 (near-equity). Risk-weighting based on credit risk for bank business
1988	Directive on Liberalization of Capital Flows	Free cross-border capital flows, with safeguard for countries with balance payments problems
1989	Second Banking Directive.	Single EU banking license. Principles of home country control and mutual recognition
1992	Large Exposures Directive.	Bank should not commit more than 25% of their own funds to a single investment. Total resources allocated to a single investment should not exceed 800% of own funds.
1993	Investment Services Directive.	Legislative framework for investment firms and securities markets, providing for a single passport for investment services.
1994	Directive on Deposit Guarantee Schemes	Minimum guaranteed investor protection in the event of bank failure.
1999	Financial Services Action Plan (FSAP)	Legislative framework for the Single Market in financial services
2000	Consolidated Banking Directive	Consolidation of previous banking regulation
2000	Directive on e-money	Access by non-credit institution to the business of e-money issuance
2001	Directive on Reorganization and Winding up of credit institution	Recognition throughout EU of reorganization measures proceedings by the home state of an EU credit institution
2001	Regulation on the European Company Statute	Standard rules for company formation throughout the EU
2004	New EU takeover Directive	Common framework for cross-border takeover bids
2006-2008	Capital Requirement Directive	Update Basel I. Improve consistency of capital regulation Make regulatory capital more risk sensitive.

During the period from 2005 to 2011, there were various legal initiatives relating to the banking sector completed, which aimed at advancing the creation of a dynamic, competitive and efficient market for financial services in Europe. Since May 1999 the Council launched the Financial Sector Action Plan (FSAP) including actions and measures. They were set to develop the legislative and non-legislative framework with the purpose of creating a single EU wholesale market, making retail insurance markets

open and secure as well as strengthening the rules on prudential supervision for an optimal single financial market. (Casu et al. 2006:353).

In 2004 and early 2005, the most significant regulatory developments were the finalizations of the Basel II framework, the introduction of new International Reporting Standards (IFRS) and the revision of some existing International Accounting Standards (IAS). Basel II is considered more risk-sensitive than the existing rules (Basel I) because they allocate the more capital for lower quality loan than that of the better loan quality. Therefore, this new framework gives banks an incentive to achieve higher efficiency by improving their risk management systems. Besides, the adoption of the IFRS and corporate governance resolutions were to address the need of improving transparency as well as strengthening investor confidence and promoting market discipline. (ECB 2004-2005)

From 2006 to 2007, there were two initiatives implemented namely Capital Requirements Directive (CRD) adopted in June 2006 and the Markets in Financial Instruments Directive (MiFID) executed in November 2007. Both the CRD and MiFID were supposed to enhance the efficiency and competitiveness of the financial sector. The CRD provides incentives for banking firms to improve their risk management systems to meet the capital requirements. In addition, it also includes provisions for cooperation between home and host supervision for the cross-border institutions. Besides, the MiFID provides regulatory tools for the investment firm by extending the range of services and activities that they can offer and improve clarity to the allocation of responsibilities between the home and host authorities, and promotes investor protection. (ECB 2006-2007)

In the period from 2008-2009, due to the bankruptcy of Lehman Brothers in 2008, there was a significant loss of confidence in financial markets and institutions. Thus the government and central banks at the international level have to provide appropriate legal actions to support the financial system. In order to address the shortcomings caused by crisis, in the EU, a European Systematic Risk Board (ESRB) is established with the purpose of forecasting the stability of the financial system. Besides, a European System of Financial Supervision (EFFFS) also is set up to increase supervisory convergence and cooperation in the supervision of individual institution. Additionally, the European Commission amends the Capital Requirements Directive (CRD). The amendments include higher capital requirements for trading book and re-securitization, remuneration policies and the disclosure of securitization. Besides, the Directive on the deposit

guarantee schemes was amended in March 2009, following a commitment made by the EU Finance Ministers in October 2008. (ECB 2010)

3.2 Consolidation

According to Casu et al. (2006:347), the consolidation, integration and internationalization are important factors that affect the structure of the European banking system. The domestic consolidation is preferred due to the fact that it helps domestic banking firms reduce costs and complications in merger and acquisition operation. Besides, there is a comparative advantage for the domestic banks in consolidating locally that they can gain stronger national presence and become more competitive in a cross-country consolidation phase. The consolidation trend has resulted in the number of credit institution in the EU declining since 1997, and dropped by a further 2.8% in 2004. This suggests that consolidation is proceeding in a decelerating pace. This decline can be explained mainly by a slowdown in domestic M&A activity.

Besides, Casu et al. (2006:349) also states that merger and acquisition activities emphasize more on cross-border markets in recent years because the domestic markets become neutral and competition intervention from authorities. In particularly, cross-border M&A increased relative to the period 1993-1998, both in absolute and relative terms, accounting for about 30% of the number and 24% of the value of all deals in the more recent period, up from 20% in the earlier period. According to Casu et al. (2006:41), there are some common motives for M&As such as economies of scales, economies of scope and eliminating inefficiency. Merger and acquisitions can help combined institutions to increase their size with being capable of achieving lower unit cost of producing financial services. In addition, they can generate cost savings from delivering services jointly through the same organization rather than through specialized providers. Moreover, banks with poor management are naturally targets for being taken over by other institutions with more efficient management. Other motives can include increasing market power through removal of a competitor and political power enhancement; and diversification of product lines and improvement of marketing and distribution. These potential gains will likely produce higher margins and improve the profitability and value of the combined institutions.

Consolidation in the banking sector continued in 2006-2007 at deceleration rate, meanwhile there was an increasing exception of cross-border deals compared to

previous years. Whereas the number of credit institutions declined, total assets of the EU banking sector increased, signaling the emergence of larger institutions. However, the value of M&A transactions in the first half of 2007 increased and a number of significant deals are currently in progress. In the Euro area the number of credit institutions declined by 1.9% to 6,130 in 2006, with Netherlands, Denmark and France once again being the main drivers of this trend. While Denmark, France and the UK continued to witness a consolidation process, a sharp decline in the number of credit institutions in the Netherlands during 2007. In the first half of 2008 the number of M&A transaction remained at the same level as in the same period of the previous year, while their value was significantly affected by the acquisition of ABN Ambro by the consortium of Royal Bank of Scotland (RBS), Fortis and Santander. (ECB 2007)

Consolidation process of the EU banking sector continued in 2008 and 2009, leading the number of credit institution declined at a steady pace, with an exception of a reclassification in Ireland in 2009. Besides, the decline was particularly marked in Cyprus, as a consequence of the consolidation of its credit cooperatives sector. There was also a declining trend taking place in Denmark, Germany, France, the Netherlands and Sweden. However, the Baltic countries witnessed an increase trend in both domestic and foreign banks. Overall, the number of M&As in the EU dropped by a quarter in 2008, bringing the total number to the lowest point throughout the period under observation (see figure 1). In terms of the total value of transactions, the M&A data revealed a significant decline in EU cross-border and outward transactions. By contrast, M&A activity started to pick up in 2009, with the clearest increase taking place in the sub-category of domestic deals. The values of the deals have remained modest (see figure 2). Important deals in 2009 and early 2010 include the acquisitions of Dresdner Bank by Commerzbank and HBOS by Lloyds TSB as domestic deals, but also Fortis by BNP Paribas as an example of a cross border deal and Mellon United National Bank by Banco Sabadell as an example of an outward deal. Most of these deals were accelerated or included by the financial crisis. (ECB 2010)

Figure 1: Bank M&As - number of transactions in EU during 2000-2010 (ECB 2010:15)

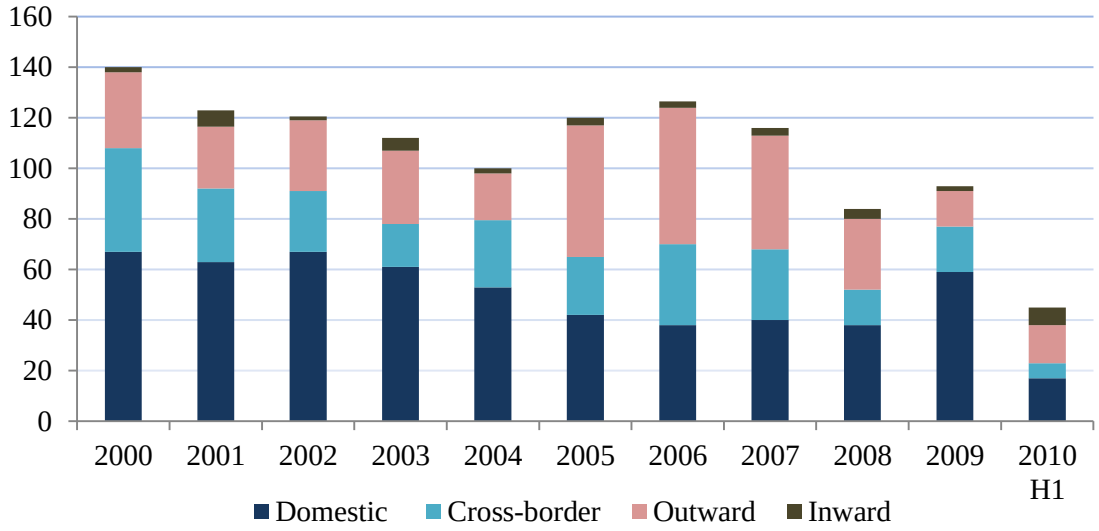
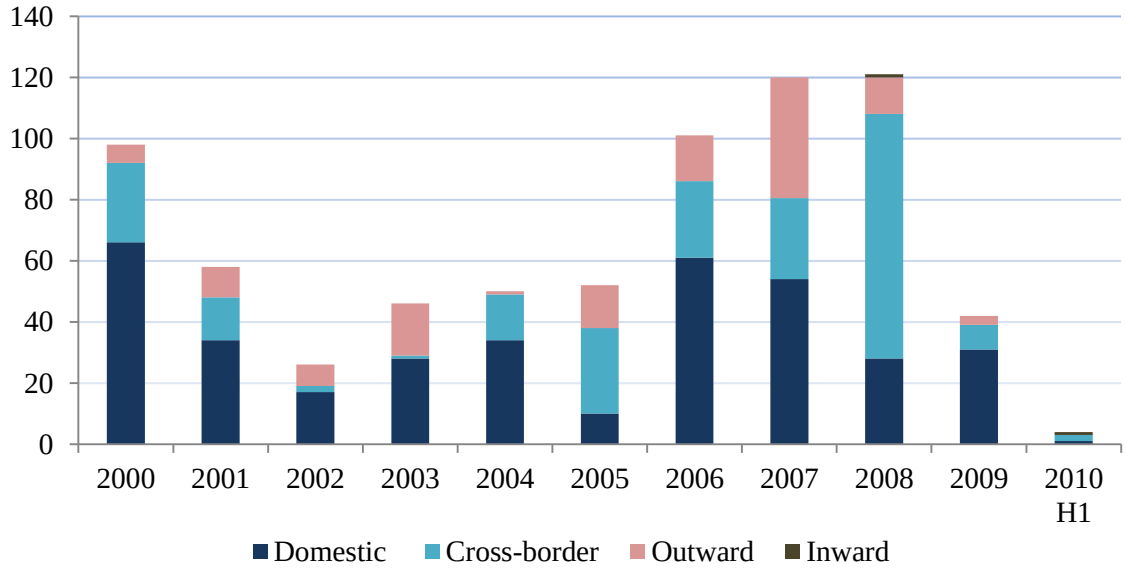


Figure 2: Bank M&As - value of transactions in EU during 2000 - 2010 (ECB 2010:16)



Overall, the cross-border M&A activity is expected to recover quickly once the economic cycle turns. Thus, the observed decline in cross-border and outward M&A is only temporary. There are three reasons behind this expecting trend. First, the number of cross-border deals has already picked up since early 2009. Second, there was an exit

from government recapitalization measures, which result in more M&A opportunities in Europe in the near future. Third an ESCB survey conducted in May 2009 revealed that bank have temporarily delayed their plan of revising their internationalization strategies.

3.3 Funding and Capital Structure

In terms of funding structure in EU banking sector, it is observed that there are significant differences from one bank to another. Two determinants factors are the bank's country of residence and its specialization. Firstly, banks' resource to deposit financing differs across countries. Deposit funding is especially important in the new member states and Greece (up to 80% of total liabilities), while in Denmark, Ireland and France, deposits account for less than 30% of total liabilities. These variations in banks' overall funding structure may result from differences in banking system structure, the size and development of the local financial market, the legislative environment, and finally the proportion foreign ownership. Another structural factor that may differ across counties is household saving levels differ from one country to another. In countries where saving levels are high, customers demand for deposits is likely to be higher. However, households' investment preferences also play an important role. While households in some countries mainly invest in deposit, households in other countries may prefer non-bank financial products, such as mutual funds and life insurance contracts.

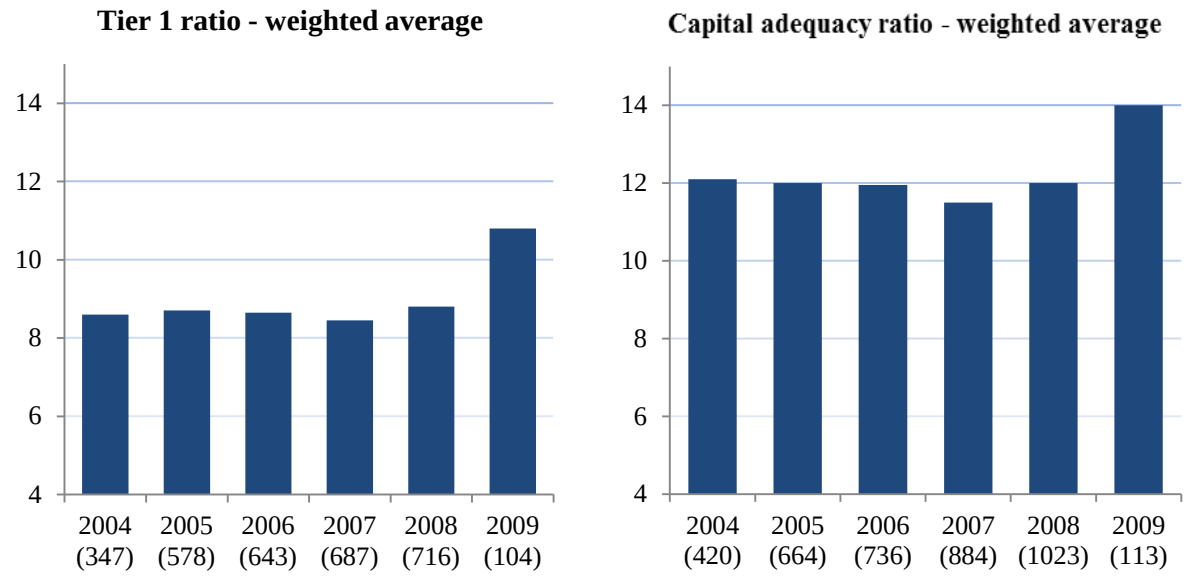
Another source of funding is non-deposit funding (excluding equity and other liabilities mainly related to banks' financial market activities), which accounted for around 42% of banks' total liabilities between 2000 and 2005. Three important non-deposit funding sources are interbank funding, money and capital market funding and securitization. The first important non-deposit funding channel is banks' borrowing on the interbank market. Through this market, banks with excess funds can transfer them to banks experiencing a funding deficit. As a result, liquidity is redistributed among banks. It is clear that interbank transaction mainly serve short-term funding needs, to insure against short-term liquidity shocks. Consequently, these positions are rather volatile over time. Bank can also turn to non-bank financial market participants to obtain funding. They traditionally issue large range of money and capital market instruments such as: certificates of deposit, medium-term notes floating rate notes, commercial paper and other types of bonds, characterized by a wide range of currencies, maturities and interest rates. The use of market instruments allows banks to diversify their funding base and

may bring funding more in line with the assets' characteristics. Another instrument that plays a role in banks' funding strategies and has grown considerably in recent year is securitization. There are many reasons for originators to securitize their assets, ranging from liquidity to capital adequacy reasons, and in practice banks often pursue a combination of benefits. It may be an efficient and cheap source of funding, as these bonds may achieve a higher credit rating than the banks' conventional bonds because they are segregated in tranches according to credit quality. Securitization also allows issuers to diversify their financing sources, bringing them more in line with the characteristics of their assets. Finally, it helps originators to remove assets from their balance sheet and thus, essentially to sell their exposure and release the regulatory capital assigned to it.

The financial crisis highlighted the weaknesses of the internal funding policies of the financial industry. Drawing on the lessons of 2008 and 2009, banks and public authorities will reshape the funding characteristics of the sector. Banks will be forced to improve their funding and capital structures in terms of quality and reliability, however, this structural adjustment will also translate into higher funding costs. The amount of capital that banks hold will increase, whether as a result of regulatory reforms or of capital markets' demands. Regulatory reforms aim to increase the amount and quality of capital that banks have to hold; also the crisis has increased investors' awareness of banks' capital endowments. Greater awareness is to be found not only among equity investors, but also among debt holders, as higher capital buffers also reduce the risk of a bank defaulting on its debts.

