



# CEO Compensation and Risk-Taking in Banking Industry

Thi Phuong Mai Le

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Ecole Doctorale SJPEG

# CEO Compensation and Risk-Taking in Banking Industry

## THÈSE

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par

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(Lê Thị Phương Mai)

En vue de l'obtention du titre de Docteur en Sciences de Gestion

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*Dedicated to my parents,  
To Thai, Tom and Jenny*

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## Abstract

The 2008 financial crisis was largely caused by excessive risk-taking of banks from the U.S. and also from all over the world, which have been in big trouble since then. One of the major questions raised by scientists and regulators is the role of executive remuneration methods in encouraging bank risk-taking. We conduct this research to investigate whether the banks' executive compensation payment mechanisms induced risk-taking and contributed to the financial crisis. We analyze separately the impact of each component of CEO compensation, which include CEO salary, CEO bonus, CEO other annual compensation, percentage of CEO salary, percentage of CEO bonus, percentage of other annual compensation and equity-based compensation, on risk-taking in the banking sector. We also try to identify more specifically the possible responsibility of each remuneration method in triggering the financial crisis and the manifestations of bank risk in the first two years of crisis. Different measures of bank risk include total risk, systematic risk, idiosyncratic risk, loan loss provision to total loan ratio, non-performing loan to total loan ratio, distance-to-default measured by Z-score, sharp drop in bank stock price, the change in bank ratings and the change in CDS during the crisis period. Using a sample of 63 large banks in Europe, Canada and United States from 2004 to 2008 we find that both CEO salary and CEO bonus decrease with most types of bank risk, CEO other annual compensation increases with bank risk. These components of CEO compensation are illustrated to have no relationship to the change of bank risk during the crisis. Regarding the CEO equity-based compensation, we find that usage of restricted stock to compensate CEO during the pre-crisis period has no effect on any abnormal changes in bank risks during the crisis period, whereas usage of stock option to compensate CEO in the same period augments the manifestations of bank risk in the crisis.

**Keywords:** executive compensation, CEO compensation, bank risk-taking, financial crisis.

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# General Introduction

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The 2008 financial crisis has been largely caused by excessive risk-taking of banks from the U.S. and also from all over the world, which have been in big trouble since then. Some have failed; but most major banks have been bailed out by the regulatory authorities or have been saved by the implementation of a monetary policy highly accommodative intended primarily to restore their liquidity. The analysis carried out in academic or political environments tend to highlight the behavior of managers and banking executives who have induced risk-taking regardless of the banking stability. One of the major questions raised by scientists and regulators is the role of executive remuneration methods in encouraging bank risk-taking. Studies on this issue lead us to believe that remuneration can have a detrimental role in incentivizing excessive risk when linked to short-term performance of the bank, including the stock price of its shares. Consequently, regulators have proposed many changes to the regulation on compensation policies to better match the long-term performance of the bank.

The Financial Stability Board (FSB), an international regulatory body, has issued two international systems: 1 / Principles for sound compensation practices and 2 / The implementation standards. The objective is to influence the incentives of leaders in order to promote prudent risk management. Similarly, the European Union (EU) also stressed the need to align remuneration with long-term objectives in order to better control risk-taking by banks. As a result, several European countries published texts to reform executive pay. However, these reforms were not based on rigorous empirical studies. Since then, empirical studies on the relationship between executive compensation and risk-taking by banks have been carried out. The obtained results are not the ones that politicians or regulators were waiting because they found no evidence that the payment mechanisms inciting short-term performance had led to excessive risks in the banking sector. However, most of these studies are based on US banks' data only. Similar research targeting European or non-US banks is rare. The reason is that information about the remuneration of the bank executives of these

countries is either insufficient or inconsistent from one to another. Consequently, the empirical results obtained by the US academic research are less significant for European practices. Thus, the controversy over executive compensation still exists.

The purpose of this research is to investigate whether the banks' executive compensation payment mechanisms induced risk-taking and contributed to the financial crisis. One of the originalities of our research is that we analyze the different forms of executive compensation. First, we distinguish between the remuneration which is based on bank equity and others. Second, within each of these two categories, we consider different components of the remuneration and analyze their influence on risk-taking: salary, bonuses, and other annual compensation in the case of non-equity-based remuneration; and restricted stock, stock options in the case of equity-based remuneration.

We then examine whether executive pay was one of the reasons for the financial crisis. Our research is different from previous studies because it is based on a sample of large banks in Europe, America and Canada. The results of these empirical studies are illustrated in Part 2 of this thesis.

#### **a. Our research is based on the previous studies and complete them**

According to authorities, pre-crisis remuneration policies often focus on short-term achievements. The remuneration is excessive and insufficiently justified by the obtained performance. Many regulations were published (without theoretical arguments or empirical evidence) to limit short-term incentive compensation (bonuses) and encourage payment mechanisms that promote the long-term viability. Since then, scholars have focused on examining the influence of individual compensation on risk in the banking sector (Suntheim, 2010, DeYoung, Peng, et al., 2009, Hagendorff and Vallasas, 2011, Ayadi, 2011, Kaplanski and Levy, 2012, Cheng, Hong, et al., 2009, Bolton, Mehran, et al., 2011). The results of these empirical studies, however, are inconsistent, contradictory and do not allow to draw clear conclusions. For example, CEO bonus is claimed to induce executive to take greater bank risks in research of Salami (2009), Kaplanski and Levy (2012), and Fortin, Goldberg, et al. (2010). However, Ayadi (2011) used a sample of 53 European banks from 1999-2009 and showed the evidence that CEO annual bonus negatively related to bank risk. Vallasas and

Hagendorff (2011) supported this result by showing that at the least risky bank, CEO bonuses lower risk and stock options do not induce risk-taking.

The difference in empirical results can be explained in different ways:

Firstly, some studies use a database of non-US banks (Burhof and Hofmann, 2000; Suntheim, 2010; Vallascas and Hagendorff 2012; Ayadi, Arbak, et al, 2011; Benchmann and Raaballe, 2009; Salami, 2009), while the remainder is based on samples of US banks. The database on executive pay in US banks, drawn from the Database Execucomp, is quite complete. While studies on executive compensation for non-US banks must rely on manual collection of data from the annual reports which do not always disclose all the remuneration details. This problem can bias study results. We built a composite database consisting of US and European compensation data.