Besides, both regulatory developments and the current economic and financial environment will affect the capital structure of banks. The expected increase in cost of risk will continue to consume bank capital in the near future, and the supervisory requirements relating to risk weights on a wider range of assets classes will probably be permanently higher for the foreseeable future. EU banks have already raised their Tier 1 and capital adequacy ratios by roughly 2 percentage points. However, future developments are likely to be affected by two factors: first the ability to tap markets will differ between banks, and second governments are now important shareholders in the banking sector of some EU countries. In the period preceding the crisis, the funding of banks was characterized by low interest rates, low risk and thus an inadequate pricing of cost of risk. Wholesale and interbank sources of funding had continuously grown in importance, whereas funding through deposits was considered unattractive.

Figure 3: Capital ratios of EU banks from 2004 - 2009 (ECB 2010:29)



Before the crisis, some banks were becoming increasingly dependent on cheaper short-term interbank and wholesale funding, increasing the maturity mismatched in the balance sheet. In a crisis and post-crisis environment, where banks are likely to look for safety, funding sources such as repo funding, simple forms of securitization and covered bonds may become preferred choices. A shift towards secured funding has been observed since 2000 and may become a persistent trend in the medium term. Over the coming 5 years, lenders to banks will attempt to limit credit and funding risks and therefore demand greater security and be more aware of the liquidity of collateral provided. Therefore, although the crisis highlighted the flaws of securitization, analysts and market participants agree that securitization will again need to become a part of the financial landscape but the exact nature and size of the market is as yet undetermined. There are currently some signs of the reopening of the primary and secondary securitization market, even if most of the issuance is in fact retained for repo operations. Owing to the existence of a large number of uncertainties, the future state of the securitization market is still unclear. One probable trend is the development of amore standardized market, in terms of both instruments and documentation.

The regulatory proposal on liquidity requirement may have an impact on the role of the interbank markets as a funding source for banks. The recent regulatory proposal on liquidity requires banks to hold highly liquid assets and an amount of stable funding.

Therefore, it is expected that in order to meet the net stable funding ratio requirements, banks would have to increase the duration of their funding. This in turn would lead to an increased multi-year demand for term liabilities for the banking system. Given that banks have to fund themselves at longer maturities, market participants see potential difficulties in finding providers of this medium-term funding, as even banks with a liquidity surplus under the current regime would have an incentive to invest these funds in highly liquid assets rather than in interbank assets. Additionally, regarding the liquidity coverage ratio, market participants find the definition of the high-quality liquid assets in the BCBS proposal restrictive. As such, banks may be tempted to use the less liquid assets as collateral for operations with central banks and to keep other assets (eligible for buffer) to meet the supervisory requirements. The assets pledged to central banks would not be used as collateral in the secured funding markets. This could also weaken repo markets for covered bonds.

In the post crisis period, funding will not be as easily accessible as before the crisis and it will be more expensive. Funding structures will move towards stable and long-term sources, such as capital and deposits, and away from more volatile and short-term sources in the interbank and money markets. Banks will also have to increase their capital. As a consequence, not only the median costs of capital and bond issues but also the dispersion between banks will increase: investors will discriminate more between solid and less solid banks. The price of all sources of funding, including capital, is likely to increase. Deposits are being rediscovered as a funding source. This will result in higher cost of higher costs of deposit funding owing to increased competition spilling into higher interest rates offered. Funding on interbank and money markets will be more expensive owing to higher requirements regarding the quality of collateral and the pricing of liquidity risks. Generally, risk will be more sensitive to the idiosyncratic risks of banks. The Basel III proposals for improvements in capital and liquidity endowments, the withdrawals of state support and the expiry of unconventional central bank policy measurements will create additional pressure on banks' funding. Many banks will have to issue securities to offset their maturing debt. They will probably try replacing some maturing debt with new longer-term debt, which exposes them to increase in interest rates and funding costs. This could be main concern in the near future, with a possible steepening of yield curve. Wholesale funding costs are also likely to increase as a result of a possible congestion of the market.

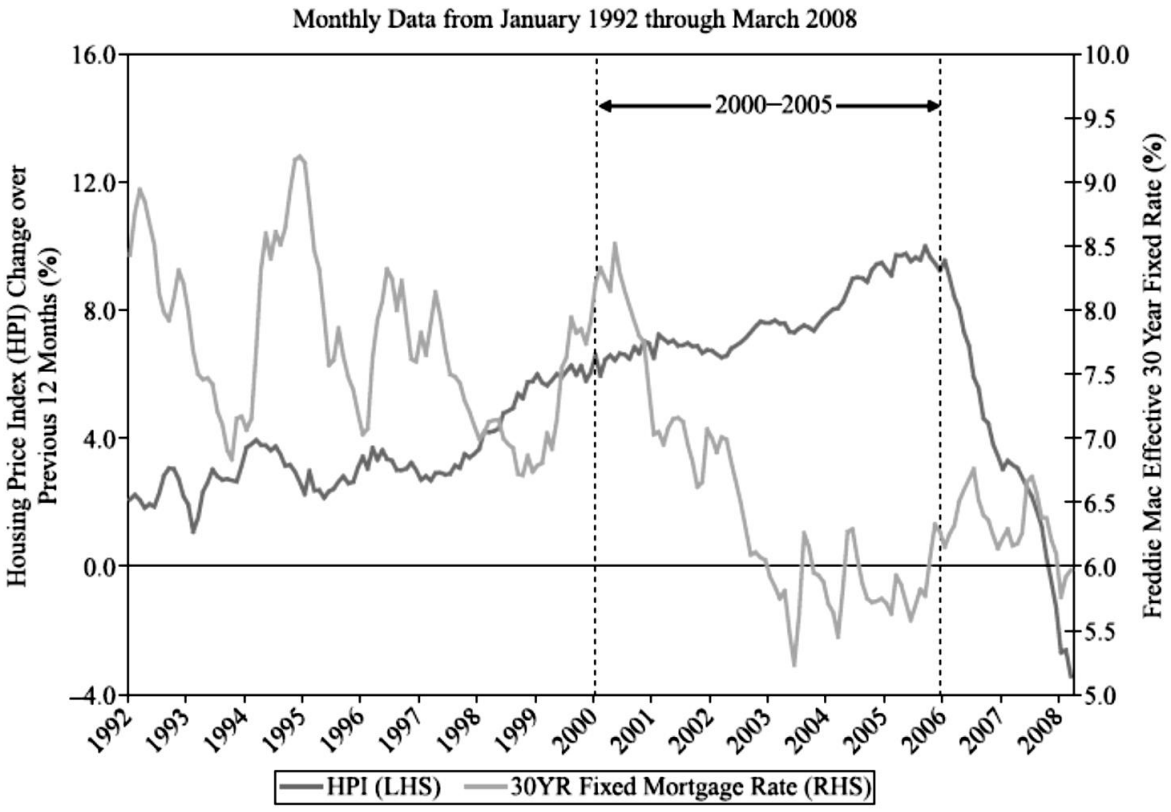
3.4 Recent Banking Crisis

Economists of a monetarist persuasion employ a narrowed definition of financial crisis as they argue that a financial crisis is normally associated with a banking crisis and when the stability of the banking system is threatened, the financial infrastructure could collapse in the absence of central bank intervention (Heffernan 2005:407). The collapse of a key financial firm normally prompts runs on the banks: customer panic, unable to distinguish between healthy and problem banks withdraw their deposits. Fractional reserves lending results in multiple contraction of deposit once the run begins. In the absence of central bank intervention, providing liquidity to solvent but illiquid banks, healthy banks are also threatened because of declines in their asset values in the rush to become more liquid. Other definition of financial crisis comes from the literate was summarized as the banking sector is often identified as a source of the problem. Banks take on increasing amounts of risk by lending to firms and households, which use the loan to finance purchases in assets such as properties, equities, etc. Increasingly the purchases are made for speculative purposes. As the proportion of short-term debt finance rises, the risk increases. An agent triggers a fall in value of these assets and increasingly borrowers find they are unable to repay the banks. Banks have typically accepted the assets as collateral, thus they encounter the problems as their ratio of non-performing loan to total loans begin to rise. With lower profit prospects, the share price begins to fall and the capital is depleting. Depositors become concerned and in the absence of adequate deposit insurance, move their funds to safe investments. If this transfer is sufficiently widespread, the bank would collapse. (Heffernan 2005:410)

However, according to Sarby and Okongwu (2009), the current crisis started in the housing sector, unlike other financial crisis in recent history. The crisis originated from the so-called subprime crisis in the United States that spilled over to many other countries (Sanders 2008). Central banks all around the world tried to fuel the financial system by creating capital liquidity and by lowering the interest rates. In the figure 4, the opposing trends in housing prices and cost of credit during the period 2000 to 2005 shows that the increasing in housing price and the decline in the cost of credit made the prospect of getting mortgage seem less risky since the option of refinancing or selling the house were both viewed as viable. This led to a surge in subprime and other types of mortgage origination and securitizations. In addition, the mortgage loans had been bundled to so-called asset-backed securities (ABS) and sold to banks all over the world. The buying banks usually refinanced the purchased of these financial instruments by

issuing revolving bonds with short maturities. When the real estate market crisis in the US revealed that the underlying loans were uncollectible, the issued bonds also lost in value. As maturities were short, the respective banks faced massive liquidity problems. With the bond market collapsing, banks had to refinance the redemption of the matured bonds by other means than issuing new bonds. With many banks facing similar liquidity problems, it got, however, nearly impossible to obtain funds from other sources such as interbank market. Securitization of the mortgages thus made a regional crisis in the real estate sector a global crisis of the financial system. (Gregoriou 2010:153)

Figure 4: Low cost credit and rising house prices (Sarby and Okongwu 2009)



The banking and financial markets crisis mainly originated from the US. As defaults increased massively mortgage loans had to be depreciated. This affected not only the banks that directly conferred the loans but also a large number of other institutes. In the first wave, European banks were hit by the financial crisis mainly because of their role as ABS investors and sponsors of asset-backed commercial paper (ABCP) programs. Many European banks had invested heavily in the US subprime market. As delinquency rate started to rapidly increase in 2007, market prices for RMBS tranches tumbled and banks were forced to write off significant portions of their RMBS investments. While

ABCP programs have originally been designed to securitize constant income streams such as leasing receivables, they have in recent years been increasingly used to refinance long-term assets with cheaper short term debt. European banks were subsequently hit by a second wave of losses when the financial crisis started spreading to the real economy. With more and more workers being forced out of employment, mortgage delinquency rates have been rising throughout Europe. Economies that have suffered the most from a housing price bubble have been hit particularly hard with rapid drops in house price leading to rising loss ratios for mortgages in default. The impact of the wave in Continental European markets has however, been considered stronger, has affected financial institutions more swiftly and rather unexpectedly. (Gregorious 2010:283).

According to Gregoriou (2010:291), financial crisis has been revealed significant shortcomings in risk monitoring and risk management for all types of banking institutions. Senior management often lacked knowledge and control of the institutional risk book and organizational risk management functions dis not possess the required capabilities to handle stress scenarios. On top, the relevance of liquidity risk and its inter linkage with capital adequacy requirements were systematically ignored. Top management should be informed regularly on all financial risk exposures and should also carry the responsibility for setting institutional risk tolerance levels. In addition, compensation and incentive systems play a central role in shaping the risk-taking behavior of bank managers. In the past, there has clearly existed a symbiotic relationship between institutional myopia of financial institutions and the short term focus of institutional bonus systems. With large compensation packages at stake, some managers have been tempted to take disproportionate risks, especially if the risks were only expected to become visible after several years. Senior managers had certainly no reason to worry about creating a performance minefield with their actions if their risk of ever stepping into it again was negligible. By now there appears to be an agreement among national regulators and legislatures across Europe that looking forward bonus arrangements must be risk adjusted and must also be capped that golden parachutes guarantees for senior bank executives must be restricted, and that board remuneration committees must be able to act more independently.

Moreover, financial supervision has failed to spot and prevent the financial crisis. The shortcomings of the supervisory systems of some of the most developed countries in the world are striking and fundamental reforms appear to be inevitable. To ensure more effective supervising bodies must be strengthened and unified across national

boundaries. Regulators must gain access to reliable and comprehensive information. Their reach must include off balance sheet positions and so far unregulated nonbanks (mortgage firms, hedge funds) which must be bound the same regulatory standard as banks. More importantly, the incentive structures of regulatory agencies must be revised to provide stronger incentives for regulators to keep up with new financial developments. The fact that regulators have been to some extent aware of the rising systematic risk in the subprime market, but have nevertheless failed to take effective action further points in this direction. In Europe, financial service supervision has been somewhat more centralized with fewer agencies sharing supervisory functions, but only on national level. Despite the establishment of single currency area and a single central bank, bank supervision has remained a national undertaking largely for political reasons. The existence of a single European institution for banking supervision would have clearly enforced more consistent European standards for the rescue or support of ailing banks and would have prevented the emergence of national discrepancies. (Gregoriou 2010:292)

4. THEORETICAL BACKGROUND

This section explains basic theories and key concepts relating to bank capital, bank performance and bank exposure. In addition, it also provides their main financial measures. This theoretical part is largely based on the textbook *Commercial Bank Financial Management* of Sinkey (1983), *Bank Management Text and Cases* of Hempel, Coleman and Simonson (1990), *The Economics of Money, Banking and Finance – A European Text* of Howells and Bain (1998), *Modern Banking* of Heffernan (2005), *Value at Risk and Bank Capital Management* of Saita (2007), *Bank Management and Financial Services* of Rose and Hudgins (2008), *The Principle of Banking* of Choudhry (2011).

4.1 Bank Capital

Bank capital is important as it is the cushion that absorbs any unreserved losses that the bank incurs. By acting as this cushion, it enables the bank to continue operating as a going concern and thus avoid insolvency or bankruptcy during periods of market correction or economic downturn. When the bank suffers a loss or writes off a loss-making or otherwise economically untenable activity, the capital is used to absorb the loss. This can be done by eating into reserves, freezing dividend payment or (in more extreme scenario) writing down equity capital. Moreover, banks occupy a vital and pivotal position in any economy, as suppliers of credit and financial liquidity, so bank capital is important. As such, banks are heavily regulated by central monetary authorities, and their capital is subject to regulatory rules governed by the Bank for International Settlements (BIS). (Choudhry 2011:10)

Rose and Hudgin (2008:476) also clearly define the vital function of capital in banking operations and their long-run viability. The primary function of bank capital is to absorb unexpected financial and operating losses as a cushion against failure risk. Second, capital provides the funds needed to charter, organize, and operate a financial firm before other sources of funds come flowing in. A new institution needs start-up funding to acquire land, build or lease facilities, purchase equipment, and hire offices and staff even before opening day. Third, capital promotes public confidence and reassures creditors concerning an institution's financial strength. Capital must also be strong enough to reassure borrowers that a lending institution will be able to meet their credit needs even if the economy turns down. Fourth, capital provides funds for the

organization's growth and the development of new services and facilities. An infusion of additional capital will permit a financial firm to expand into a larger quarter or build additional branch offices in order to keep pace with its expanding market and follow its customers. Fifth, capital serves as a regulator of growth, helping to ensure that growth is sustainable in the long run. Both the regulatory authorities and the financial markets require that the capital increases roughly in line with growth of risky assets. Thus the cushion to absorb losses is supposed to increase along with the financial institution's growing risk exposure. Finally, capital regulation has become increasingly important tool to limit how much risk exposure financial firms can accept. In this role capital not only rends to promote public confidence in the financial system but also serves to protect the government's deposit insurance system from serious losses.

There are different concepts related to bank capital such as regulatory capital and economic capital. Required regulatory capital is calculated according to regulators' rules and methodologies. The regulators define for each bank a minimum regulatory capital requirement (MRCR) as well as clearly identify which components of the bank's balance sheet can be considered to be eligible as capital. In contrast, economic capital is developed internally by the bank, which represents an estimate of sufficient fund needed to run the business. This estimate may differ from MRCR because the regulators and banks use different parameters or methodologies. (Saita, 2007:7)

4.1.1 Economic Capital

Economic capital is a fundamental and vital part of the commercial banking industry. In the bank's balance sheet, bank capital or stock holder's equity represents the difference between the book value of a bank's assets and its liabilities. The capital or equity of bank includes preferred stocks, common stock, surplus, undivided profits and equity reserves (Hempel et.al 1990:40). The bank capital is also categorized into three principal forms of such as subordinated debt, preferred stock, and common equity. Subordinate debt includes all forms of interest-bearing obligations that repay a fixed amount of money at some future time.

The major form of subordinate debt range from capital notes to long-term debentures. Subordinated notes and debentures are relatively small components of bank capital but a growing source of long-term funding for banks and other intermediaries. Due to contractual maturities of debt issues, they have to meet the requirements from the

regulatory authorities in order to be qualified as bank capital. Regulations require that these capital notes be subordinated to the claims of general creditors of a bank, including creditors, thus if a bank closes and its assets are liquidated, the depositors have first claim on the proceeds and investors in debentures have a secondary claim. However, subordinated debt holders have a prior claim over the common and preferred stock holders against earnings and assets.

Preferred stock is relatively insignificant though preferred has increased its importance in recent years among the larger banks and bank holding companies around the world. Preferred stock often carries floating dividend rates and redeemability feature that allow management to call in outstanding shares and pay off shareholders when it is financially advantageous to do so. However, bank preferred stock has been slow to win the confidence of some investors because of bad experiences during the Great Depression of the 1930s when many troubled banks sold preferred shares just to stay afloat. (Rose and Hudgin (2008:480). Generally subordinated debt qualified as capital and preferred stock are referred to as senior capital because their claims on assets and earnings are above those of common stock.

Common equity considered as basic form of bank capital is the sum of the common stock, surplus, undivided profits, and equity reserve accounts. The common stock account is the total par or stated value of all bank's outstanding shares. The surplus account can be increased by sale of common stock at a premium above its par value. Equity reserves include contingency reserves for securities losses and the contingency portion of provisions for possible loan losses. Common equity has a residual claim on income and assets behind deposits, other liabilities, indebtedness, and preferred stock. The book value of the common equity of a commercial bank can be computed by subtracting deposit, other liabilities and senior capital from the book value of total assets. Although, this book value is imperfect since it ignores the market value of a bank's assets and liabilities, book value is the most widely used measure of common equity and always used for capital adequacy purposes. (Hempel et al. 1990:260-262).

The composition of capital is markedly differently for the largest versus the smallest financial firms. The smallest banks rely most heavily upon retained earnings (undivided profit) to build their capital position and issue minuscule amount of long term debt (subordinated notes and debentures). In contrast, in the biggest banks rely principally upon the surplus value of their stock sold in the financial marketplace, as well as retained earnings, and also issue significant amount of long-term debt capital. These

differences reflect the greater ability of the biggest institution to sell their capital instruments in the open markets, while the smallest institutions having only limited access to the financial markets, must depend on their ability to generate adequate income and retain significant portions of those earnings in order to build an acceptable capital cushion. (Rose and Hudgin 2008:481)

4.1.2 Regulatory Capital

The capital position of the banks has been regulated for generations. Banks must meet minimum capital requirements before they can be chartered, and they must hold at least the minimum required level of capital throughout their corporate life. The cost of the capital is the driver behind return on calculation and primary objective of banking operations is to meet return of capital target. Hence regulatory capital issues play an important part in bank strategy. The need for adequate regulation of the banking industry is widely recognized and a string of banking failures in the 1990s emphasized this. Lessons were not learned, however, as capital inadequacy was again an issue during the "credit crunch" of 2007-2008. By the nature of their activities, banking trading and lending desks are risk-takers and the reward culture in many banks provide strong incentives for perhaps excessive risk-taking. However, the regulators are more concerned with systematic risk, the risk that, as a result of the failure of one bank, the whole banking system is put on danger, due to knock-on effects. The integrated nature of the global financial industry means that banks are closely entwined and the failures of one bank generate a risk of failure for all those banks that have lent funds to the failed banks. Therefore, while a bank will be concerned with risk management of its own operations, regulators are concerned with the risk to the whole financial system. The systematic risk inherent in the banking system means that it is important to have sufficiently adequate financial regulation, of which capital requirement rules are one example. (Choudhry 2011:76)

Banks and financial institutions are subject to a range of regulations and controls; the primary one is concerned with the level of capital that a bank holds, and this level is sufficient to provide a cushion underpinning the activities that the bank enters into. Typically, an institution is subject to regulatory requirements such as European Union's Capital Adequacy Directive. A capital requirement scheme proposed by a committee of central banks acting under the auspices of the BIS 1988 has been adopted universally by banks around the world. These are known as the BIS regulatory requirements or the

Basel capital ratios. Under the Basel requirements all cash and off-balance sheet instrument in a bank's portfolio are assigned a risk weighting based on their perceived credit risk. The Basel Accord of 1988 was a consistent standard applied for determining minimum capital requirement across internationally active banks. The regulatory capital under Basel Accord was defined to make required capital sensitive to differences in risk profiles among banking organizations, thereby with banks holding risker assets acquired to a higher level of capital. The ratio required by a regulator will be that level deemed sufficient to protect the bank's depositor. Regulatory capital included equity, preferences shares and subordinated debt, as well as the general reserves. The common element of these items is that they are all loss-absorbing.

Under Basel I, the BIS rules set a minimum ratio of capital to assets of 8% of the value of the assets. Assets are defined in terms of their risk, and it is weighted risk assets that are multiplied by the 8% figure. Each asset is assigned a risk weighting, which is 0% for risk-free assets such as certain country government bonds, to 20% for inter-bank lending, and up to 100% for the highest risk assets such as certain corporate loans. The regulatory capital would be broken down into two components as Tier 1 and Tier 2. Tier 1 capital consists of higher-quality forms of capital which have the greatest capacity to absorb losses. Tier 1 capital includes primarily of core capital, namely common stock, surplus, undivided profit, capital reserves and minority interest in consolidated subsidiaries. Because these items arise from ownership in the bank, they have the lowest priority of repayment in the event of insolvency, thereby representing the highest quality of capital. Tier 2 capitals considered as supplementary capital are less reliable. It is comprised of items such as hybrid debt/equity instruments, intermediate-term preferred stock and term subordinated debt and reserves held for loan losses. These instruments are subordinate to the debt the bank owes to other creditors. Due to the lower quality of tier 2 capital, Basel I limited the amount of tier 2 capital that could be included in the bank's capital to 100% of tier 1 capital. In order to be considered sufficiently capitalized under Basel I, bank had to maintain a capital ratio of 8%. (Hempel et.al, 1990:285)

The level of capital requirement is given by the formula:

$$\frac{Tier\ 1\ capital}{Risk-adjusted\ exposure} > 4\%$$

$$\frac{Tier\ 1\ + Tier\ 1\ capital}{Risk-adjusted\ exposure} > 8\%$$

The ratio above therefore set minimum levels. A bank's risk-adjusted exposure is the cash risk-adjusted exposure, together with the total risk-adjusted off-balance sheet exposure. For cash products on the banking book the capital charge calculations (risk-adjusted exposure) is given by the formula, which is calculated for each instrument:

Principal value x Risk Weighting x Capital charge (8%)

The sum of the exposure is taken. Firms may use netting or portfolio modelling to reduce the total principal value. The BIS makes a distinction between banking book transaction as carried out by retail and commercial banks (primarily deposits and lending) and trading book transactions as carried out by investment banks and securities houses. Capital treatment differs between banking and trading books. A repo transaction, for example, attracts a charge on the trading book. The formula for calculating the capital allocation is:

$$CA = max.\ (((C_{mv} - S_{mv})\ x\ 8\%\ x\ RW),\ 0)$$

Where: C_{mv} = is the value of cash proceeds

S_{mv} = is the market value of securities

RW = is the counterparty risk-weighting (as a percentage)

The table 2 summaries the elements that comprised the different types of capital that made up regulatory capital in the EU's CAD for Basel I. Tier 1 capital supplementary capital is usually issued in the form of non-cumulative preference shares, known in the US as preferred stock. Banks generally build Tier 1 reserves as a means of boosting capital ratios as well as support a reduced pure equity ratio. Tier 1 capital now includes certain securities that have similar characteristics to debt, as they are structured to allow interest payment to be made on a pre-tax basis rather than after tax; this means they behave like preference shares or equity, and improve the financial efficiency of the bank's regulatory capital. Such securities, along with those classified as Upper Tier 2 capital, contain interest deferral clauses so that they may be classified similar to preference shares or equity. (Choudhry 2011:80-82)

Table 2: European Union regulatory capital rules, Basel I (Choudhry 2011:81)

	Limits	Capital Type	Deductions
Tier 1	▪ No limit to Tier 1 ▪ "Esoteric" instruments such as trust-preferred securities are restricted to 15% of total Tier 1	▪ Equity share capital, including share premium account ▪ Retained profit ▪ Non-cumulative preference shares and other hybrid capital securities	▪ Bank holdings of its own Tier 1 instruments ▪ Goodwill and other tangible assets ▪ Current-year unpublished losses
Tier 2	▪ Total Tier 2 may not exceed 100% of Tier 1		
Upper Tier 2		▪ Perpetual subordinated, loss-absorbing debt ▪ Cumulative preference shares ▪ General reserves ▪ Revaluation reserves	▪ Holdings of other banks' own fund instruments in excess of 10% of the value of own capital ▪ Holdings of more than 10% of another credit institution's own funds ▪ Specified investments in non-consolidated subsidiaries ▪ Qualified investments, defined as a holding of more than 10% of a company
Lower Tier 2	▪ Cannot exceed 50% of Tier 1 ▪ Amount qualifying as capital amortized on a straight-line a basis in the last five years	▪ Fixed maturity subordinated debt ▪ Perpetual subordinated non-loss absorbing debt	
Other	▪ Capital to only include fully paid up amounts ▪ Issues of capital cannot include cross-default or negative pledge clauses ▪ Default of Lower Tier 2 capital is defined as non-payment of interest or a winding up of the bank ▪ No rights of set-off to be included in capital issue documentation ▪ Early repayment of debt must be approved by the bank's regulator ▪ Interim profit must be audited amounts, and net of expected losses, tax and dividend		

The perceived shortcoming of the 1988 Basel capital accord attracted many arguments. The main criticisms were that its risk-weightings framework lacked the sensitivity to differentiate credit quality in the same asset class, and it used membership in the OECD as a measure of sovereign risk. In addition, it did not capture well the associated with bank's securitization exposures in particular and different other financial activities in general; thus it was accused of being "one-size fits all approach". (Heffernan 2005:185). The 1988 accord was based on very broad counterparty credit requirements, and despite an amendment introduced in 1996 to cover trading book requirements, it remained open to the criticism of inflexibility. In response to criticism of the 1988 Accord, a number of changes were made, culminating in the 2001 proposal, which were designed "to promote safety and soundness in the financial system, to provide a more comprehensive approach for addressing risks, and to enhance competitive equality. The proposals were also intended to apply to all banks worldwide, and not simply those that are active across international borders. The Basel II rules have three pillars in order to be more closely related to the risk levels of particular credit exposures, which were minimum capital requirements, supervisory review and market discipline.

Basel II requires for a supervisory approach to capital allocation, which is the pillar 2. This is based on three principles. First, banks must have a procedure for calculating their capital requirements in accordance with their individual risk profile. This means they are required to look beyond the minimum capital requirement as provided for under Pillar 1, and assess specific risk areas that reflect their own business activities. Second the risk-weighted capital requirement calculated under Pillar 1 is viewed as minimum only, and banks are expected to set aside capital above this minimum level to provide an element of reserve. Supervisors are empowered to require a bank to raise its capital level above the stipulated minimum. Finally, supervisors are instructed to constantly review the capital levels of banks under their authority act accordingly in good time so that such levels do not fall below the level deemed sufficient to support an individual bank's business activity. Pillar 3 provides the rules of disclosure about capital, capital adequacy and risk exposure. The definition of capital under Basel II remains as it is under Basel I and the minimum capital ratios of 4% for Tier 1 and 8% for total capital also remain. (Choudhry 2011:88)

The minimum capital requirement is calculated by the following formula:

$$Minimum\ capital\ ratio = \frac{Capital\ (Tier\ 1\ \&\ Tier\ 2)}{Amended\ credit\ risk + Market\ risk + Operational\ risk}$$

In December 2010 the Basel Committee for Banking Supervision (BCBS) which comprises the regulators and central bankers of 27 countries, released details of the new banking regulatory capital rules, which were termed Basel III. The rules require banks to hold a higher amount of core Tier 1 capital than was required under Basel I and Basel II regimes. The main provisions under Basel III are summarized in the table 3.

Table 3: Basel III capital ratios

Ratios	Core Tier 1	Tier 1 Capital (%)	Total Capital (%)
Minimum ratio	4.5	6.0	8.0
Capital conservation buffer	2.5	-	-
Minimum plus capital conservation buffer	7.0	8.5	10.5
Countercyclical capital buffer range	0 - 2.5	-	-

The Basel III capital rules will have the effect of improving the overall quality of bank capital. There is also a greater emphasis on capital being able to absorb losses on a going concern basis. The core Tier 1 consists of ordinary shares and retained earnings. This capital takes the first and proportionately greatest share of losses. It is the most deeply subordinated, and is perpetual with no expectation that the liability will be bought back or redeemed. Non-core Tier 1 consists of contingent convertible and preference shares-type instruments that exhibit the following features:

- fully discretionary coupons, which is non-cumulative;
- perpetual, with no incentive to redeem;
- Call feature allowed, but not expectation of call.

Tier 2 capital consists of long-dated subordinated debt, with no incentives to redeem early. Most banks compare both regulatory requirements with regulatory capital and internally estimated required economic capital with available economic capital. However, economic capital, rather than regulatory capital, is mainly used for risk-adjusted performance measurement. (Saita 2007:17).

4.2 Bank Performance

According to Rose and Hudgins (2010), as for financial firms, performance refers to how adequately a financial firm meets the needs of its stockholders (owners), employees, depositors and other creditors and borrowing customers. At the same time, financial firms must find a way to keep government regulators satisfied that their operating policies, loans, and investments are sound, protecting the public interest. The success or lack of success of these institutions in meeting the expectations of others is usually revealed by a careful study of their financial statement. The first step in analyzing financial statements to evaluate bank performance is to determine the objectives. Performance must be directed toward specific objectives. A fair evaluation of any financial firm's performance is started by evaluating whether it has been able to achieve the objective its management and stockholders have chosen. Therefore, there are two outstanding methods of performance measurement namely stock valuation and profitability ratios (accounting measurement). This section centers on the most important dimension of performance-profitability and risk. It provides a detailed look at the most widely used indicators of the quality and quantity of bank performance.

According to Casu et al. (2006:214), bank performance is calculated using ratio analysis and assessed with the aim of (1) looking at past and current trends, and (2) determining future estimates of bank performance. Financial ratios analysis investigates different areas of bank performance, such as profitability, asset quality and solvency. The basic component of ratio analysis is a single ratio, constructed by dividing one balance-sheet and/or income-expense item by another. The denominator of such ratio may be conceived as a “base” or “scale” factor. In terms of measure of profitability, a bottom line variable such as ROE or ROA is well considered, which are measuring the profitability ratio of a firm. ROE and ROA use equity capital and total assets, respectively, as the scale factors. The return on assets (ROAA) is the net income for the year divided by total assets, usually the average value over the year.

$$\frac{Net\ Income}{Average\ Total\ Assets} = ROAA$$

ROAE is an internal performance measure of shareholder value. It is considered the most popular measure of performance, since it proposes a direct assessment of the financial return of a shareholder’s investment. In addition, it uses public information, thus it is

easily available for analysts as well as it allows for comparison between different banks or different sectors of the economy.

$$\frac{Net\ Income}{Average\ Total\ Equity} = ROAE$$

Since there are several definitions of profits and capital, ROE figures may be constructed in alternative ways (Sinkey 1986:235). Three common measures of bank profits are

- Income before taxes and securities gains or losses
- Income after taxes but before securities gains or losses
- Net income (after taxes and securities gains or losses)

Three common measures of bank capital include:

- Total equity capital (consisting of common stock, surplus, and undivided profits)
- Total equity capital plus reserves for losses
- Total equity capital plus reserves plus debt capital

In addition, other two typical ratios are used to evaluate bank profitability such NIM (Net interest margin) and C/I (Cost-income) ratio. NIM is net interest margin and measures the net interest income relative to the bank's total, average or earnings assets.

$$\frac{Interest\ Income\ -\ Interest\ Expense}{Total\ Assets} = NIM$$

It reflects the difference between interests earned on assets minus interest costs per unit of assets. The NIM measures the bank's spread per unit of assets. High NIM suggests that the difference between deposit rates and loan (+ other interest earnings assets) rates are high and vice versa. Finally, the Cost-income ratio is a quick test of efficiency that reflects bank non-interest costs a proportion of income.

$$\frac{Non\ Interest\ expenses}{Net\ interest\ income\ +Non\ Interest\ income} = C/I$$

However, in order to get more comprehensive picture of overall performance, it is supposed to look at the profile or vector of financial characteristics. Altman, Haldeman and Narayanan (1977) develop a failure prediction model for manufacturers and retailers, to distinguish between failed and non-failed firms. Their model consisted of the following variables:

1. *Cumulative profitability (CP)= Retained Earnings/Total Assets*
2. *Stability of earnings (SOE)= Standard deviation of ROA*
3. *Capitalization (CAP)= Total Assets/Total Equity*
4. *Size (S)= Log (Total Assets)*
5. *Liquidity (LQD)= Liquid Assets/Total Assets*
6. *Debt service (DS)= Total Interest Income/Total Interest Expense*
7. *Return on assets (ROA)= Net Income/ Total Assets*

The dimensions captured by these seven variables are: current profitability, variability of earnings (risk), interest coverage, long-term profitability, liquidity, leverage and size respectively. Since Sinkey (1983) shows the Zeta model can be applied with reasonable accuracy to the problem of predicting bank failures. The ultimate objective of Zeta model is to predict failure. The predictability comes from the coefficients that are estimated from a statistical comparison of the financial characteristics of the two groups of firms. The rationale is to discriminate between two groups prior to failure and then to use the model to identify future failures. One crucial requirement for an early-warning model is that the estimated coefficients be stable or stationary so they can be applied to future data with confidence. Regarding the use of accounting data, such information is subject to different interpretation and to manipulation or "window dressing". Moreover, earnings are especially subject to manipulation.