Second, in previous studies, the researchers used many different measures to capture banking risks (e.g. risks related to the market, the distance to the fault, z-score) and executive compensation (e.g. total compensation, annual bonuses, remuneration based on equity, incentive compensation, and "inside debt"). This variety of measures may explain for the difference of results. We reused and compared these diverse measures in our research in a systematic manner.

Finally, it seems logical that the results obtained may differ depending on the considered period. The difference due to the study periods is also a reasonable explanation. Houston (1995), for example, used a research sample of the year 80s. He found no link between remuneration policy and banking risks. Chen, Steiner et al. (2006) also examined the same relationship using the database of the years 90s. Their results showed a positive significant effect of the remuneration structure on risk-taking in the banking sector. In the more recent studies, the use of samples including/or without crisis period also has an impact on results. Fortin, Goldberg et al. (2010) used a sample of 83 US banks in 2005 and concluded that both CEO bonus and CEO stock options increase bank risks. On the contrary, Ayadi, Arbak, et al. (2011) reached the opposite conclusion using the data from the period 1999-2009. We thus must be careful in establishing remuneration control measures since the beginning of the financial crisis can distort the research result based on the database that covers both pre-crisis and crisis periods. Our research separately investigates the impact of

CEO compensation on bank risk-taking in the pre-crisis period. We then examine the possible responsibility of CEO compensation for the financial crisis.

## **b. Research methodology**

Referring to the mixed results on the influences of the global executive compensation on bank risk and responsibility of the remuneration for the recent financial crisis, we propose to analyze separately the impact of each component of CEO compensation on risk-taking in the banking sector, and we also try to identify more specifically the possible responsibility of each remuneration method in triggering the financial crisis and the manifestations of bank risk in the first two years of crisis. As a result, we conduct in this dissertation two independent empirical researches.

The first one investigates the effect of CEO annual compensation on bank risk during the period 2004-2008 by using panel data. Since our objective is to investigate which component in executive compensation package induces bank risk-taking, we treat risk as a dependent variable while executive compensation as an independent variable in the research model. We use six measures of bank risk alternatively: total risk, systematic risk, idiosyncratic risk, loan loss provision to total loan ratio, non-performing loan to total loan ratio, and distance-to-default measured by Z-score. Regarding the compensation we consider its level (including CEO salary, CEO bonus, CEO other annual compensation) and structure (including percentage of CEO salary, percentage of CEO bonus, and percentage of other annual compensation). Compensation variables are put separately into the research model. We also consider the effects of control variables which are bank size, bank capital, bank structure, and bank's charter value.

$$Risk_{i,j,t} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j,t-1} + \beta_2 Size_{i,j,t-1} + \beta_3 BC_{i,j,t-1} + \beta_4 BC_{i,j,t-1}^2 \\ + \beta_5 CV_{i,j,t-1} + \beta_6 LOAN_{i,j,t-1} + \sum \phi_i Y_{i,t} + \varepsilon_{i,j,t} \end{cases}$$

The second experimental research examines the responsibility of CEO compensation for the financial crisis by using cross sectional data. Throughout the crisis period, most banks were impacted in such a way that all types of risk rapidly increased. The changing level in bank risk is very different from one bank to another. For example, regards to the stock price in the banking market, most banks suffered a sharp drop in price in the period 2007-2009. Some banks had lost most of its stock value such as Dexia (-90%), Bank of Ireland (-96%) or



Fannie Mae (-99%), while other banks suffered a reduction which was less than 50% such as Royal Bank of Canada (-44%) or Bank of Nova Scotia (-46%). Consequently, bank risk volatility during the crisis is one of the factors that capture the best the deterioration of the situation in the banking sector. We therefore use  $\Delta Risk$  (i.e. change in bank risk) in the first two years of crisis (2006-2008) as a dependent variable in the second research model. Ten measures of  $\Delta Risk$  are used alternatively in this empirical analysis including sharp drop in bank stock price, change in total risk, change in idiosyncratic risk, change in loan loss provision ratio, change in non-performing loan ratio, change in CDS1Y index, change in CDS5Y index, change in short-term bank ratings, change in long-term bank ratings, and change in distance-to-default. CEO salary, CEO bonus, CEO other annual compensation, percentage of CEO salary, percentage of CEO bonus, percentage of other annual compensation, usage of stock option, and usage of bank stock to compensate CEO are separately put in the place of compensation variable. Compensation variables are collected for the year 2006. If CEO compensation is one of the main reasons of the recent financial crisis, it should play an important role in our model.

$$\Delta Risk_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases}$$

### c. Important results

Our findings indicate that:

CEO salary level and structure are found to decrease with most types of bank risk including total risk, idiosyncratic risk, systematic risk and ratio of loan loss provision to total loan. CEO salary has no relation to bank Z-score. However, CEO salary structure increases the ratio of non-performing loan to total loan of bank. We also found an evidence of the positive relation between CEO salary and the abnormal change in the ratio of non-performing loan to total loan during the crisis period. Except for this relation, no association between CEO salary and any other abnormal change in bank risk during the crisis is found.

CEO bonus level does not increase with bank risk but conversely, it statistically decreases with idiosyncratic risk, loan loss provision to total loan ratio and non-performing loan to total loan ratio. We also found no evidence of the positive association between percentage of CEO bonus and bank risk. On the contrary, percentage of CEO bonus is showed

to decrease with idiosyncratic risk, ratio of loan loss provision to total loan, and ratio of non-performing loan to total loan. The obtained results also confirmed that CEO bonus is not the cause of the abnormal changes in bank risk during the crisis period.

CEO's other annual compensation, in our research, is illustrated to increase with most of bank risk measures including total risk, idiosyncratic risk, systematic risk, ratio of loan loss provision to total loan, and ratio of non-performing loan to total loan. However, we cannot find any evidence of the relationship between this component and the abnormal changes in bank risk during the crisis.

Usage of stock option to compensate CEO in the pre-crisis period has a positive link with the increase in total risk, with the increase in idiosyncratic risk and especially with the drop in bank stock price during the crisis. In contrast, usage of restricted stock to compensate CEO during the pre-crisis period has no effect on any abnormal changes in bank risks during the crisis period.

#### **d. Contribution of our work**

This dissertation contributes to the current understanding of executive compensation in a number of ways. Firstly, our research sample is more diversified than previous studies. As to be mentioned in the theoretical part of this dissertation, most research on executive compensation was based on data collected from U.S. firms. The reason is that data on compensation of U.S. firms can be collected quite easily from the professional database such as Thomson One Banker, Execucomp, BoardEx... On the other hand, data on executive pay of European firms had been considered to be sensitive until 2008 when the banking crisis happened. In order to conduct this dissertation, we had to manually collect information on executive compensation directly from public documents of banks. Our sample covers large banks including European banks, Canadian banks and U.S. banks. As a result, the findings from this dissertation are more comprehensive.

Secondly, existing research on executive compensation mostly focuses on equity-based compensation, which is believed to incentivize managers to take risk. Since the start of the 2008 crisis, studies on the effect of executive bonus on bank risk have been published. However, the impact of executive salary and other annual compensation on taking-risk are hardly considered. We conduct in this dissertation a comprehensive research on the effect of

all important components in the CEO compensation package, including CEO salary, CEO bonus, CEO's other annual compensation, and equity-based compensation on bank risk. We also investigate their possible responsibility for the abnormal changes in bank risk during the recent financial crisis.

Thirdly, to conclude whether CEO compensation is one of causes of the recent financial crisis, we propose a new way to quantify the responsibility of each compensation component. We assume that if a compensation component is responsible for the crisis, that component must play an important role in explaining the sharp increase in bank risks during the crisis period. By means of this new quantification, we can illustrate clearly which component in the CEO compensation package is related to the crisis.

Finally, based on the results obtained from our research, we could show the effect of each component in CEO compensation package on bank risk and propose some solutions to help control bank risk-taking. This finding, therefore, can be valuable for authorities when they need to consider which compensation components should be regulated to control bank risk-taking.

#### **e. Structure of dissertation**

This dissertation is organized in two main parts: a theoretical part and a part of empirical research. In the first part, we will present the general theoretical framework of our study. We start in Section 1 with the basic concepts of banking activities and roles of the bank in the economy to understand the relationship between the banking system and the crisis as well as the research context. We then present in Section 2 the key concepts that are often used throughout this dissertation. Section 3 is reserved for a literature review of existing works on executive compensation in general and on the relationship between executive compensation and risks in the banking sector in specific. Section 4 concludes the theoretical part.

In the second part of the dissertation, we will conduct empirical studies to investigate the influence of each component in the CEO pay package on bank risk measures. For this purpose, we present in Section 5 the research methodology, including the research questions, followed by hypotheses and research models. Section 6 is reserved to present the empirical results.

At the end of this dissertation, we discuss all the key obtained results in Section 7. We then summarize in Section 8 our work, including the main empirical results, the theoretical contribution, the limits of the thesis, and finally suggestions for future research.

# PART 1. THEORY

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## 1 Introduction

Executive compensation in the banking sector has been a popular debating topic, especially after the financial crisis in 2008. Many have claimed that because of the excessive compensation, executives took on higher risk investments/ decisions, which led to the damaging crisis in 2008. Critics have focused particularly on executive compensation in banking sector not properly related to long-term performance hence it led to the poor incentives. In response to these critics, regulators have proposed many ways to change practices to better align executive pay with long-term performance. With support from the media, politicians argued that it was due to short-term incentives of bank managers which caused the recent financial crisis. As a result, soon after that, the Financial Stability Board (“FSB”), formerly known as the Financial Services Forum (“FSF”), adopted two international schemes: 1/ the Principles for Sound Compensation Practices and 2/ the Principles for Sound Compensation Practices: Implementation Standards. The objective of these principles is to direct management incentives to long-term orientation, which – according to regulators - should assure an optimal alignment of executives’ motivations with prudent risk taking. Following a similar path, The European Union (“EU”) also emphasized the need for long-term orientation of pay and its role for the control of risk taking by banks. As a result, many national reforms related to executive compensation have been issued.

Because regulations on reforming executive pay were issued without any empirical studies, scientists have not been convinced and therefore, more empirical studies have been conducted. However, the results does not come out as politicians or regulators had expected because they found no proof showing that short-term incentives led to excessive risks in the banking sector. Infact, most of these studies are based on data from American banks but similar researches on European banks or other countries’ are rare. The cause is data on executive compensation in these countries is either insufficient or disclosed heterogeneously. The empirical results of U.S. academic research therefore are less meaningful for European practices. The executive compensation controversy therefore still exists.

The aim of this research is to investigate whether executive compensation at banks before the crisis induces risk-taking and contributes to the financial crisis. We classify executive compensation into two main groups: non-equity-based compensation and equity-based compensation to consider their roles in creating poor incentives. In each group we consider the effects of every component (salary, bonus, other annual compensation for the in-equity-based group and option, stocks for equity-based group) on bank risk. We then examine whether executive compensation was one of the roots causes of the financial crisis. Different

from the previous studies, in this research we take into account a sample of large banks from Europe, America and Canada. The results of these empirical researches are illustrated in Part 2 of this thesis.