4.3 Bank Risks

Recent changes in the banking environment have posed serious risk challenges for banks but also offered productive opportunities. This section will describe the main types of risks modern banks have to face. The first primary risk in banking is credit risk. According to the Basel Committee on Banking Supervision (2000), credit risk is defined as "the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms". Besides, credit risk is also described as the risk of a bad loan unpaid in full in the servicing of a loan (Heffernan 2005:104). Therefore, credit risk is considered as the risk of decline in the creditworthiness of counterparty. Such deterioration does not imply default, but means that the probability of default increases. Thus, it is recommended for bank managers to build diversified portfolio assets by combining both loans and securities to minimize credit losses since this assets combination will diversify the degree of risk. A portfolio of assets with varying degree of risk will help banks avoid credit risk by providing them compensation in a way that that

higher default risk is accompanied by higher expected return. In addition, there is an internal financial ratio needed to be monitored when managing credit risk by looking at the changes in the ratio: medium-quality loans/total assets ratio. The bank can choose to lower its credit risk by lowering this ratio. Another important credit-risk measure is the ratio of total loans to total deposits. The higher the ratio the greater the concerns of regulatory authorities, as loans are among the riskiest of bank assets. A greater level of non-performing loans to deposits could also generate greater risk for depositors. If the data on medium quality loans are not available, traditional proxies for credit risk include instance: (1) total loans/total assets, (2) non-performing loans/total loans, (3) loan losses/total loans, (4) loan loss reserves/total assets.

In banks the key market risk is interest risk, which is the risk of loss of earnings due to movement in interest rates. Interest rate risk arises from the impact of fluctuating interest rates and will directly affect either borrowers or investors. A rise in market interest rates has the effect of increasing banks' funding costs because the cost of variable rate deposits and other variable rate financing increases. If loans have been made a fixed interest rates this obviously reduces the net returns on such loans. On the other hand, banks will be vulnerable to falling rate of they hold an excess of fixed rate liabilities. In the case of bonds, increasing interest rate will reduce the market value of a bond investment. Typically, long term, fixed-income securities subject their holders to the greatest amount of interest rate risk. In contrast, short term securities such as Treasury bills are much less influenced by interest rate movements (Casu et al. 2006:262). Besides, reinvestment risk is an essentially interest rate risk, which is created when an asset makes any payments before the investor's horizon, whether it matures or not. Thus, there is the risk of reinvesting that cashflow until the horizon date with lower interest rates. Since the reinvestment rate is unknown when the asset is purchased, the final cash flow is uncertain.

Another important risk is liquidity risk, which is the risk that the bank is holding insufficient liquid assets on its balance sheet to meet requirements without impairment to its financial or reputational capital. On other words, liquidity risk is generated in the balance sheet by a mismatch between the size and maturity of assets and liabilities. Thus, banks have to manage their liquidity to ensure that both predictable and unpredictable liquidity demands are met. There are two common types of liquidity risk. The first type is day-to-day liquidity risk relating to daily withdrawals. This is usually predictable because only a small percentage of a bank's deposit will be withdrawn in a given day. The second is liquidity crisis occurs when depositors demand larger withdrawals than normal. In this

situation, banks are forced to borrow fund at an elevated interest rate, higher than the market rate that other banks are paying for similar borrowings. This is usually unpredictable and can be due to either a lack of confidence in the specific bank, or some unexpected need for cash. Liquidity cries can ultimately hinder the ability of a bank to repay its obligations and in the absence of central bank intervention or deposit insurance it could result in "a run" and even the insolvency of the bank. Typically banks can reduce their exposure to liquidity risk by increasing their proportion of funds committed to cash and readily marketable assets, such as Treasury bills (T-bills) and other government securities, or use longer term liabilities to fund the bank's operations. However, there is the trade-off between liquidity and profitability, as the opportunity cost of stored liquidity is high and holding low-yielding assets on the balance sheet reduces bank profitability (Heffernan 2005:105). One measure banks can use to monitor liquidity risk relate short-term securities, a proxy for bank's liquidity sources, to total deposits – this provides an approximate measure of a bank's liquidity needs. Another traditional ratio of liquidity risk is the loan/deposit ratio. This ratio tends to focus on the liquidity of assets on the balance sheet. A high ratio of short term securities/deposits and a low loan/deposit ratio indicate that the bank is less risky but also less profitable. (Casu et al. 2006:265)

The fourth risk in banking is operational risk, which is the risk of loss associated with non-financial matters such as fraud, system failure, accidents and ethics. Risk Management Group of the Basel Committee on Banking Supervision (2001b) defines operational risk as the risk of loss resulting from inadequate or failed internal processes, people and systems from external events. Operational risk can be mitigated by defining strict procedures for all aspects of a bank's business functions, and ensuring adherence them. Operation risk is one of the main innovations proposed for Basel II requiring banks to hold capital for such risks along with credit and market risk. The bank's risk management function should assign a dedicated person or team to managing operational risk and each department of the bank should appoint an operational risk liaison who will work as the primary contact for the head of operational risk.

Capital is considered important as well because all the risks described above can potentially affect a bank's capital. In other words, excessive credit risk, market risk, operational risk and liquidity risk, etc. could all result in a bank having insufficient capital to cover such losses. Therefore, capital risk refers to the decrease in market value of assets below the market value of its liabilities. Besides, capital risk is closely tied to financial leverage and banks are typically highly leveraged firms (Heffernan 2005:109). It also depends on the asset quality and the overall risk profile of the institution. In

addition, banks with high capital risk also normally experience greater periodic fluctuations in earnings. Capital risk, therefore, is the same as the risk of insolvency or risk of failure. In order to monitor capital risk, the banks should well manage the following indicators since they are all signals of failure risk. The first common indicator is the interest rate spread between market yields on bank debt issues and market yields on government securities of the same maturity. If the spread increases then investors believe that the bank in question becoming more risky relative to government debt – investors in the market expect a higher risk of loss from purchasing and holding the bank's debt. Another indicator is the ratio of stock price per share to annual earnings per share. The ratio will often fall if investors come to believe that a bank is undercapitalized relative to the risks it has taken on. In addition, the ratio of equity capital to total assets: a low level of equity relative to assets may indicate higher risk exposure for debt holders and shareholders. Besides, the Basel Tier 1 (equity capital to risk-weighted assets) and Basel Tier 2 (total capital to risk weighted assets) ratios: indicate how well equity capital and total capital, respectively, relate to the minimum (4% and 8%) regulatory requirements. A decline in either ratio indicates that a bank has less capital to cover potential losses. Ratios that fall below the minimum levels, as was the case for certain Japanese banks between 1997 and 2005, are an indication of technically insolvent institutions. (Casu et al. 2006:275)

5. EMPIRICAL TESTS

This section focuses on description of empirical testing that is used to test hypotheses of the study. The main hypothesis is to test whether higher bank capital level can help enhance the level of profitability and reduce risk exposure that banks take around the crisis. In addition, it also emphasizes on further testing whether the capital effect on bank profitability and bank risk is different among bank categories and bank size. The sample covers banks operating in 15 European countries during the financial crisis from 2005-2011. The empirical part begins with the construction of empirical hypotheses based on previous studies and related theories. The next section is to provide information about the data source and collection as well as data description. The methodology describes the models and different variables that are used to construct the models.

5.1 Empirical Hypotheses

The main empirical hypotheses of this paper are formulated basing on previous studies and existing theories about the effects of bank capital on different dimensions of bank activities. This section will review these theories and empirical evidences and indicate how they explain the relationship between capitals, risk, and profitability; thereby forming the hypotheses to be tested.

- Bank capital and bank profitability

The hypotheses about the relation between bank capital and bank performance are affected by following theoretical and empirical literatures. According to “trade-off” theory, there is an optimal capital structure that maximizes the value of firm in balancing the cost and benefits of additional unit of debt. Thus, a bank in equilibrium will hold an optimal level of capital to trade off their cost and benefits, implying a “zero relationship” at the margin. There is an implication for optimal capital that if the capital level the bank holds is below its target, that bank can improve its profitability by increasing their capital. In the long-run, regulatory capital requirements may exceed the bank’s optimal capital ratio and drive a negative relationship between capital and return. Therefore, this theory implies that higher capital only reduce bank’s profitability if banks are above their target capital level, for instance due to capital requirement or unexpected shocks. Besides, banks’ optimal capital ratios are likely to vary over the cycle, typically rising when there are higher expected cost of distress, the relationship between capital and profitability

becomes more positive during periods of distress as banks increase their capital ratios to provide reassurance to investors and improve their profitability. In terms of empirical evidence, as being documented in the study of Berger (1995), large banks with higher capital ratios are able to improve profitability during crises and also sustain their higher profit in the post-crisis period. However, the profitability of small banks with higher capital level is enhanced during banking crisis but deteriorates after the crisis relative to that of their lower-capital peers. On the other hand, medium banks suffer an inverse relationship between their capital and profitability after banking crisis but "zero relationship" during banking crisis. Overall, it is expected that bank's capital has positive impact on its profitability Therefore, the hypothesis used to test the relationship between bank capital and bank profit is as follows:

Hypothesis 1: *Capital improves the bank's profitability around the financial crisis.*

- Bank capital and bank risk

The theories and empirical evidences provide mixed results for the relation between bank capital and bank risk. The regulatory hypothesis regulators encourage banks to increase their capital relatively with the amount of risk taken. As indicated by Kahane (1977), Koehn and Santomero (1980) and Kim and Santomero (1988), banks could respond to regulatory actions forcing them to increase their capital by increasing their asset risk. As Altunbas et al. (2007) document, there is a positive relationship between capital levels and banks risks. Namely, banks with higher loan loss reserves tend to have higher capital levels. However, "moral hazard hypothesis" predicts the bank with greater financial leverage (lower capital ratio) and greater operational leverage would have greater risk-taking incentives. The negative relationship between bank capital and bank risk is also related to deposit insurance system which backed up by the government. Deposit insurance enables the banks to undertake excessive risky strategies by insulating the major creditors or depositors of banks against decrease in bank asset values. Depositors view insured deposits as riskless, and therefore, they would not require higher risk-premiums for the bank's greater risk-taking. Basing on above literature, the second hypothesis relating to association between bank capital and bank risk is formed as follows:

Hypothesis 2: *Capital reduces bank's riskiness around the financial crisis*

5.2 Data Description

This study analyzes a panel data comprising 15 European countries over the period 2005-2011 including Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherland, Portugal, Spain, Sweden and UK. The complete sample of banks includes a total number of 4,700 observations; however, a smaller sample is being used for the study. There are several banks being deleted since they entered, exited or were taken over during the study time, which would create the possibility of various kinds of sample selection effects. In addition, bank with smaller than maximum number of time observations are excluded, creating a balanced panel. The final data set consists of 850 banks from 15 countries. A panel data set on different ratios of bank performance such as capital ratios, ROA, ROE, NIM, etc., is collected for same group of bank in different years.

The data covers seven-year period from 2005-2011. This period of time is divided into three sub-periods which is relevant with financial crisis timeline. In detail, the period from January 2005 to December 2006 is defined as the pre-crisis. The crisis period spans from January 2007 to December 2008. The period from 2009 to 2011 is defined post-crisis. Moreover, I split the sample into different bank specializations as commercial banks, corporate banks and other banks. Also, total 850 banks is categorized into small banks with total assets up to 1 billion euro; medium bank with total assets exceeding 1 billion euro and up to 3 billion euro and large bank with total assets exceeding 3 billion euro. The data set is panel data because this thesis studies the same set of banks over years from 2005-2011. The benefit is that I can have multiple observations on the same bank to control for certain unobserved characteristics of the banks.

The data relating bank's profitability and other specific characteristics are extracted from income statement and balance sheet of European banks acquiring from Bureu van Dijk's BankScope database. The bank risk data are manually calculated. The macroeconomic rates are extracted from World Bank database. The summary of data source and definition is in table 4.

Table 4: Summary of Variables, Descriptions and Data Sources.

Classification	Variable	Descriptions	Sources
Profitability	ROA	Return on Assets	BankScope
	ROE	Return on Equity	BankScope
	NIM	Net Interest Margin	BankScope
Risk	SDROA	Standard deviation of ROA	Calculated
	SDROE	Standard deviation of ROE	Calculated
	Ln(Z – Score)	Natural Logarithm of Z-Score	Calculated
Capital	CAP	Equity to Capital	BankScope
Bank Control Variables	Ln(TA)	Natural Logarithm of Total Assets	Calculated
	NLTA	Net Loans to Total Asset	BankScope
	LAD	Liquid Assets to Customer and Short term Deposits	BankScope
Macro Control Variables	INFL	Inflation	World Bank
	GW	GDP Growth rate	World Bank
	CON	Market concentration	World Bank
	PUB	Public Debt	World Bank
	UNEM	Unemployment rate	World Bank

5.3 Regression Variables

In the empirical method, I examine the effect of capital on bank performance and bank risk during the financial crisis. The dependent variables used in the regressions are bank's profitability and risk, capital is a key independent variable; whilst there is a list of control variables for bank specific characteristics and macroeconomic environment. This section will give the definitions of the variables as well as their expected sign and reasons to use them in the regression.

- Profitability variables

I measure bank's performance using the bank's return on equity (ROE), return on assets (ROA) and net interest margin (NIM). These performance variables are computing basing on accounting method using ratio analysis. NIM is a measure of a bank's efficiency in

maintaining interest expenses at a minimum for a given value of interest income. ROA relates to a bank's ability to generate positive net income from its investment in its assets, while ROE is the return that shareholders receive from their investment in bank capital. Among them, ROE is a comprehensive profitability measure since net income and equity both reflect the banks' on and off-balance sheet activities. In addition, ROE is considered the most popular measure of performance, since it provides direct assessment of the financial return of a shareholder's investment. Moreover, it uses public information and allows for easy comparison between different banks or different sectors of the economy.

- Risk variables

Dependent variables used to measure bank's risk are as standard deviation of ROA (SDROA), standard deviation of ROE (SDROE), which is calculated using the overlapping ROA and ROE data averaged every two years. According to Brealey, Myers and Marcus (2004:275), risk depends on the dispersion or spread of possible outcomes. More variable returns imply greater risk. This suggests that some measure of dispersion will provide a reasonable measure of risk and dispersion is precisely what is measured by variance or standard deviation. Therefore, SDROA and SDROE are standard deviation of return on assets and standard deviation of equity respectively are obtained as proxies for bank's risk.

Furthermore, I use Z-score as a proxy for bank's risk-taking behavior. The Z-score has frequently used to analyze the determinants of bank risk-taking (Altunbas et al. 2017). It is defined as the ratio of the return on assets plus the capital ratio divided by the standard deviation of the return on assets. The Z-score is the inverse of the probability of insolvency, as higher Z-score indicates that a bank incurs fewer risks and is more stable. More specifically, it indicates the number of standard deviation below the expected value of a bank's return on assets at which equity is depleted and the bank is insolvent (Boyd et al 1993). Because the Z-score is highly skewed, I use the natural logarithm of the Z-score in my empirical analysis. Moreover, according to Strolbel and Lepetit (2013), the log of Z-score is considered unproblematic insolvency risk measure to use in the standard regression analysis. Besides, the traditional calculation method of Z-score is shown to be upwardly unbiased. This ratio is calculated by the formula that:

$$Ln(Z-score) = Ln(\frac{ROA+Equity/Total\ Assets}{\sigma_{ROA}})$$

- Capital variable

The capital ratio of each bank is obtained, which is used as independent variable for evaluating its relation with bank's profitability and riskiness. It is the ratio of book value of equity to total assets. There are several empirical results showing a significant positive association between bank capital and bank performance (Berger 1995; Demiguc-Kunt and Huizinga (1999), thus capital ratio is expected to be positive with bank profitability. For example, Demiguc-Kunt and Huizinga (1999) document a direct association between bank capital and net interest margin, as well-capitalized banks have higher net interest margins and are more profitable. Altunbas et al. (2007) also confirm that capital levels and profitability are positively related.

- Bank control variables

The regressions contain a set of bank specific control variables which include: bank size, bank's liquidity (Lee & Hsieh 2013, Akhigbe et al 2012, Berger & Bouwman 2013, Altunbas et al. (2007). The bank specific variables include net loan to total assets, liquid asset to deposit and bank size. Since the ratio of net loan to total assets is considered as a measure of both credit risk and lending specialization in the empirical banking literature, which may increase risk when rising. Higher loans volumes can indicate looser loan granting criteria which results to decrease in credit quality and increase in credit risk. Also, higher NLTA might indicate that a bank specializes in lending because it benefits from informational advantages, which may reduce intermediation costs and enhance profitability. Therefore, loan ratio is expected to have positive impact on bank riskiness and profitability. Dietrich & Wanzenreid (2011) also find a positive relationship between growth of gross loans and profitability. In terms of bank liquidity, it is expected to have inverse relation with bank risk as the banks that are more liquid may be more efficient and less likely suffer shock during crisis. Meanwhile, it is reasonable to expect banks will hold liquid assets to the extent they help to maximize its profitability. Bank size is measured as the natural log of the bank's assets. Since though economies of scale bank size may influence the relationship between capitals and risk, I control for the assets size of bank. Goddard et al. (2004) explore a result relating to impact of bank size on its performance. However, Boyd and Runkle (1993) discover an inverse association between bank size and profitability in their study.

- Macroeconomic control variables.

In the empirical analysis, there are some specifications incorporate a group of macroeconomic controls including Inflation (INFL), public debt (PUB), unemployment (UNEM), GDP growth (GW) and the regional market concentration which is Herfindahl - Hirschman index for credit institution for each country (CON). The coefficients of PUB and UNEM are uncertain. Molyneux and Thorton (1992) provide an empirical evidence for a positive link between inflation and bank profitability. Besides, a higher economic growth may imply that banks can generate more profitability and less risk. Moreover, it is necessary to control for market concentration. Banking systems in larger countries such as Germany, France and Italy are more fragmented; meanwhile in smaller countries tend to be concentrated. For banks operating in more concentrated countries have higher HHI index and they have more probability to increase the profitability of local loans and deposits as well as make it easier to improve profitability.

5.3 Empirical Method

For econometric analysis of panel data, it is unable to assume that the observations are independently distributed across time. In any cross-section there are so many unmeasured explanatory variables that determine dependent variable that their influence gives rise to a different intercept for each individual (Kennedy 2003:303). This phenomenon suggests that OLS is biased unless the influence of these omitted variables is uncorrelated with the included explanatory variables. Therefore, with the aim of improving estimation, fixed effects estimator is used to remove the unobserved effect and also any time-constant explanatory variables prior to estimation. The fixed effect transformation consists of subtracting from the observation of each individual the average value of all observations for that individual. The method is described as considering the following econometric model:

$$y_{it} = \beta_1 x_{it,1} + \beta_2 x_{it,2} + \beta_3 x_{it,3} + \beta_4 x_{it,4} + a_i + u_{it} \quad t = 1,\ldots, T;\ i = 1,\ldots, N. \quad (a)$$

For each *i*, average this equation over time, I get

$$\bar{y}_i = \beta_1 \bar{x}_{i1} + \beta_2 \bar{x}_{i2} + \beta_3 \bar{x}_{i3} + \beta_4 \bar{x}_{i4} + a_i + \bar{u}_i \quad (b)$$

Where, $\bar{y}_i = T^{-1} \sum_{t=1}^{T} y_{it}$, $\bar{x}_i = T^{-1} \sum_{t=1}^{T} x_{it}$, $\bar{u}_i = T^{-1} \sum_{t=1}^{T} u_{it}$

Because a_i is fixed over time, it appears in both (a) and (b), therefore I subtract (b) from (a) for each *t* to eliminate a_i and gives,

$$y_{it} - \bar{y}_i = \beta_1(x_{it,1} - \bar{x}_{i1}) + \beta_2(x_{it,2} - \bar{x}_{i2}) + \beta_3(x_{it,3} - \bar{x}_{i3}) + \beta_4(x_{it,4} - \bar{x}_{i4}) + (u_{it} - \bar{u}_i)$$

Or

$$\ddot{y}_{it} = \beta_1\ddot{x}_{it,1} + \beta_2\ddot{x}_{it,2} + \beta_3\ddot{x}_{it,3} + \beta_4\ddot{x}_{it,4} + a_i + \ddot{u_{it}}\text{ , t = 1… T} \qquad \text{(c)}$$

Where, $\ddot{y}_{it} = y_{it} - \bar{y}_i$, $\quad \ddot{x}_{it} = x_{it} - \bar{x}_i$, $\quad \ddot{u}_{it} = u_{it} - \bar{u}_i$

As can be seen from equation (c), the unobserved effect a_i has disappeared. Therefore, I will estimate (c) by panel least squares method, based on the time-demeaned variables. Under a strict exogeneity assumption on the explanatory variables, the fixed effects estimator is unbiased, meaning the idiosyncratic error u_{it} should be uncorrelated with each explanatory variable across all time periods. The fixed effects estimator allows for arbitrary correlation between a_i and the explanatory variables in any time period. Hence, any explanatory variable that is constant over time for all *i* gets swept away by the fixed effect transformation (Wooldridge 2013:467).

The other assumption needed for least squares analysis to be valid is that the error u_{it} is homoscedasticity. Thus, a White test was also conducted to investigate cross-sectional heteroscedasticity and the null hypothesis of homocedasticity is not rejected at the 5% level of significant. Even though heteroscedasticity does not cause coefficient estimates to be biased, the variance and standard error of the coefficients tend to be underestimated. Therefore, robust standard errors are used in the regression. Besides, a challenge in modelling a panel with long time dimension is that variables are likely to be non-stationary. Thus, I conduct the unit root test to test the null hypothesis if the variables are non-stationary. The test statistics reject the null hypothesis to conclude that the data is stationary.

The approach adopted to test empirical hypotheses is suggested by Shrieves and Dahl (1992) and Rime (2001) to estimate the relationship between risk, capital and profitability. However, with the modification of the original approach, the data level is used rather than changes of data as the thesis is limited by the length of data period. The model that establishes the relationship between bank capital and profitability (risk) is based on earlier literature. According to the earlier literature discussion and purpose of

this thesis, I modify the works of Altunbas et al (2007) to establish the relationship between bank capital and bank profitability (riskiness). This paper mainly investigates the relationship among capital and profitability as well as riskiness for European banks with the latest and wider ranges of panel data covering 850 banks in 15 countries from 2005-2011. The relationship between bank capital and bank profitability (risk) can be specified as follows:

$$Profit_{i.t} = \beta_0 + \beta_1 CAP_{i,t} + \beta_2 Bank_{i,t} + \beta_3 Country_t \quad (1)$$

$$Risk_{i.t} = \alpha_0 + \alpha_1 CAP_{i,t} + \alpha_2 Bank_{i,t} + \alpha_3 Country_{i,t} \quad (2)$$

Here, *t* and *i* denote time period and banks, respectively. Equation (1) and (2) are designed to examine the impact of bank capital on bank profitability and bank risk, respectively. Term $CAP_{i,t}$ is the level of bank capital, proxies by the equity-to-assets ratio; $Profit_{i,t}$ refers to the *ith* bank's profitability in the period t, proxied by three profitability variables: return on assets *(ROA),* return on equity *(ROE)* and net interest margin *(NIM).* In addition, $Risk_{i,t}$ denotes the ith bank's risk in the period t, proxied by three risk variables: standard deviation of ROA (*SDROA*), standard deviation of ROE *(SDROE)* and *Ln(Z-score).* Term $Bank_{i,t}$ includes the set of internal control variables related to bank specific characteristics such as net loan to total assets *(NLTA),* liquid assets to customer and short-term deposits *(LAD)* and bank size (SIZE). Term $Country_{i,t}$ refers to five macro control variables relating to country-specific characteristics such as: inflation *(INFL),* GDP growth rate *(GW),* public debt *(PUB),* unemployment *(UNEM)* and market concentration *(CON).*

6. EMPIRICAL RESULTS

This chapter goes through the empirical results and analysis as well as their implications. The first section presents the descriptive statistic describing the variable means over the sample period for different size and type of banks and correlation matrix between variables. The second section discusses the results of empirical tests relating to relationship between capital and profitability (risk) considering different bank types and bank size. In addition, the analysis also is extended by presenting the result of stock return and capital relation during and post crisis. Finally, in order to check the robustness of the empirical results, I present the empirical results after considering the impact of the financial crisis.

6.1 Descriptive Statistics

Table 5 provides the descriptive statistics for all variables used in the regression models. Table 6 only presents the comparative study on the variables means of banking characteristics in terms of bank categories (commercial, cooperative and other bank) and bank size (large, medium and small bank). The mean capital ratio among all banks in the sample is about 10%, with the range from -30.52% to 92.8%. The minimum capital ratio at -30.52% belongs to a commercial bank, due to the fact that the value of bank's assets falls below the value of bank's total liabilities. It is can be explained that during the financial crisis, bank capital becomes negative because of large amount of write-off bad loans, thereby bank insolvency occurs. Besides, the cooperative banks obtain the highest mean value of capital ratio at 11.6% versus other banking types because they are supervised and controlled by banking authorities and have to maintain their capital level in line with prudent banking regulation. Meanwhile, the small banks have the highest average value of capital ratio of 12.6%; the large banks, on the other hand, have the lowest mean of only 6.6%. This is understandable because the large banks benefits from economies of scale, which allows better diversification to reduce risk and operate with lower capital level as well as less-stable funding.

As shown in Table 5, typically the average value of ROA for all banks was 0.56%, while ROE was 5.5% and NIM 2.52%. Usually, the benchmark for ROA level is around 1% whilst ROE is considered good when over 10%. Among different bank categories, on average, cooperative banks earn the highest return on assets and net interest margin (0.64% and 2.9%, respectively) and commercial banks earn the lowest return (0.39% and

2.2%, respectively). Regarding performance across different bank size group, medium banks have the highest average value of ROA and ROE (0.77% and 7.97%, respectively); while the lowest ROA mean belongs to larger bank (0.41% and 4.93%, respectively). As expected, the profitability is significantly lower than for commercial banks and large banks, but higher for cooperative and medium banks. The reason might be around the financial crisis, there is an increase in non-performing loans and assets and charge-offs, leading to sharp decline in commercial bank's earnings. In addition, large banks' profit is most negatively impacted due to changes in the market value of investment securities during earnings stress period, since large banks frequently hold large amount of these assets on their balance sheet.

Table 5: Summary statistics for all variables

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
CAP	9.973	9.141	92.854	-30.518	6.321
NIM	2.522	2.502	26.309	-5.759	1.579
ROA	0.568	0.575	21.199	-22.429	1.175
ROE	5.508	6.443	202.727	-992.293	21.985
SDROA	0.324	0.143	21.391	0,000	0.767
SDROE	4.332	1.574	701.221	0,000	17.160
Ln(Z-score)	4.314	4.166	9.312	-6.441	1.372
LAD	29.413	18.780	927.680	0.000	39.214
NLTA	63.799	69.161	99.583	0.004	20.524
CONCE	531.590	407.000	3700.00	174.000	380.785
GDP	0.635	1.683	6.588	-8.539	2.652
INF	2.054	1.999	4.880	-4.480	1.021
PUB	87.221	104.250	136.888	3.610	28.850
UNE	7.710	7.700	21.700	3.100	2.180

Notes: All values are sample means, CAP: Equity-to-total-assets, ROA: Return on assets, ROE: Return on equity, NIM: net interest margin, SDROA (SDROE): Standard deviation of ROA (ROE) is calculated using overlapping ROA (ROE) data averaged every two year, Ln(Z-score) is natural logarithm of Z-score, LAD: Liquid assets to customers and short-term deposits, NLTA: net loans to total assets, CONCE: Market concentration index, GW: GDP growth rate, INFL: inflation, PUB: public debt to total GDP, UNE: Unemployment rate.

Comparing the average return volatility across banking groups, I find that the small banks and cooperative banks have the lowest standard deviation of ROA & ROE, while the highest value results from the commercial banks and large banks. Meanwhile, the highest mean value of Ln(Z-score) fall on cooperative banks, followed by other banks and commercial banks. Besides, medium banks show the highest distance from insolvency as measured by Ln(Z-score), followed by large banks and small banks. Briefly, cooperative banks might be less fragile than others as they have stable deposit and customer basis, focus on capital preservation and do not maximize profits as commercial banks but customer surplus which could serve as a potential cushion in weaker periods. Furthermore, disperse membership and dominance by managers in risk-taking decision might reduce incentives for riskiness and thus fragility. In addition, large banks are expected to suffer more volatile returns as they are have greater reliance on non-interest income. A plausible explanation is that fee-based activities are associated with increased earnings volatility. Besides, as shown in Table 5, commercial banks and small banks have lowest distance to insolvency compared to other bank specializations.

Table 6: Variable means over the sample period (2005 - 2011).

Variables	All banks	Commercial Bank	Cooperative Bank	Other Bank	Large Bank	Medium Bank	Small Bank
CAP	9.973	8.034	11.647	9.203	6.639	9.633	12.652
NIM	2.521	2.211	2.904	2.237	1.845	2.611	3.024
ROA	0.568	0.396	0.639	0.608	0.414	0.774	0.635
ROE	5.508	4.383	5.499	6.445	4.931	7.971	5.312
SDROA	0.324	0.425	0.224	0.381	0.311	0.255	0.351
SDROE	4.331	7.230	2.050	5.168	6.419	3.246	2.993
Ln(Zscore)	4.314	4.152	4.479	4.215	4.347	4.596	4.215
LADSF	29.413	39.615	21.139	32.706	37.424	28.979	23.301
NLTA	63.798	57.382	67.652	63.632	60.097	64.813	66.408
Bank No	850	216	371	263	324	109	417

Notes: All values are sample means, CAP: Equity-to-total-assets, ROA: Return on assets, ROE: Return on equity, NIM: net interest margin, SDROA (SDROE): Standard deviation of ROA (ROE) is calculated using overlapping ROA (ROE) data averaged every two years, Ln(Z-score) is natural logarithm of Z-score, LAD: Liquid assets to customers and short-term deposits, LLP: Loan loss reserves to gross loans, NLTA: Net loans to total assets.

The sample mean of loan ratio (NLTA) is 29.4% for all banks, which ranges from 0 to 99.6%. The financial institutions holding very low loan to total assets ratio are securities firms and private banking and asset management companies, when they have almost zero loan growth. While finance companies (credit card, factoring and leasing) have the largest portion of loan, as their net loans accounts for approximately 100% of total assets. Among different banks categories, on average, cooperative banks and small banks have the highest loan ratio (67.65% and 66.4%, respectively), but commercial banks and large banks have the lowest (57.4% and 60%, respectively). The figures reflect the fact that these banks more involved in market-based activities rather than traditional bank lending. Whilst the cooperative banks in Europe have impressive market shares and traditionally play dominant role in lending to small- and medium-sized enterprises.

In terms of bank liquidity, the mean value of liquid assets to customer and short-term deposits (LAD) is 29.4% for all banks. The maximum mean value is 927.68% belonging for specialized government credit institution, while the minimum value was almost zero resulting from finance companies (credit card, factoring and leasing). Comparing average LAD across bank types, I find that commercial banks and large banks hold the largest portion of liquid assets to customer and short-term deposits (39.6% and 37.4%, respectively); meanwhile, cooperative banks and small banks have the lowest mean ratio (21.14% and 23.3%, respectively).

The mean GDP growth among 15 countries in the sample was 0.64% with a range from -8.5 to 6.5%. The country experienced the negative GDP growth is Finland in 2009. During the period of financial crisis, there are many European countries suffering two consecutive years of negative economic growth such as Italy, Ireland, and Sweden. It is obvious that, the credit crunch causes a fall in bank lending and investment, leading to a serious recession in European region. In terms of inflation rate, the average value is 2.08% for 15 countries, ranging from -4.48 to 4.88%. The country has the negative inflation rate is Ireland in 2009; also Ireland has the highest positive rate of 4.88% in 2007. During the period 2007-2009, Ireland had to suffer a sharp decline in both GDP growth as well as inflation. This is due to the fact that when the global financial crisis came, the Irish property market collapsed, saddled with substantial loss of government revenue, Ireland suddenly suffered a large amount of fiscal deficit. Regarding public debt-to-GDP ratio, the mean ratio is 87.2%; the maximum value is 136.89% from Greece in 2009; while the minimum is 3.61% from Luxembourg in 2005. It is understandable that the recession causes a steep deterioration in government finance, especially when there is negative economic growth; the government receives less tax, leading to a rapid

rise in debt-to-GDP ratio. In terms of unemployment rate, the average ratio among 15 countries is 7.7%, ranging from 3.1% from Netherlands in 2008 to 21.7% from Spain in 2011. It is explained that due to the severe impact of global recession, Eurozone GDP decreases significantly during the crisis, and is accompanied by a sharp increase in unemployment.

Table 8 provides the matrix of correlation coefficient. The correlation coefficients measure the degree to which two variables movements are associated. If the explanatory variables in the regression model are perfectly or highly correlated, multicollinearity exists, which leads to biased estimation for explanatory variables but still keeps the model reliable. As shown in the table, the coefficients are usually small (less than 0.5), indicating that the correlation between variables fairly. According to Kennedy (2003), the multicollinearity is a critical problem when the correlation is above 0.8, which is not the case of this study. Even though there are two significantly high correlation coefficients occurring between ROA and ROE as well as SDROA and SDROE at 0.67 and 0.77, respectively, these two pairs are not explanatory variables in the same regression. Therefore, multicollinearity is not a problem in all regressions running in this thesis.

Table 7: Correlation matrix.