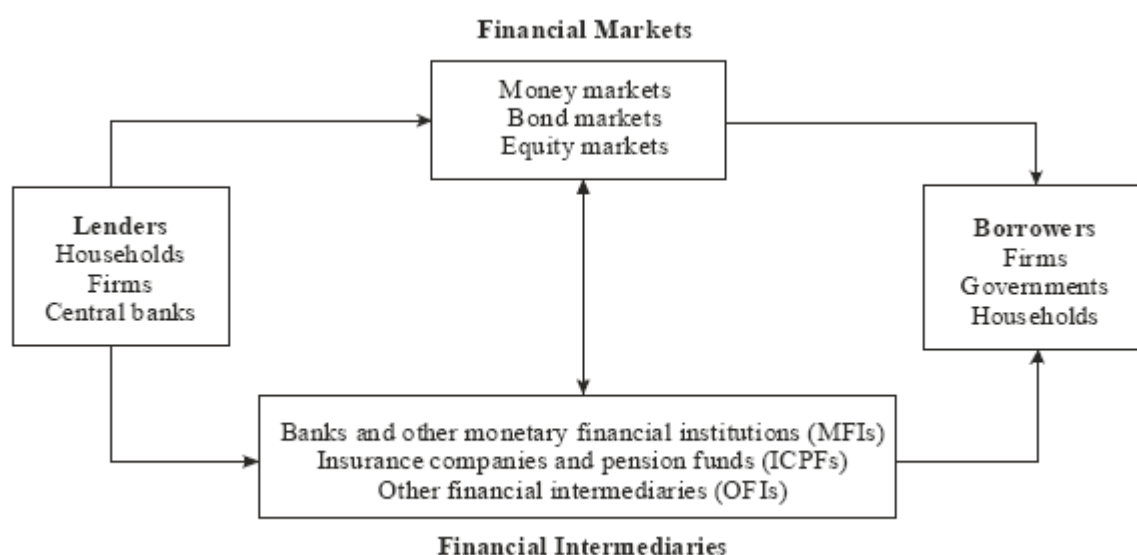
In order to conduct empirical works, we firstly need to focus on theoretical issues which are the main contents of this part. We start with basic concepts of banking activity and roles of bank in the economy to understand about the link between banking system and the crisis and about the reason that the banking sector is strictly regulated in most jurisdictions by governments. We then mentioned about the research context in the period 2008-2009 when many bank simultaneously felt into distress. The key concepts such as executive compensation or bank risk are referred in the next section and a literature review on executive compensation will close the theoretical part.

## 1.1 Role of banks in the economy

### 1.1.1 The financial intermediary

The process of taking in funds from people who have extra money to those who do not have enough money to carry out their desired activities is known as financial intermediation. Institution that performs the financial intermediation is called the financial intermediary. The financial intermediaries are banks, money market funds, mutual funds, insurance companies and pension funds.

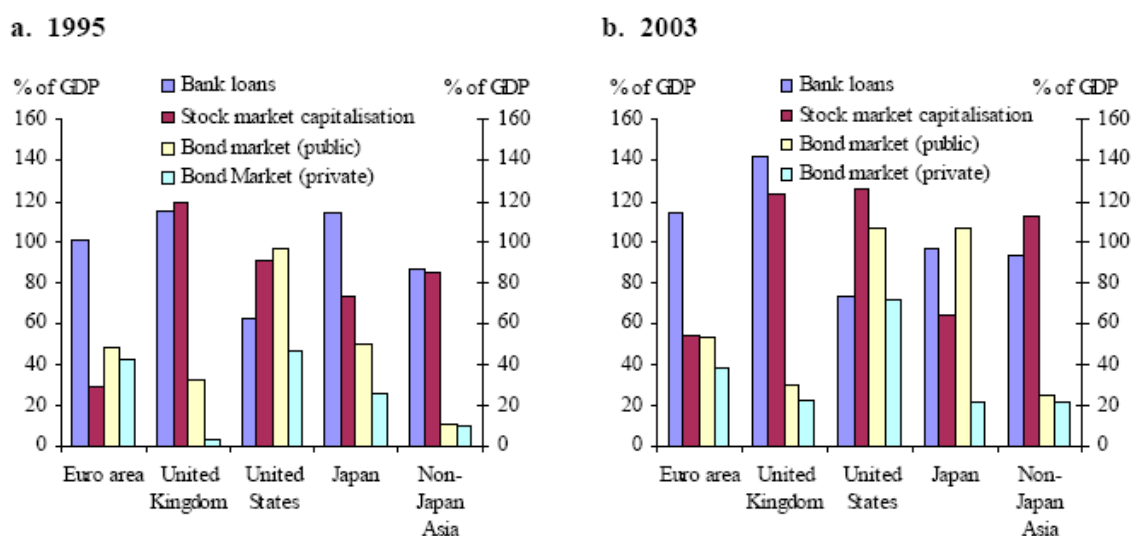
**Figure 1 Process of transferring capital from lenders to borrowers**



*Source: Allen, Chui, and Maddaloni (2004) p. 491*

Traditional banks accept deposits (mostly from households and firms) then make loans to borrowers who are mainly firms, governments and households to get profit from the interest rate difference between the depositors and the borrowers. Consequently, the bank is the most important financial intermediary in the economy as it connects the surplus and deficit economic agents most effectively on the widest range. Actually the lenders of funds in the economy can “directly” supply funds to the borrowers through financial markets such as money markets, bond markets or equity markets. However, this kind of investment requires the lenders to have a deep knowledge of finance as well as ability to analyze the borrowers’ situation and a willingness to take all risks. And there is only a few of such agents in the market. Supplying funds through banks is much easier and faster as the surplus economic agents do not need to know the borrowers. Another advantage is that due to the risk-sharing role of banks, the surplus economic agents do not have to bear all the risk. As a result, capital flows from the surplus economic agents to the deficit economic agents in the economy and this process is performed through banks play a very important role in the economy. Figure 2 illustrates the differences among the long-term financing structure of the Euro area, the U.K., the U.S., Japan and non-Japan Asia and the changes from 1995 to 2003..

**Figure 2 Size of the financial markets by country/region**



Bank loan is total value of domestic credit to the private sector. The figures in stock market column are based on the total market capitalization. Bond market is divided into two groups: public and private sector bonds. All the figures are given as percentage of GDP.

*Source:* Allen and Carletti (2008) p.29

Figure 2.a in 1995 shows that the European area had small stock markets and the economy was largely based on bank loans. In this sense, European area could be considered as bank-based countries. The U.K. is illustrated to depend on bank loans and stock markets at the same level. However, the value of bond market to the private in the country is very small.