	CAP	CONCE	GW	INF	LAD	NIM	NLTA	PUB	ROA	ROE	UNE	SDROA	SDROE	Ln(Z-score)	SIZE
CAP	1														
CONCE	-0,139***	1													
	(0,000)														
GW	-0,017	0,122***	1												
	(0,177)	(0,000)													
INF	-0,010	-0,047***	0,290***	1											
	(0,400)	(0,000)	(0,000)												
LAD	-0,001	0,051***	0,043***	0,024*	1										
	(0,928)	(0,000)	(0,000)	(0,060)											
NIM	0,310***	-0,178***	-0,020	0,021*	-0,207***	1									
	(0,000)	(0,000)	(0,116)	(0,096)	(0,000)										
NLTA	0,055***	-0,039***	-0,048***	-0,042***	-0,558***	0,234	1								
	(0,000)	(0,002)	(0,000)	(0,001)	(0,000)	(0,000)									
PUB	0,119***	-0,442***	-0,322***	-0,033**	-0,154***	0,203***	0,161***	1							
	(0,000)	(0,000)	(0,000)	(0,010)	(0,000)	(0,000)	(0,000)								
ROA	0,179***	-0,037**	0,176***	-0,031**	0,002	0,129***	0,012	-0,043***	1						
	(0,000)	(0,040)	(0,000)	(0,014)	(0,846)	(0,000)	(0,333)	(0,001)							
ROE	0,027**	-0,030**	0,153***	0,006	0,040***	0,023*	-0,005	-0,056***	0,672***	1					
	(0,034)	(0,022)	(0,000)	(0,627)	(0,000)	(0,075)	(0,663)	(0,000)	(0,000)	-----					
UNE	-0,019	-0,012	-0,172***	-0,165***	-0,008	-0,090***	-0,009	0,080***	-0,119***	-0,126***	1				
	(0,137)	(0,352)	(0,000)	(0,000)	(0,510)	(0,000)	(0,448)	(0,000)	(0,000)	(0,000)	-----				
SDROA	0,090***	0,084***	-0,060***	-0,007	0,034***	0,042***	-0,081***	-0,078***	-0,270***	-0,330***	0,054***	1			
	(0,000)	(0,000)	(0,000)	(0,559)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)				
SDROE	-0,105***	0,092***	-0,052***	0,000	0,023*	-0,030**	-0,069***	-0,062***	-0,310***	-0,623***	0,076***	0,770***	1		
	(0,000)	(0,000)	(0,000)	(0,991)	(0,068)	(0,017)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)			
Ln(Z-score)	0,069***	-0,090***	-0,002	0,012	-0,035***	-0,033***	0,090***	0,046***	0,080***	0,075***	0,010	-0,250***	-0,180***	1	
	(0,000)	(0,000)	(0,850)	(0,347)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,440)	(0,000)	(0,000)		
SIZE	-0,510***	0,321***	0,084***	0,023*	0,174***	-0,412***	-0,161***	-0,382***	-0,104***	-0,017	0,010***	-0,040***	0,099***	0,030**	1
	(0,000)	(0,000)	(0,000)	(0,077)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,170)	(0,000)	(0,000)	(0,000)	(0,021)	

Note: Numbers in parentheses are p – values, ***, ** and * indicate the 1%, 5% and 10% significant level, respectively. CAP: Equity-to-total-assets, ROA: Return on assets, ROE: Return on equity, NIM: net interest margin, SDROA (SDROE): Standard deviation of ROA (ROE) is calculated using overlapping ROA (ROE) data averaged every two years, Ln(Z-score) is natural logarithm of Z-score, LAD: liquid assets to customers and short term deposits, SIZE is natural logarithm of total assets, NLTA: net loan to total assets, CONCE: market concentration index, GW: GDP growth rate, INF: Inflation rate, PUB: ratio of public debt to total GDP, UNE: unemployment rate.

6.2 Empirical Results

This section discusses the estimation results regarding relationship between capital and profitability (risk). The study econometrically adopts fixed-effects panel regressions. Besides, it also presents the variability in earnings performance and riskiness of banks under different factors of bank categories and sizes. Finally, the robustness analysis is reported to check if the main hypotheses still hold under the impact of recent financial crisis.

6.2.1 Effects of Bank Capital on Profitability

Table 9 summarizes the regression results for the estimation results of capital and profitability relation derived from the fixed-effects panel regressions. Accounting measures of bank's profitability (NIM, ROA and ROE) are used as the dependent variable. The overall R^2 statistics for all three regression models are fairly high, indicating the high fitness between the model and explanatory variables.

The ratio of equity-to-total assets is significantly and positively related to profitability ratios (NIM, ROA and ROE) at the significant level of 1%-10%. In other words, European banks with higher capital level generate higher profitability. Specifically, bank capital has strongest positive effect on return on equity, followed by return on assets and net interest margins. This finding is consistent with the results of Goddard et al. (2010), Iannotta et al (2007), Demirguc-Kunt and Huizinga (2000) and Berger (1995). It is can be explained that when banks hold capital above their regulatory requirement, they can channel this excess capital and invest in the form of securities or portfolio of risky assets, and thereby earn higher profit. In addition, well-capitalized banks earn high creditworthiness and need to borrow less than their lower counterparts, thus reducing their funding cost and improve their interest margin. In general, these empirical results support for the hypothesis that capital improves the bank's profitability around the financial crisis. This direct relationship, however, violates the literature on the discipline role of debt (Calomiris and Kahn 1991). As they suggest that banks with higher leverage will improve their assets choice and hence their profitability. Thus, banks with higher capital level have lower quality assets. If these assets deteriorate in value during crisis, banks with higher capital may suffer bigger decline in profitability than their lower capital counterparts.

Table 8: All banks – Estimation results of capital and profitability.

	NIM	ROA	ROE
CAP_{it}	0.018 ***	0.027 ***	0.113 *
	(0.001)	(0.000)	(0.099)
LAD_{it}	-0.001 **	0.000	0.022 **
	(0.004)	(0.476)	(0.019)
$NLTA_{it}$	0.012 ***	0.003	0.021
	(0.000)	(0.124)	(0.566)
$SIZE_{it}$	-0.303 ***	-0.084	-0.391
	(0.000)	(0.119)	(0.704)
GW_{it}	-0.005 *	0.058 ***	0.700 ***
	(0.080)	(0.000)	(0.000)
$INFL_{it}$	0.069 ***	-0.084 ***	-0.716 ***
	(0.000)	(0.000)	(0.002)
$CONCE_{it}$	-0.000 **	-0.001 **	-0.009 **
	(0.000)	(0.000)	(0.000)
UNE_{it}	-0.025 ***	-0.129 ***	-1.749 ***
	(0.000)	(0.000)	(0.000)
PUB_{it}	-0.007 ***	-0.001	-0.004
	(0.000)	(0.221)	(0.870)
Number of Banks	850	850	850
Observation	5950	5950	5950
R^2	0.89	0.61	0.59

Note: Dependent variable is profitability: NIM, ROA and ROE, respectively. Estimation method is Panel least square estimator. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. P-values are in parentheses. CAP: Equity-to-total-assets, ROA: Return on assets, ROE: Return on equity, NIM: net interest margin, LAD: liquid assets to customers and short term deposits, SIZE is natural logarithm of total assets, NLTA: net loan to total assets, CONCE: market concentration index, GW: GDP growth rate, INF: Inflation rate, PUB: ratio of public debt to total GDP, UNE: unemployment rate.

Other bank's control variables also perform differently in the relation with profitability. The coefficient proxy for bank liquidity (LAD) indicates a significant and negative impact on net interest margins but positive effect on return on equity. The direct relation between bank capital and liquidity supports the finding of Berger (1995) as banks holding more liquid assets receive a favorable signal from funding markets, reducing their financing costs and increasing profitability. However, at some point this benefit is outweighed by the opportunity cost of holding such low-return assets; thereby

diminishing their profitability as documented by Molyneux and Thornton (1992). Besides, when considering this relation in the context of financial distress, it is stated that banks that follow more market-based rather than traditional banking model will earn profit as they increase liquid assets (Bordeleau and Graham 2010). The coefficient of the ratio of net loans to total assets (NLTA) is significantly and positively related to net interest margin at the significance level of 1% but it shows no significant impact on ROA and ROE. Specifically, banks with higher loan ratio (or potential credit risk) will generate higher profitability. This result implies that banks demand higher interest to compensate for exposure from expected and unexpected credit risk. This finding is also confirmed by an empirical study of Maudos and Guevara (2004).

The coefficient of bank size measured by logarithm of total assets indicates a significantly negative association with net interest margin, but there is no evidence of its impact on ROA and ROE. This finding gives support to the diseconomies of scale existing from a level of size upwards. Namely, growing banks may face diminishing marginal returns on average since their profit will decline with size. This result violates the theory about benefit of economies of scale, as larger banks have lower costs per unit of income and hence higher net interest margin. It is also against the finding from Goddard et al. (2001) as they find that scale economies and productive efficiency in European banking were positively related to profits using 1989-1996 data.

As illustrated in table 8, bank profitability also depends on the country-specific macroeconomic variables. The impact of GDP growth (GW) on ROA and ROE are significantly positive, but negative on NIM. The inverse relation between GDP growth and net interest margin is previously found by Demiguc-Kunt and Huizinga (1999). This can be explained that during period of recession characterized by lower economic growth, credit risks are relatively high due to lower quality of loan portfolio; hence banks will charge higher rates of loan to absorb unexpected shocks resulting in higher interest margin. However, the direct association between bank profit and economic growth supports the empirical results of Dietrich and Wanzenried (2011). The reason might be that in the period of good economic condition and well-functioning markets, banks are easier to identify investment opportunities, select the most profitable projects, facilitate trading and diversify risks; thereby improving their return on investments.

Inflation also explains variation in NIM and ROE and ROA. Specifically, inflation is significantly associated with higher net interest margin but lower return on assets and return on equity at the significance level of 1%. The direct association between inflation

and net interest margin is simply explained as inflation entails with higher costs, which encourages banks charge higher loan rate to compensate, leading to higher margin. This result supports the findings of Demirguc-Kunt and Huizinga (1999). On the other hand, the negative impact of inflation on earnings suggests that European banks are not able to project the effect of inflation expectations in their cost for their investment, especially for banks applying modern model business rather than traditional model. Another noticeable finding is that market concentration is significantly and negatively related to bank profit, indicating banks operating in the less concentrated markets will generate higher profitability. Meanwhile, coefficients of other macroeconomic indicators such as public debt to GDP (PUB), and unemployment rate (UNE) are all significantly negative, indicating that unfavorable economic environment crashes profitability of the banks.

6.2.2 Effects of Bank Capital on Riskiness

Table 9 reports the empirical results about the impact of bank capital on riskiness derived from the fixed-effects panel regressions. Standard deviation of return on assets (SDROA), standard deviation of return on equity (SDROE) and natural logarithm of Z-score (Ln (Z-score)) are used as the dependent variables. R^2 statistics measures the level of fitness between model and explanatory variables. The model explains about 40-97% of the total variation in dependent variables of riskiness.

As can be seen from the table, there is a significantly negative relation between capital and return volatility. Namely, well-capitalized banks with suffer less volatile on earnings. This finding matches with the results of Lee and Hsieh (2013), Baselga-Pascual et al. (2013) and Konishi & Yasuda (2004). The reason is stated that low-capital banks respond to moral hazards incentives by increasing the riskiness of their loan portfolios, which results in higher non-performing loans. Meanwhile, banks holding higher capital will improve their loan loss provision, especially during financial distress in order to absorb unexpected loss and reduce volatility of earnings. Another important finding is that bank capital has significantly direct impact on stability as measured by positive coefficient of Ln (Z-score). It is obvious that safer banks will have lower volatility in their earnings that drives banks higher distance from insolvency. Overall, these empirical results confirm the hypothesis that capital reduces bank's riskiness around financial crisis.

Table 9: All banks - Estimation results of capital and risk.

	SDROA	SDROE	Ln(Z-score)
CAP_{it}	-0.009 ***	-0.131 ***	0.007 ***
	(0.000)	(0.000)	(0.000)
LAD_{it}	0.000	0.014 *	-0.000 **
	(0.239)	(0.079)	(0.044)
$NLTA_{it}$	-0.005 ***	-0.076 **	0.001 **
	(0.001)	(0.010)	(0.040)
$SIZE_{it}$	-0.230 ***	-2.354 ***	-0.142 ***
	(0.000)	(0.004)	(0.000)
GW_{it}	-0.010 ***	0.041	0.005 ***
	(0.005)	(0.553)	(0.000)
$INFL_{it}$	-0.011	-0.074	-0.016 ***
	(0.239)	(0.685)	(0.000)
$CONCE_{it}$	-0.000	-0.003	-0.000 *
	(0.853)	(0.189)	(0.060)
UNE_{it}	-0.011	-0.284 **	0.011 ***
	(0.112)	(0.043)	(0.000)
PUB_{it}	-0.000	-0.038 *	-0.000 *
	(0.608)	(0.064)	(0.070)
Number of Banks	850	850	850
Observation	5950	5950	5950
R^2	0.40	0.57	0.97

Note: Dependent variable is profitability: NIM, ROA and ROE, respectively. Estimation method is Panel least square estimator. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. P-values are in parentheses. CAP: Equity-to-total-assets, ROA: Return on assets, ROE: Return on equity, NIM: net interest margin, LAD: liquid assets to customers and short term deposits, SIZE is natural logarithm of total assets, NLTA: net loan to total assets, CONCE: market concentration index, GW: GDP growth rate, INF: Inflation rate, PUB: ratio of public debt to total GDP, UNE: unemployment rate.

Ratio of liquid-assets-to-customer and short term deposits as a measure of bank liquidity has a significant and positive impact on volatility of return on equity but negative effect on stability. Conceptually, during credit crunch period, when banks increase the proportion of funds committed to cash and readily marketable assets to fund their operations, those liquid assets tend to yield lower returns than other investments. In addition, the opportunity cost of stored liquidity is higher and holding low-yielding assets on the balance sheet reduces bank returns; thereby increasing volatility of return on equity. Besides, banks suffering high earnings volatility will be less stable. This

finding is in line with Wagner (2007), as it is documented that an increase in asset liquidity in times of crisis will reduce stability. However, the negative effect of liquidity on stability does not have significant and economic meaning since its coefficient is almost zero. Surprisingly, this result is against the expectation that liquid assets are less risky, since liquid assets are a buffer against liquidity shocks. It also somehow violates the result of Altunbas et al. (2007) as they documented a strong positive relationship between liquidity and risk.

Turning to control variable for credit risk, the ratio of net loan-to-total-assets (NLTA) has a significant and negative relation with return volatility but a positive association with stability. Namely, bank with higher loan ratio will suffer less volatile return but more stable. Conceptually, higher loan-to-assets ratio is accompanied with higher loan loss provisions, especially during crisis time, as well as low earnings. According to Greenawalt and Sinkey (1988), higher loan loss provision can improve earnings managements or reduce return volatility; thereby enhance financial soundness.

Further, as indicated in table 9, the coefficients of Ln (TA) are significantly and negatively related to return volatility and bank's stability as well. This result implies that larger banks have lower earnings fragility. It is also confirmed by Stever (2007) that smaller banks have fewer diversification opportunities, which drives them to make loan for low credit risk or more collateralized borrowers. Hence, this lower diversification may result in higher earnings volatility. However, DeYoung and Roland (2001) find a direct relation between bank sizes and return volatility. They provide empirical evidence that fee-based activities are associated with increased fragile earnings, indicating larger banks with greater reliance on non-interest incomes will suffer more volatile returns. In addition, as documented by Maudos and DeGuevara (2010), the financial stability is greater in smaller banks and decreases as their size increase, which is in line with the finding of this study.

With respect to the macroeconomic variables, the economic cycle affects bank riskiness as well. As indicated from the coefficients of economic growth (GW), higher growth will reduce the fragility of banks' return on assets and improve their financial soundness. It is easily explainable that as banking profitability is an increasing function of GDP growth, thereby improving stability as measured by Ln (Z-score). This finding matches with that of Lee and Hsieh (2013).

Table 10 Bank Specializations - Estimation result of Capital, Profit and Risk.

	Profitability			Risk		
	NIM	ROA	ROE	SDROA	SDROE	Ln(Z-score)
Commercial banks						
CAP_{it}	0.048 ***	0.052 ***	0.288 **	-0.017 **	-0.256 ***	0.011 ***
	(0.000)	(0.000)	(0.030)	(0.016)	(0.000)	(0.000)
LAD_{it}	-0.002 ***	-0.000	0.000	0.000	0.007	-0.000
	(0.000)	(0.327)	(0.959)	(0.414)	(0.661)	(0.345)
$NLTA_{it}$	0.010 ***	0.009 **	-0.086	-0.009 **	-0.210 ***	0.001
	(0.000)	(0.032)	(0.668)	(0.016)	(0.009)	(0.302)
$SIZE_{it}$	-0.055	0.425 ***	3.630 ***	-0.057	-0.150	-0.198 ***
	(0.352)	(0.001)	(0.000)	(0.645)	(0.950)	(0.000)
No of Observation	1512	1512	1512	1512	1512	1512
R^2	0.90	0.61	0.53	0.40	0.62	0.95
Cooperative bank						
CAP_{it}	-0.005	0.101 ***	0.529 **	-0.017 ***	-0.256 **	0.086 ***
	(0.663)	(0.000)	(0.030)	(0.006)	(0.000)	(0.000)
LAD_{it}	0.002	0.000	0.026 ***	0.000	0.007	-0.000
	(0.655)	(0.298)	(0.007)	(0.395)	(0.661)	(0.345)
$NLTA_{it}$	0.012 ***	0.002	0.043 **	-0.003 **	-0.047 ***	0.000 ***
	(0.000)	(0.202)	(0.043)	(0.052)	(0.005)	(0.000)
$SIZE_{it}$	-0.038	0.345 ***	4.769 ***	-0.207 ***	-2.601 ***	-0.040 ***
	(0.540)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
No of Observation	2597	2597	2597	2597	2597	2597
R^2	0.88	0.60	0.58	0.34	0.38	0.99
Other banks						
CAP_{it}	-0.001	0.019 ***	0.126	0.002	-0.097	0.043 ***
	(0.826)	(0.001)	(0.265	(0.612)	(0.172)	(0.000)
LAD_{it}	0.000	0.000	0.037 **	-0.000	0.009	-0.000
	(0.788)	(0.261)	(0.016)	(0.863)	(0.264)	(0.155)
$NLTA_{it}$	0.016 ***	-0.000	0.169 ***	0.002	0.029	0.000
	(0.000)	(0.838)	(0.007)	(0.357)	(0.442)	(0.809)
$SIZE_{it}$	-0.288 **	-0.269 ***	-4.560 ***	-0.389 ***	-2.755 **	-0.118 ***
	(0.019)	(0.001)	(0.004)	(0.000)	(0.012)	(0.000)

Note: Dependent variables are profitability (NIM, ROA and ROE) and risk (SDROA, SDROE and Ln (Z-score). Estimation method is Panel least square with fixed effects estimator. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. P – Values are in parentheses.