As a result the U.K. is a both market-based and bank-based country. The U.S. financial structure is significantly different from all other areas with a small amount of bank loans but a significant stock market and the largest bond market. U.S. therefore is the most market-based economy. All figures in Japan are significant; however bank loans play the most important role to the economy. The financial structure in non-Japan area is nearly the same as the one in the U.K. with a large amount of bank loans and stock markets and insignificant participation of the bond markets.

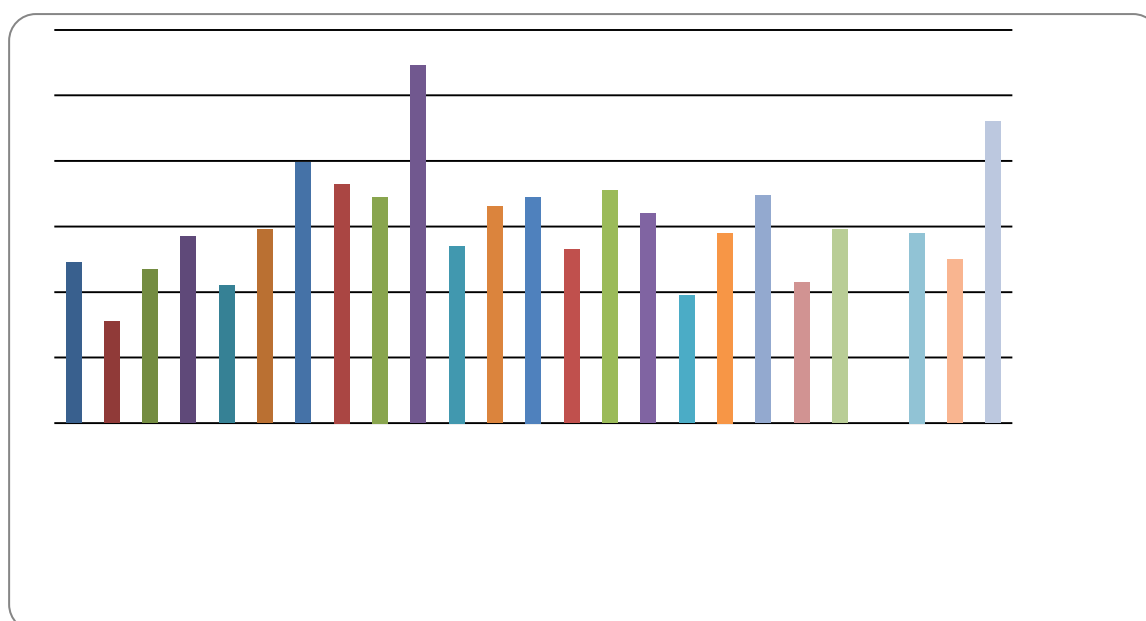
Figure 2.b illustrates the situation of the same areas in 2003. We found no big difference in financial structure in all areas except for the Japanese government debt, which has increased significantly. Figure 2, therefore is a confirmation of the importance of banks in the economy.

### 1.1.2 Banking and crises

The banking industry is a very special one that is permitted to do banking business which includes receiving money on current or deposit or saving account, paying and collecting checks drawn by or paid in by customers, making loan to customers. Derived from these features, two particular characteristics of the banking industry that make it totally different from the others are:

- Each bank is a money creator (Richard D. Irwin, 1963).
- The capital to assets ratio in banking sector (3-10%) is much smaller than that in other sectors.

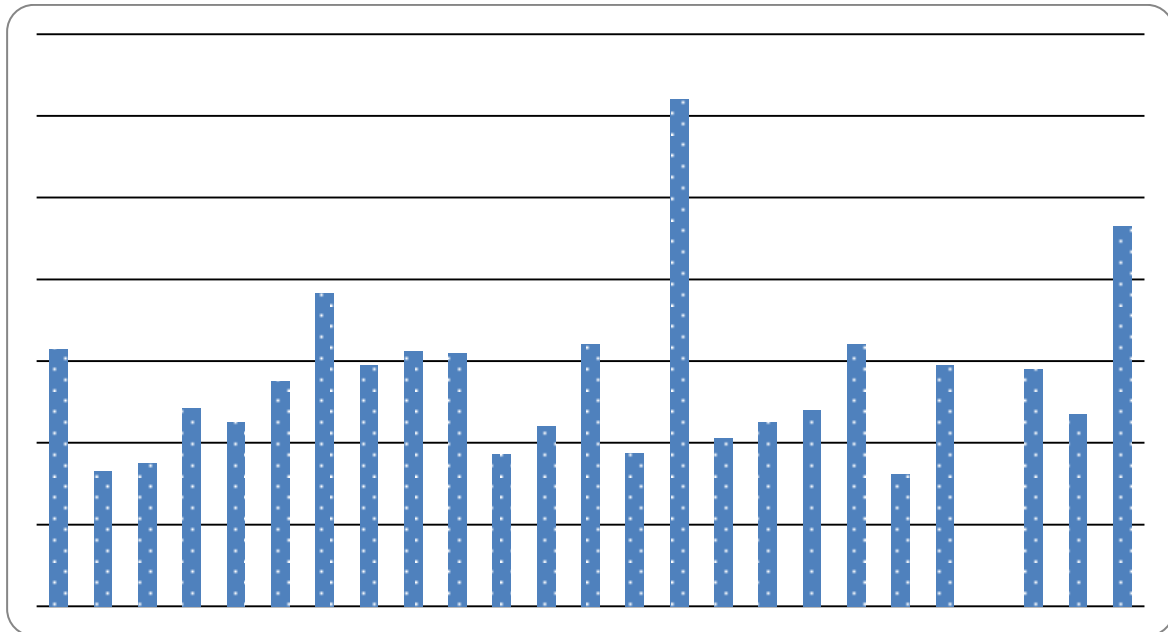
**Figure 3 The capital to assets ratio in banking sector by country in 2003**



Source: Worldbank



**Figure 4 The capital to assets ratio in banking sector by country in 2008**



*Source:* Worldbank

As banks collect demandable deposits and raise funds mostly in the short-term capital markets but invest these funds in long-term assets, all of them have to accept the maturity mismatch between two sides of their balance sheet. The positive aspect of the maturity mismatch is to allow commercial banks to offer risk-sharing to the depositors. Banks while doing business set aside reserves in good conditions of returns on assets and run them down in the bad situations. Through building up these reserves, risks can be averaged over time and have less effect on individual welfare (Allen, Carletti, 2008). The maturity mismatch, however, in the negative aspect can expose banks to the possibility that all depositors withdraw their money early or at the same period. Runs involve the withdrawal by depositors can occur spontaneously as a panic resulting from the crowd psychology (Kindleberger, 1978) or originate from fundamental causes that are part of the business cycle (Mitchell, 1941). In an economic downturn or in some certain events, if depositors receive information related to a bank's financial difficulties, they will certainly worry about their deposited funds in the bank and try to withdraw their money as soon as possible. Since the capital on assets ratio in banking sector is very small, banks cannot base on their own capital to face with the spontaneous withdrawal. Without any external help the bankruptcy is inevitable. As each bank plays a role of money creator and node in the banking network, small shocks that initially affect only one or a few banks spread rapidly by contagion through interlinkages between financial institutions to the rest members of the sector. Consequently, a bankruptcy happened in the banking sector seriously affects the banking system as well as the economy and that is when the crisis triggered.

Because of the very important role of banks in the economy, banking sector is regulated in most jurisdictions by governments and requires a special banking license to operate. Banks are also most regulated and controlled compared with other institutions doing business. In most cases, when banks get into financial distress situations, governments have to intervene not only to prevent the troubled banks from bankruptcy but more importantly to protect the banking system from the serious crisis.

## 1.2 The research context

Executive compensation is a problem that has been studied and criticized for 20 years; however this issue has never been as strong and focused particularly in the banking sector as the current moment. In order to understand deeply why and when the controversy on executive compensation appeared, we need to look at the main events happened in United States, which are considered the root cause of the debate on executive compensation, and at the disputation in United Kingdom as well as in Europe. We will then summarize events under two subcategories: The economic context and the legal context. The former lists all the events related to banker compensation, which raises political and public outrage and the later synthesizes regulations on both sides of the Atlantic that were issued to limit banker compensation with the objective of controlling bank risk.

### 1.2.1 The economic context

The 2008-2010 financial crisis marked the return of the debate on executive compensation. The most tumultuous events appeared in September 2008 on Wall Street was the bankruptcy of Lehman Brothers and the hasty marriage between Bank of America and Merrill Lynch.

Lehman Brothers was founded in 1850. After some major mergers and acquisitions in a long history, Lehman Brother had been the fourth-largest bank in the U.S. until 2008. As a result, Lehman's bankruptcy filing is considered to be the largest catastrophe in the financial history of the U.S<sup>1</sup>. This event is also thought to mark the beginning of the late-2000s global financial crisis. The largest failure in the banking sector though raises some inquires:

- Why could a giant bank like Lehman Brothers collapse so rapidly and easily?
- What are the effects of this bankruptcy on the global economy?

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<sup>1</sup> Mamudi, « Lehman folds with record \$613 billion debt » (Sep. 15, 2008), available at <http://www.marketwatch.com/story/lehman-folds-with-record-613-billion-debt?siteid=rss>

## **Causes of Lehman Brothers' collapse**

Reasons of Lehman Brothers' failure are supposed to be: leverage, losses and liquidity<sup>2</sup>. In the period 2004 – 2005, as it was considered to be a good time for the economy, Lehman decided to raise the leverage which is known as the best way to enhance bank's returns. Started at 20 in 2004, Lehman's leverage then rose past the twenties and thirties the following years and peaked at incredible 44 in 2007. Since a significant portion of this leveraging was put in housing-related assets in the years 2005-2008, Lehman Brothers then suffered heavy losses due to the downturn in the mortgage market in the period 2007-2009 (Lartey, 2012). In the years leading to its bankruptcy in 2008, a lot of investment decisions which were described as "unnecessary and risky" (Lartey, 2012) were made. These investments were: commercial real estate, residential whole loans, residential mortgage-backed securities, collateralized debt obligations, derivatives. In the period 2004-2006, these assets initially offered very attractive rates of return due to the higher interest rates on the mortgage-based assets. Because most of the investments were based on the lower credit quality, their market value decreased sharply when the U.S. subprime mortgage crisis happened (2007-2009). As a result, Lehman was unable to sell subordinate pieces of securitizations such as residential mortgage-backed securities or collateralized debt obligations. Some significant figures about Lehman's assets situation are as follows:

- As of May 31, 2008 Lehman reported that it owned \$8.3 billion residential whole loans (RWL) (Valukas, 2010)<sup>3</sup>.
- Lehman was the largest underwriter of property loans in 2007 with over \$60 billion invested in commercial real estate and another large proportion of subprime mortgage-loans to risky homebuyers (D'Arcy, 2009).
- Because of the deteriorating value of the mortgage market, many of Lehman's CDO positions were such pieces and the CDO issuances in 2008 dropped dramatically. Lehman reported a decline of \$17.0 billion in CDOs for the year 2008 (Valukas, 2010).