Further, in the case of the inflation rate, its coefficient only shows a significant and negative impact on bank's stability. It has to be taken into account that returns are

negatively related to inflation as being explained from previous section, thereby reducing the distance to insolvency of the banks. Surprisingly, market concentration has insignificant effect on bank riskiness as it only has statistically inverse impact on stability though the magnitude is almost zero. Meanwhile, Repullo (2004) finds a negative association between market concentration and bank risk since it is perceived that merger between banks increases market concentration and reduce banks' investment in gambling assets but focuses on prudent assets. Regarding other macroeconomic variables such as unemployment rate (UNE) and public debt ratio (PUB), they are both significantly and negatively related to bank's riskiness at the significance level of 5%.

6.2.3 Effects of Bank Capital across Bank Specializations

It is perceived that banks of different characteristics differ in their attitudes to managing capital, profits and riskiness; for instance, commercial banks will exploit their capital for profit maximization but cooperative focus on their stakeholder's surplus. Therefore, the earnings performance and financial stability of banks vary widely from one bank type to another. This section will discuss the estimation results of studying the effects of bank capital on profitability and riskiness across different bank types, one factor believed to contribute to profit's variability. Table 10 demonstrates the empirical results derived from the fixed-effects panel least regressions. It repeats the exercises of table 8 and 9, but groups banks by different categories as commercial, cooperative and other banks. I conclude with 216 commercial banks, 371 cooperative banks and 232 other banks. The reported R-squared is higher for cooperative banks, followed by commercial banks and other banks. In order to save space, only important variables and significant results are reported in the table.

Firstly, across three types of banks, bank capital has the strongest positive impact on profitability of cooperative banks, followed by commercial banks and other banks. Specifically, one percentage point increase in capital can raise 10.1 percentage point in ROA and 52.9 percentage point in ROE for cooperative banks, but only 5.2 percentage point in ROA and 28.8 percentage point in ROE for commercial banks; meanwhile the effect on profit of other banks is not remarkable. It can refer that cooperative banks gain more profit advantages when improving their bank capital level since they obtain more prudential approach to manage capital to weather the financial crisis better than commercial banks. Thus, it is demonstrated by their stronger effect of their capital on

profitability. Besides, there is a significant and positive relation between capital and net interest margin in only commercial banks, but insignificant association exists in the rest of bank categories.

Other bank-specific characteristics perform differently in relation with profit. Higher liquid assets will improve return on equity of cooperative and other banks but deteriorate net interest margin of commercial banks. It indicates that commercial banks holding a high fraction of liquid assets have lower margin. Additionally, higher loan ratio also enhances NIM and ROA for commercial banks, but NIM and ROE for cooperative and other banks. Increasing assets size will generate higher earnings for commercial and cooperative banks but reduce returns for other banks.

Secondly, turning to capital effect on bank's riskiness, among different bank categories, the effect is stronger and more significant on earnings volatility and financial soundness of commercial and cooperative banks, while capital only has significant impact on stability of other banks. Specifically, one percentage point increase in capital can reduce 1.7 percentage points in volatility of return on assets and 25.6 percentage points in volatility of return on equity for both commercial and cooperative banks. Likewise, loan ratio (NLTA) also has significantly negative effects on earnings fragility for commercial and cooperative banks but insignificant impact for other banks. Namely, higher loan ratio will reduce volatile earnings in commercial and cooperative banks, while the impact is stronger for commercial banks. Besides, size effect is significantly negative on profitability of cooperative banks and other banks only, indicating for these types of banks, increasing assets size will help them to reduce earnings volatility but make them less stable.

6.2.4 Effects of Bank Capital across Bank Size

This section will consider another factor which also contributes to variability of profit and risk among banks. The same regression models as equation (1) and (2) are conducted to examine the extents to which banks size associated with bank profitability and riskiness. Table 11 reports the estimation results regarding effects of bank capital on profitability and riskiness across different bank sizes. I split the banks according to the cut-off point that is defined earlier in this paper. I conclude with 324 large banks (2268 observations), 107 medium banks (763 observations) and 417 small banks (2919 observations).

Table 11: Bank Size - Estimation results of capital, profitability and risk.

	Profitability			Risk		
	NIM	ROA	ROE	SDROA	SDROE	Ln(Z-score)
Large banks						
CAP_{it}	0.022 ***	0.090 ***	0.502 *	-0.020 **	-0.592 ***	0.066 ***
	(0.001)	(0.000)	(0.064)	(0.025)	(0.001)	(0.000)
LAD_{it}	-0.000	0.000	0.023 *	0.000	0.005	0.000
	(0.448)	(0.163)	(0.099)	(0.795)	(0.592)	(0.882)
$NLTA_{it}$	0.011 ***	0.000	0.021	-0.005 **	-0.051	0.000
	(0.000)	(0.765)	(0.747)	(0.030)	(0.268)	(0.557)
$SIZE_{it}$	-0.195 ***	0.208 **	0.151	-0.148 **	-2.925 **	-0.076 **
	(0.000)	(0.019)	(0.939)	(0.026)	(0.032)	(0.018)
No of Observation	2268	2268	2268	2268	2268	2268
R^2	0.94	0.55	0.67	0.47	0.69	0.95
Medium banks						
CAP_{it}	0.003	0.053 ***	-0.012	0.000	-0.196	0.061 ***
	(0.879)	(0.000)	(0.952)	(0.926)	(0.154)	(0.000)
LAD_{it}	-0.008 **	0.011 ***	0.088 **	0.004 **	0.051 **	-0.003 ***
	(0.018)	(0.000)	(0.016)	(0.035)	(0.040)	(0.000)
$NLTA_{it}$	0.005	0.007	0.079	-0.000	0.069	0.001
	(0.431)	(0.143)	(0.275)	(0.795)	(0.161)	(0.151)
$SIZE_{it}$	0.270	-0.320 **	-3.147 *	-0.362 ***	-2.600 **	-0.201 ***
	(0.155)	(0.021)	(0.098)	(0.001)	(0.044)	(0.000)
No of Observation	763	763	763	763	763	763
R^2	0.71	0.87	0.72	0.46	0.51	0.99
Small banks						
CAP_{it}	-0.007	0.014 ***	0.138 ***	-0.010 **	-0.149 *	0.041 ***
	(0.119)	(0.004)	(0.001)	(0.029)	(0.078)	(0.000)
LAD_{it}	-0.003 ***	-0.003 ***	-0.001 **	0.001	0.022	-0.002 ***
	(0.009)	(0.003)	(0.032)	(0.273)	(0.271)	(0.000)
$NLTA_{it}$	0.014 ***	0.007 **	0.047 **	-0.005 *	-0.136 **	0.000
	(0.000)	(0.034)	(0.033)	(0.074)	(0.010)	(0.106)
$SIZE_{it}$	-0.282 ***	-0.029	0.604	-0.239 ***	-1.156	-0.133 ***
	(0.000)	(0.719)	(0.294)	(0.001)	(0.398)	(0.000)
No of Observation	2919	2919	2919	2919	2919	2919
R^2	0.88	0.54	0.54	0.33	0.25	0.99

Note: Dependent variables are profitability (NIM, ROA and ROE) and risk (SDROA, SDROE and Ln (Z-score). Estimation method is fixed-effects Panel least square estimator. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. P – Values are in parentheses.

Coefficients of capital level are positively related to bank's profitability across all bank sizes. Specifically, the capital has the strongest effect on profitability of large banks, followed by medium banks and small banks. In addition, increasing capital can improve higher return on equity rather than return on assets and net interest margin, especially in large banks. According to Berger and Bouwman (2013), bank capital can enhance the earnings performance of medium and large banks during banking crises. This finding matches with the results of Bourke (1989), Molyneux and Thornton (1992) and Goddard et al. (2004) as they confirm that bank size is linked with higher equity capital. It is suggesting that bank size are highly capitalized, resulting in larger banks have stronger effect of capital on bank's profit.

Turning to effects of other bank control variables on profitability when considering their assets size, they also perform differently. Bank liquidity as measured by ratio of liquid assets-to-customer and short term deposit has mixed effects on profit across bank sizes. As banks with higher liquidity only generate higher return on equity and return on assets in large banks and medium banks, but deteriorate earnings performance in small banks. In addition, liquidity has stronger effects on medium banks, followed by small banks and large banks. Besides, loan ratios shows a significant and positive effect on profitability of small banks solely and only on net interest margin of large bank but no evidence of its impact in medium banks.

The influence of bank capital on riskiness is more significant and negative in large banks, followed by medium banks and small banks. It implies that capital effect on riskiness increases with bank size. Specifically, large banks will reduce more earnings volatility and enhance their financial stability more when they increase capital level. Interestingly, bank liquidity is directly related to earnings fragility of medium banks only, but no significant effect on volatility of large banks and small banks. However, it is significantly and negatively related to financial stability of medium and small banks. Meanwhile, credit risk as measured by ratio of net loan-to-total assets has stronger effect on volatile returns of small banks, followed by large banks but no impact on riskiness of medium banks.

6.2.5 Robustness Analysis

This section presents the robustness analysis as I examine whether the main results hold when considering the impact of the crisis. The whole period is divided into the sub-periods such as prior to crisis (2005-2006), during crisis (2007-2008) and after crisis (2009-2011). Table 12 reports the estimation results of capital effects on profitability and risk in three sub-periods derived from fixed-effects panel regressions. Accounting measures of bank's profitability (NIM, ROA and ROE) are used as the dependent profitability variables and SDROA, SDROE and Ln (Z-score) are used as the dependent riskiness variables. The overall R^2 statistics for all three regression models are fairly high, indicating the high fitness between the model and explanatory variables.

Overall, only the results obtained from the post-crisis period are similar to earlier findings, whilst the findings during crisis and prior to crisis are slightly different. As shown in table 12, prior to crisis, bank capital has positive effect on ROA and ROE but negative impact on net interest margin. While there is no statistical evidence about the relationship between capital and profitability during crisis; however, after crisis, bank capital is significantly and positively related to profitability. An explanation is given that the period before financial crisis is a loose regulation time; banks are not strictly required to raise adequate capital or reserve for loan losses. For banks specializing in traditional banking, thus, increasing capital instead of making loans will lower their main driver of profitability or net interest margin. For banks employing modern banking model or specializing in market-based activities, higher capital will improve their return on assets and return on equity. After crisis, however, under the regime of prudent financial regulation, all banks are required to raise their capital, leading to positive effect of capital on bank profitability. The magnitude and significance of the capital coefficients are greater and stronger for the period after crisis with more strengthened capital regulations. Regarding bank-specific variables, the coefficient of credit risk is significantly and positively related to earnings performance before and after crisis, but inversely during crisis. Obviously, during the credit crunch, banks suffering higher credit risk will deteriorate their earnings further. Another noticeable finding is that, prior to and after the crisis, banks increasing their assets size will perform better but they will suffer lower profit in the period of crisis.

Turning to capital effect on riskiness of European banks, the effect is consistent in all sub-periods, meaning there is consistently significant and negative association between capital and bank's risk. Obviously, in all cases, higher capital will help banks buffer for

earnings volatility and strengthen their financial stability. It is remarkable that the magnitude and significance of capital effect on riskiness are stronger in the period of post-crisis, followed by prior to crisis and crisis time. For example, the capital coefficients on Ln (Z-score) in post-crisis period, prior to crisis and crisis are 0.069, 0.043 and 0.040, respectively. Surprisingly, there is no significant relation between bank liquidity and bank risk before and during crisis, but positive association exists after crisis. Namely, banks holding higher liquid assets can increase their earnings volatility, leading to higher risk in post-crisis period. Besides, the coefficient of loan ratio shows a negative relation with returns fragility before crisis and during crisis but positive with stability only before crisis. Another remark is about size effect on bank's riskiness. As illustrated in table 12, as banks increasing their assets size, they will suffer less risk during and after crisis but less stable before crisis. Specially, in the post-crisis period, larger banks can reduce significantly their earnings volatility as being shown by the negative coefficients on SDROA and SDROE (-1.159 and -9.856, respectively).

Table 12: All banks in sub periods – Estimation result of capital, profitability and risk.

	Profitability			Risk		
	NIM	ROA	ROE	SDROA	SDROE	Ln(Z-score)
Pre - crisis period						
CAP_{it}	-0.052 ***	0.042 ***	0.269 **	-0.032 **	-0.621 **	0.043 ***
	(0.000)	(0.000)	(0.046)	(0.019)	(0.029)	(0.000)
LAD	0.000	-0.000	-0.012	0.001	0.032	-0.000 ***
	(0.960)	(0.713)	(0.482)	(0.376)	(0.396)	(0.000)
NLTA	0.017 ***	0.019 ***	0.196 ***	-0.014 *	-0.266 *	0.017 **
	(0.000)	(0.000)	(0.000)	(0.057)	(0.089)	(0.015)
SIZE	0.471 ***	0.330 **	2.354	0.006	3.399	-0.232 ***
	(0.000)	(0.023)	(0.272)	(0.978)	(0.453)	(0.000)
Observation	1700	1700	1700	1700	1700	1700
R^2	0.97	0.87	0.68	0.71	0.66	0.99
Crisis period						
CAP_{it}	0.006	-0.002	0.020	-0.009 ***	-0.026	0.040 ***
	(0.341)	(0.761)	(0.766)	(0.001)	(0.552)	(0.000)
LAD	0.000	-0.000	-0.001	-0.000	-0.000	-0.000
	(0.183)	(0.251)	(0.830)	(0.593)	(0.897)	(0.135)
NLTA	0.023 ***	-0.009 ***	-0.124 ***	-0.002	-0.048 *	-0.000
	(0.000)	(0.004)	(0.004)	(0.195)	(0.083)	(0.620)
SIZE	0.010	-0.304 **	-0.704	-0.150 **	-0.266	0.105 ***
	(0.946)	(0.015)	(0.658)	(0.036)	(0.805)	(0.000)
Observation	1700	1700	1700	1700	1700	1700
R^2	0.95	0.92	0.93	0.87	0.91	0.99
Post - crisis period						
CAP_{it}	0.019 ***	0.087 ***	1.045 ***	-0.074 ***	-0.600 ***	0.069 ***
	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LAD	-0.001 **	0.000	0.037 ***	0.001 **	0.026 *	0.000
	(0.024)	(0.524)	(0.003)	(0.030)	(0.087)	(0.603)
NLTA	0.011 ***	-0.000	-0.042	0.005 **	-0.033	0.000
	(0.000)	(0.891)	(0.453)	(0.027)	(0.553)	(0.858)
SIZE	0.094	0.670 ***	4.000	-1.159 ***	-9.856 ***	-0.037
	(0.255)	(0.000)	(0.278)	(0.000)	(0.000)	(0.475)
Observation	2550	2550	2550	2550	2550	2550
R^2	0.96	0.74	0.82	0.74	0.83	0.98

Note: Dependent variables are profitability (NIM, ROA and ROE) and risk (SDROA, SDROE and Ln (Z-score). Estimation method is fixed-effects panel regression. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. P – Values are in parentheses.

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7. CONCLUSIONS

This study examines the effects of bank capital on the bank's profitability and riskiness around financial crisis period. The study analyzes a panel data comprising 850 banks in 15 European countries over seven years (2005-2011) including Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherland, Portugal, Spain, Sweden and UK. Fixed-effects panel regressions have been adopted for the model in which the relationship between bank capital and profitability (riskiness) is determined. The paper also examines further capital effect on earnings and riskiness as considering other factors about different bank categories and bank sizes. In addition, a robustness analysis is also conducted to verify the main results under impact of financial crisis. The potential contribution of this study is to provide some empirical evidences about the effects of capital as well as other bank-specific factors on profitability and riskiness of European banks around the financial crisis. Also, further classifications enable to answer whether different types (sizes) of banks will influence the relationship between bank capital and profitability (riskiness).