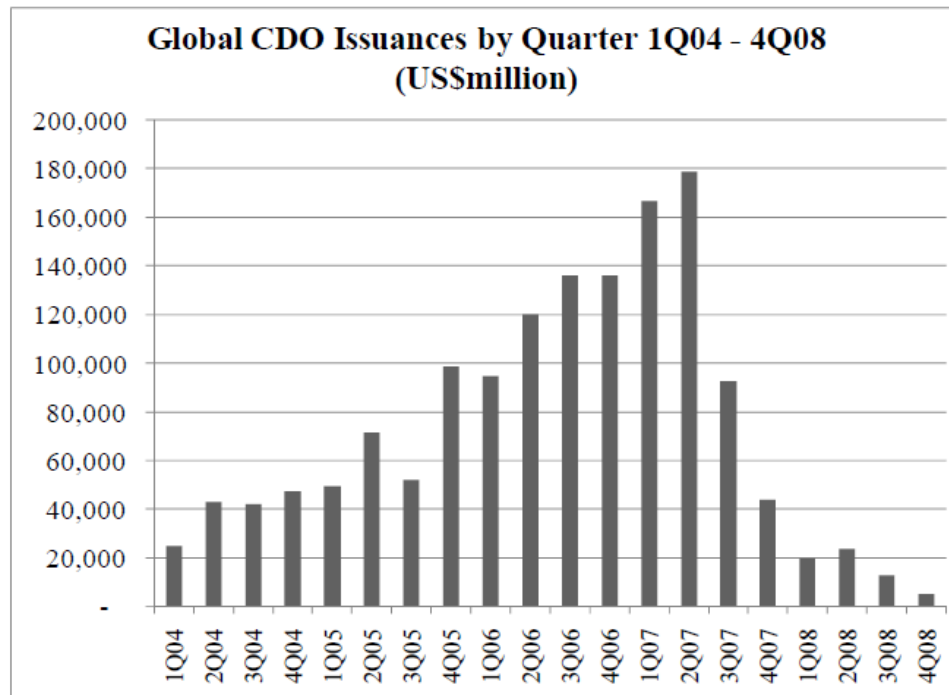
Getting incredible leverage but suffering heavy losses, Lehman faced with difficulties in converting assets into cash to satisfy the short-term obligations. With the believing that Lehman did not have enough liquidity at hand, many banks refused to trade with it by pulling Lehman's lines of credit (D'Arcy, 2009). Lehman failed to retain the confidence of lenders and counterparties (Valukas, 2010). Lehman's available liquidity therefore is considered the direct cause of its failure.

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<sup>2</sup> D'Arcy, "Why Lehman Brothers collapsed" (Sep. 14, 2009), available at <https://www.lovemoney.com/news/3909/why-lehman-brothers-collapsed>

<sup>3</sup> Valukas, A. R., "Lehman Brothers examiner's report" (Mar. 11, 2010), available at <https://jenner.com/lehman>

**Figure 5 CDO issued from 2004 to 2008**



*Source:* Valukas, 2010 cited in Lartey, 2012, P.7.

Financial statement fraud was also an important reason of Lehman’s collapse, as it hid Lehman’s weak financial situation. The investigation about Lehman’s bankruptcy found that real estate assets were not reasonably valued during the second and the third quarters of 2008 (Valukas, 2010). The “Repo 105 transactions” employed by the bank at the end of each quarter was described as an “accounting gimmick” to make its financial situation appear less shaky than they really were. These transactions, essentially, were a type of repurchase agreement that temporally removed securities from the firm’s balance sheet. Nevertheless, the Repo 105 deals were described by Lehman as an “outright sale of securities”. Accordingly this created “a materially misleading picture of the firm’s financial condition in late 2007 and 2008”<sup>4</sup>. Because Lehman Brother was in a financial distress with only toxic assets remaining, while public sources had better been used to capitalize banks and other major financial institutions to prevent the next collapses, it failed to be rescued by buyer or government bailout.

<sup>4</sup> Trumbull, “Lehman Bros. used accounting trick amid financial crisis – and earlier” (Mar.12, 2010) available at <http://www.csmonitor.com/USA/2010/0312/Lehman-Bros.-used-accounting-trick-amid-financial-crisis-and-earlier>

### **Effects of Lehman Brothers' bankruptcy to the economy**

As the fourth largest bank in the U.S. market, Lehman Brothers' bankruptcy had significant effects on the U.S. economy. Lehman invested mostly in mortgage-backed assets which were subprime lending. Through securitization, the risks of these assets were transferred from lender to the third-party investors on the market. The collapse of Lehman led to the liquidation of \$4.3 billion in Lehman's mortgage-backed securities. This sparked a selloff in the commercial mortgage-backed securities market (Lartey, 2012). Moreover, since more than \$46 billion of Lehman's market value were wiped out with its collapse, this event gave a record drop in the Primary Reserve Fund since 1994 (Lartey, 2012).

**Table 1 Example of subjects affected by Lehman's bankruptcy and the extent of damage**

| <b>Country</b> | <b>Subject affected by Lehman's collapse</b> | <b>Extent of damage</b>                                       | <b>Source</b>  |
|----------------|--|---|--|
| England        | 5,600 retail investors                       | \$160 million of Lehman's backed structured products          | Ross, 2009, cited in Lartey, 2012                            |
| England        | hedge funds in London                        | \$12 billion in assets frozen when Lehman declared bankruptcy | Spector, 2009, cited in Lartey, 2012                         |
| Hong Kong      | 43,000 individuals                           | \$1.8 billion mini-bonds issued by Lehman                     | Pittman, 2009, cited in Lartey, 2012                         |
| United States  | Renowned cities and counties                 | More than \$ 2 billion  | Carreyrou, 2010; cf. Crittenden, 2009, cited in Lartey, 2012 |
| Germany        | State-owned bank, Sachsen Bank               | Half a billion Euros  | Kirchfeld & Simmons, 2008, cited in Lartey, 2012             |

*Source:* Lartey, 2012

Not only the U.S. economy was affected, many other countries, firms, partners, investors were directly linked to Lehman and its collapse as well. Table 1 describes some certain numbers of damage.

Lehman's bankruptcy also served as a catalyst for the emergency purchase of Merrill Lynch by Bank of America conducted in September 2008.

The American government immediately enacted the "Emergency Economic Stabilization Act" ("ESSA") on October 3<sup>rd</sup> to remediate the situation. As a part of ESSA, the "Troubled Asset Relief Program" was established to purchase assets and equity from financial institutions to strengthen the financial sector.

Just three days after ESSA was signed, the compensation of Lehman's CEO was brought to the attention of public's eyes. From 2000 through 2007, he received \$484 million in salary, bonus and stock options<sup>5</sup>. Public outrage erupted as he walked away from Lehman with about \$500 million whereas taxpayers were left with a \$700 billion bill to rescue Wall Street and an economy in crisis<sup>6</sup>.