The empirical results support the hypothesis that capital improves the bank's profitability around the financial crisis. Also, this finding is consistent with the results of Goddard et al. (2010), Iannotta et al (2007), Demirguc-Kunt and Huizinga (2000) and Berger (1995) but violates the implications from Calomiris and Kahn (1991). It is explained that well-capitalized banks generate higher returns from securities portfolio investment and higher margins from lower funding cost. In addition, in the context of financial distress, there is statistical evidence that the banks focusing market-based activities will perform better when increasing their assets size. Furthermore, across three types of banks, bank capital has the strongest positive impact on profitability of cooperative banks, followed by commercial banks and other banks. Besides, the study also confirms the existence of diseconomies of scale, leading to negative association between bank size and net interest margin. Further, bank profitability is found to be positively related to economic growth but inversely to inflation rate. This finding is in line with the previous studies.

Additionally, the hypothesis that capital reduces bank's riskiness around financial crisis is also statistically proved in this study. The results imply that well-capitalized banks with suffer less earnings volatility, and thereby improving their financial stability. The influence of bank capital on riskiness is more significant and negative in large banks, followed by medium banks and small banks. This finding matches with the results of

Lee and Hsieh (2013), Baselga-Pascual et al. (2013) and Konishi & Yasuda (2004). Another interesting implication is that as holding higher liquid assets, banks will increase their earnings fragility and reduce their stability, which violates result of Altunbas et al. (2007). They documented a strong positive relationship between liquidity and risk. Besides, it is also noted that bank with higher loan ratio or credit risk will suffer less volatile return but more stability. The empirical results also confirm larger banks have lower earnings volatility and more stability.

Further, after considering the financial crisis, the empirical results slightly differ from the benchmarks. The magnitude and significance of capital are greater and stronger on profitability and riskiness for the period after crisis with more strengthened capital regulations, while there is no statistical evidence about the relationship between capital and profitability during crisis. Another noticeable finding is that, prior to and after the crisis, banks increasing their assets size will perform better but they will suffer lower profit in the period of crisis.

The limitations of this study are adopting only panel least squares method and using small samples. As this paper examines the effect of capital on bank's profit and risk, in order to allow for simultaneity among them, it is advisable to use two-step system general method of moments dynamic panel data techniques or Zeller's Seemingly Unrelated Regression approach (Lee and Hsieh 2013; Altunbas et al. (2007). In addition, due to small sample period based on data availability, the paper only focuses on absolute levels of profitability and risk rather than on their change as suggested by Berger and Bouwman (2013). Besides, for further investigation in the future, it is suggested considering the relation between capital level and stock price of the bank during financial crisis as well as stated by Akhigbe et al. (2012).

REFERENCES

Akhigbe, A., Madura, J. and Marciniak, M. (2012). Bank Capital and Exposure to the Financial Crisis. *Journal of Economics and Business* 64. 377-392.

Altman, E.I., Haldeman, R., and Narayanan, P. (1977). Zeta Analysis: A New Model to Identify Bankruptcy Risk of Corporations. *Journal of Banking and Finance*. 1. 29-54.

Altunbas, Y., Carbo, S., Gardener, Edward P.M. and Molyneux, P. (2007). Examining the relationships between Capital, Risk and Efficiency in European Banking. *European Financial Management*. 13:1, 49-70.

Avery, R. B., Berger, A. N. (1990). Risk-Based Capital and Deposit Insurance Reform. *Journal of Banking and Finance* 15: 847-874.

Baselga-Pascual, L., Trujillo-Ponce, A. and Cardone-Riportella, C. (2014). Factors Influencing Bank Risk in Europe: Evidence from Financial Crisis. [online]. [cited 2015-02-20]. *Available at SSRN*: http://ssrn.com/abstract=2304160.

Beltratti, A., and Stulz, Rene M. (2012). The Credit Crisis around The Globe: Why did Some Banks Perform Better. *Journal of Financial Economics*. 105: 1-17.

Berger, A. N. (1995). The Relationship Between Capital and Earnings in Banking. *Journal of Money, Credit, and Banking* 27:2, 432-456.

Berger, A. N., Herring, R. J. & Szego, P. G. (1995). The Role of Capital in Financial Institutions. *Journal of Banking and Finance* 19:3-4, 393-430.

Berger, Allen N. and Bouwman, Christa H.S. (2013). How Does Capital Affect Bank Performance During Financial Crises. *Journal of Financial Economics*. 109:1, 146-176.

Berger, A. N. and Udell, G.F. (1994). Do Risk-Based Capital Allocate Bank Credit and Cause A "Credit Crunch" in the US. *Journal of Money, Credit and Banking*. 26:1-56

Bessler, Wolfgang and Kurmann, Philipp (2014). Bank Risk Factors and Changing Risk Exposure: Capital Market Evidence Before and During the Financial Crisis. *Journal of Financial Stability*. 13. 151-166.

Rime, Bertrand (2001). Capital Requirements and Bank Behavior: Empirical Evidence for Switzerland. *Journal of Banking and Finance.* 25:4. 789-805.

Blum, Jurg (1999). Do Capital Adequacy Requirements Reduce Risks in Banking? *Journal of Banking and Finance*. 23.755-771.

Bordeleau, Etienne and Graham, Christopher (2010). *The Impact of Liquidity on Bank Profitability*. Bank of Canada Working Paper. Canada No 38. 23p.

Bourke, P. (1989). Concentration and Other Determinants of Bank Profitability in Europe, North America and Australia. *Journal of Banking & Finance*, 13, 65-79.

Boyd, J. H., & Runkle, D. E. (1993). Size and Performance of Banking Firms: Testing the Predictions of Theory. *Journal of Monetary Economics*, 31. 47-67.

Brealey, Richard A., Myers, Stewart C., Marcus, Alan J. (2004). *Fundamentals of Corporate Finance*. Ed. 4. Boston, McGraw-Hill/Irwin, 736p

Calomiris, Charles W., & Charles M. Kahn (1991).The Role of Demandable Debt in Structuring Optimal Banking Arrangements. *American Economic Review* 81. 497-513.

Casu, Barbara, Girardone, Claudia and Molyneux, Philip (2006). *Introduction To Banking,* Essex, Prentice Hall. 526p.

Choudhry, Moorad (2012). *The Principles of Banking*. John Wiley & Sons Singapore Pre. Ltd. 886p.

Demirgüç-Kunt, A., & Huizinga, H. (1999). Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence. *The World Bank Economic Review*, 13. 379-408.

Demirguc-Kunt, A., & Kane, E. (2002). Deposit Insurance Around the World: Where Does It Work? *Journal of Economic Perspectives*. 16:2. 175-195.

Demirguc-Kunt, A., Detragiache E. and Merrouche, O. (2010). *Bank Capital: Lessons from Financial Crisis*. IMF Working Paper. 35p.

DeYoung, R., Roland, K.P. (2001). Product Mix and Earnings Volatility at Commercial Banks: Evidence from a Degree of Leverage Model. *Journal of Financial Intermediation.* 10. 54-84.

Dietrich, Andreas and Wanzenreid, Gabrielle (2011). Determinants of Bank Profitability Before and During The Crisis. Evidence from Switzerland. *Journal of International Financial Markets, Institutions and Money*. 21:3. 307-327.

Editz, T., Michael, I. Perraudin, W. (1998). The Impact of Capital Requirements on U.K. Bank Behavior. *Reserve Bank of New York Policy Review* 4:3.15-22.

European Central Bank (2005). *EU Banking Structure October 2005.* [online] [cited 2014-05-21]. Available from Internet: <http://www.ecb.europa.eu/pub/pdf/other/eubankingstructure102005en.pdf>

European Central Bank (2006). *EU Banking Structure October 2006.* [online] [cited 2014-05-21]. Available from Internet: <http://www.ecb.europa.eu/pub/pdf/other/eubankingstructures2006en.pdf>

European Central Bank (2007). *EU Banking Structures October 2007.* [online] [cited 2014-05-21]. Available from Internet: <http://www.ecb.europa.eu/pub/pdf/other/eubankingstructures2007en.pdf>

European Central Bank (2008). *EU Banking Structures October 2008.* [online] [cited 2014-05-21]. Available from Internet: <http://www.ecb.europa.eu/pub/pdf/other/eubankingstructures2008en.pdf>

European Central Bank (2010). *EU Banking Structures September 2009.* [online] [cited 2014-05-21]. Available from Internet: <http://www.ecb.europa.eu/pub/pdf/other/eubankingstructures201009en.pdf>.

Furlong, F. T. & M. C. Keeley (1989). Capital Regulation and Bank Risk-Taking: A Note. *Journal of Banking and Finance* 13. 883-891.

Goddard, J., Molyneux, P., & Wilson, J. O. S. (2010). Do Bank Profits Converge? *European Financial Management*, 1-21.

Goddard, J., Molyneux, P., & Wilson, J. O. S. (2001). *European Banking: Efficiency, Technology and Growth.* Wiley Finance. 308p.

Greenawalt, M., and Sinkey, J Jr. (1988). Bank Loan Loss Provisions and the Income Smoothing Hypothesis: An Empirical Analysis, 1976-1984. *Journal of Financial Service Research, 1*. 301-318.

Gregoriou, Gre N. (2010). *The Banking Crisis Handbook*. CRC Press – Taylor & Francis Group. 567p.

Hellmann, T. F., Murdock, K. C. & Stiglitz, J. E. (2000). Liberalization, Moral Hazard, in Banking and Prudential Regulation: Are Capital Requirements Enough? *American Economic Review* 90:1. 147-165.

Hempel, G.H, Coleman, A.B & Simonson, D.G. (1990). *Bank Management Text and Cases.* 3. ed. John Willey and Sons, Inc. 295p

Heffernan, S. (2005). *Modern Banking.* Wiley. 763p

Holmstrom, Bengt, & Jean Tirole (1997). Financial Intermediation, Loanable Funds, and The Real Sector. *Quarterly Journal of Economics* 112. 663-691.

Horvath, R., Seidler, J. & Weill, L. (2012). *Bank Capital and Liquidity Creation: Granger - Causality Evidence.* European Central Bank Working Paper Series 1497.32p.

Howells, Peter and Bain, Keith (1998). *The Economics of Money, Banking and Finance – A European Text.* 4. Ed. Prentice Hall. 634p

Iannotta, G., Nocera, G. and Sironi, A. (2007). Ownership Structure, Risk and Performance in the European Banking Industry. *Journal of Banking and Finance 31*. 2127-2149.

Jackson, P. (1999). *Capital Requirements and Bank Behavior: The Impact of The Basel Accord, Basle Committee on Banking Supervision*. BIS Working Papers. 64p

Jacques, K. & Nigro, P. (1997). Risk-Based Capital, Portfolio Risk, and Bank Capital: a Simultaneous Equations Approach. *Journal of Economics and Business* 49:6. 533-547.

Jeitschko, Thomas D., and Jeung Shin Dong (2005). Incentives for Risk-Taking in Banking – A Unified Approach. *Journal of Banking and Finance*. 29. 759-777.

Jokipii, T. & Milne, A. (2011). Bank Capital Buffer and Risk Adjustment Decisions. *Journal of Financial Stability.* 7.165-178.

Kennedy, Peter (2003). *A Guide to Econometrics.*5 Ed. MIT Press. 500p.

Kim, D. and Santomero, A. M. (1988). Risk in Banking and Capital Regulation. *Journal of Finance* 43:5. 1219-1233.

Koehn, M. & Santomero, A. (1980). Regulation of Bank Capital and Portfolio Risk. *Journal of Finance* 35:5. 1235-1245.

Konishi, Masaru and Yasuda, Yukihiro (2004). Factors Affecting Bank Risk Taking: Evidence From Japan. *Journal of Banking and Finance*. 28. 215- 232

Maudos, Joaquin and de Guevara, Juan Fernandez (2004). Factors Explaining the Interest Margin in the Banking Sectors of the European Union. *Journal of Banking & Finance 28*. 2259-2281.

Maudos, Joaquin and de Guevara, Juan Fernandez (2010). Bank Size, Market Power and Financial Stability. [online], [cited 2015-03-13]. Available from Internet: http://wolpertinger.bangor.ac.uk/wolpertinger2010/.

Molyneux, P., & Thornton, J. (1992). Determinants of European Bank Profitability: A Note. *Journal of Banking & Finance*, 16:6.1173-1178.

Peek, Joe, & Eric S. Rosengren (1995). The Capital Crunch: Neither a Borrower Nor a Lender Be. *Journal of Money, Credit and Banking* 27. 625-638.

Repullo, R. (2004). Capital Requirement, Market Power and Risk-Taking in Banking. *Journal of Financial Intermediation*. 13, 156-182.

Rose, Peter S., and Hudgins, Sylvia C. (2008). *Bank Management and Financial Services.* McGraw – Hill Education. 6 Ed. 800p.

Saita, F. (2007).*Value at Risk and Bank Capital Management*. 1 ed. Academic Press Advanced Finance Series. 208p.

Sanders, Anthony (2008). The Subprime Crisis and Its Role in the Financial Crisis. *Journal of Housing Economics* 17. 254-261.

Sarby, Faten and Okongwu, Chudozie (2009). How Did We Get Here: The Story of The Credit Crisis? *Journal of Structured Finance*. 15:1. 53-70

Sinkey, Joseph F. (1983). *Commercial Bank Financial Management.* Macmillan Publishing Company. 696p.

Shim, J. (2010). Capital – based Regulation, Portfolio Risk, and Capital Determination: Empirical Evidence from the US Property-Liability Insures. *Journal of Banking and Finance*. 34:10. 2450-2461.

Shrieves, R. E. & Dahl, D (1992). The Relationship between Risk and Capital in Commercial Banks. *Journal of Banking and Finance* 16:2. 439-457.

Stever, Ryan (2007). *Bank Size, Credit and the Sources of Bank Market Risk*. BIS Working Paper. Basel, No 238. 35p

Strobel, F. and Lepetit, L (2013). Bank Insolvency Risk and Time-Varying Z-score Measures. *Journal of International Financial Markets, Institutions and Money*. 25. 73-87.

Thakor, Anjan V. (1996). Capital Requirements, Monetary Policy, and Aggregate Bank Lending: Theory and Empirical Evidence. *Journal of Finance* 51. 279-324.

Van Roy, Patrick (2005). The Impact of the 1988 Basel Accord on Bank's Capital Ratios and Credit Risk-taking: An International Study. *EFMA 2004 Basel Meetings, Forthcoming.*

Von Thadden, Ernst-Ludwig (2004). Bank Capital Adequacy Regulation under The New Basel Accord. *Journal of Financial Intermediation* 13. 90-95

Wheelock, David C., & Paul W. Wilson (2000). Why Do Banks Disappear? The Determinants of U.S. Bank Failures and Acquisitions. *Review of Economics and Statistics* 82. 127-138

Wagner, Wolf (2007). The Liquidity of Bank Assets and Bank Liquidity. *Journal of Banking and Finance*. 31:1. 121-139.

Wooldridge, Jefferey M. (2013). *Introductory Econometrics: A Modern Approach*. 5 Ed. Masion, Ohio, USA: Thomson South-Western. 863p.

APPENDIX

Table 13: Summary of Empirical Results

Author	Period	Countries	Methodologies	Results
Akhigbe et al. (2012)	2007 - 2009	US	Weighted Least Squares	Banks with a higher level of capital experienced greater shocks during the financial crisis
Altunbas et al. (2007)	1992 - 2000	Europe	Panel Data Model	Capital has negative impact on bank risk
Baselga - Pascual et al. (2013)	2005 - 2011	Europe	Dynamic Panel Model	Capitalization, profitability and efficiency and liquidity are negatively and significant related to banks risk
Beltratti and Stulz (2012)	2006 - 2008	Globe	Multiple regression	There is positive relation between Tier 1 capital and profit for large banks.
Berger (1995)	1983 - 1989	US	Granger - Causality	Capital has significantly positive impact on bank profitability
Berger and Bouwman (2013)	1984 - 2009	US	Logit regression & OLS	Capital increases profitability for all bank size but medium-size bank during crisis
Bertrand (2001)	1989 - 1995	Swizeland	3SLS	A positive association is found between changes in risk and capital
Bessler and Kurmann (2014)	1990 - 2011	Europe & US	Pooled OLS & Pooled Tobit Regression.	banks' risk factors are multi-dimensional but well-reflected in stock prices
Demirguc-Kunt & Huizinga (2000)	1990 - 1997	Globe	Panel Data Model	Profit is positively related to lagged equity varible.
Goddard et al. (2004)	1992 - 1998	Europe	Dynamic Panel Model	The relationship between capital and profitability is significantly positive.
Innotta et al. (2007)	1999 - 2004	Europe	Panel Data Model	Capital has significantly positive impact on bank profit and risk
Konishi and Yasuda (2004)	1990 - 1999	Japan	Panel Data Model	Negative association is found between capital requirement level and bank risk
Jacques and Nigro (1997)	1990 - 1991	US	3SLS	A positive relation is found between changes in profit and capital but inverse association between capital and risk
Jokipii and Milne (2009)	1986 - 2006	US	Panel Data Model	Banks with capital buffer approaching the minimum requirement, the relationship between adjustments in risk and capital are negative
Lee and Hsieh (2013)	1994 - 2008	Aisa	Generalised Method of Moments	Effect of increasing bank capital on profit (risk) is significantly positive (negative)
Shim (2010)	1993 - 2004	US	3SLS	Capital has a positive relationship between profit and risk.
Shrieves and Dahl (1992)	1983 - 1987	US	3SLS	A positive relation is found between changes in risk and capital