In early 2009 Merrill Lynch then fueled a growing controversy by revelation of bonuses paid to employees. Following this information, Merrill Lynch had paid more than \$1 million of bonuses to nearly 700 employees just ahead of its acquisition by Bank of America<sup>7</sup>. As Merrill was the leading underwriter of mortgage-based collateralized debt obligations by 2004, it suffered considerable losses when the mortgage market collapsed. From July 2007 to July 2008, Merrill lost about \$19.2 billion (\$52 million a day)<sup>8</sup>. Fearing of a failure of Merrill, the U.S. Treasury and Federal Reserve arranged a hastily wedding between Merrill and Bank of America with a shotgun of \$36 billion. In the reunion to take shareholder vote for the proposed merger agreement, Bank of America assured that Merrill could not pay any bonuses without acceptance in written from Bank of America. However at that moment, it had already given Merrill Lynch a written consent to pay the bonuses of \$4.2 billion. As a result, in December 2009, just before the completion of the merger, a pool of \$2.6 billion was distributed to 36,000 employees of Merrill<sup>9</sup>. The CEOs of Bank of America and the former Merrill Lynch were quickly asked to explain before the Congress.

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<sup>5</sup> Ross and Gomstyn, "Lehman Brothers boss defends \$484 million in salary, bonus" (Oct. 6, 2008), available at <http://abcnews.go.com/Blotter/story?id=5965360>

<sup>6</sup> Sterngold, "How much did Lehman CEO Dick Fuld really make?" (Apr. 29, 2010), available at [http://www.businessweek.com/magazine/content/10\\_19/b4177056214833.htm](http://www.businessweek.com/magazine/content/10_19/b4177056214833.htm)

<sup>7</sup> Merced and Story, « Nearly 700 at Merrill in million-dollar club » (Feb. 11, 2009), available at [http://www.nytimes.com/2009/02/12/business/12merrill.html?\\_r=0](http://www.nytimes.com/2009/02/12/business/12merrill.html?_r=0)

<sup>8</sup> Story, "Chief Struggles to revive Merrill Lynch" (Jul. 18, 2008), available at <http://www.nytimes.com/2008/07/18/business/18merrill.html?scp=23&sq=merrill%20lynch&st=cse>

<sup>9</sup> Conyon, Fernandes et al, "The executive compensation controversy: a transatlantic analysis" (Feb. 13, 2011), available at <http://digitalcommons.ilr.cornell.edu/ics/5/>

**Table 2 Earnings and bonus pool for original TARP recipients in 2008**

| Corporation             | 2008      | 2008   | Number of Employees         |           |           |
|-------------------------|-----------|--------|-----------------------------|-----------|-----------|
|                         | Earnings/ | Bonus  | Receiving Bonuses Exceeding |           |           |
|                         | (Losses)  | Pool   |                             |           |           |
|                         | (€bil)    | (€bil) | (€2.2mil)                   | (€1.4mil) | (€0.7mil) |
| Bank of America         | 2.9       | 2.4    | 28                          | 65        | 172       |
| Bank of New York Mellon | 1.0       | 0.7    | 12                          | 22        | 74        |
| Citigroup               | (20.0)    | 2.9    | 124                         | 176       | 738       |
| Goldman Sachs           | 1.7       | 3.8    | 212                         | 391       | 953       |
| J P Morgan Chase        | 4.0       | 6.2    | >200                        |           | 1,626     |
| Merrill Lynch           | (19.8)    | 2.6    | 149                         |           | 696       |
| Morgan Stanley          | 1.2       | 3.2    | 101                         | 189       | 428       |
| State Street Corp       | 1.3       | 0.3    | 3                           | 8         | 44        |
| Wells Fargo & Co.       | (30.8)    | 0.7    | 7                           | 22        | 62        |
| Total                   | (58.5)    | 22.8   |                             |           |           |

Source: Cuomo (2009)

Another flash point for outrage over bonuses involved American International Group (AIG). In order to offset the default-swap losses from the Financial Products unit (over €40 billion), AIG received over €125 billion in bailout funds from the government<sup>10</sup>. In March 2009, AIG revealed that it was about to pay €121 million to employees<sup>11</sup>. Following the explanation of AIG, it was the second installment of €320 million in obligated retention bonuses.

<sup>10</sup> Puzzanghera, "AIG makes \$6.9-billion repayment of TARP bailout funds" (Mar. 09, 2011), available at <http://articles.latimes.com/2011/mar/09/business/la-fi-aig-tarp-20110309>

<sup>11</sup> Goldman, « AIG: \$2.4 million in bonuses on hold" (Aug. 5, 2009), available at [http://money.cnn.com/2009/07/23/news/companies/aig\\_bonuses\\_treasury/](http://money.cnn.com/2009/07/23/news/companies/aig_bonuses_treasury/)

Information over bonuses of nine original TARP recipients is presented in Table 2. This report fueled politicians as well as public outrage. Table illustrated that the 2008 bonus pools exceed annual earnings in most of TARP recipients. The most special cases are Citigroup, Merrill Lynch and Wells Fargo & Co. No matter how the performance turned out, these banks still set aside a considerable amount of money to pay bonus to their employees.

The controversy over bankers' bonuses happened not only in the United States but was also widespread in Europe and United Kingdom. The failure of banks in Europe such as Royal Bank of Scotland or Northern Rock required them to receive bailout by taxpayers. Public concern about bank bonuses therefore has been raised. In March 2009, the French bank Natixis SA revealed plans of paying €70 million in bonuses to employees for the year 2008 whereas it had a loss of €2.8 billion the prior year<sup>12</sup>. Natixis was also one of recipients of government bailout funds at that moment with a shotgun of €2.0 billion. At the same time, nine executives at Dresdner Bank (Germany) were asked to return €58 million in bonuses as this bank had a loss of €6.3 billion the prior year.

It is not surprising that these information fueled outrage over banker bonuses all over the world. Politicians as well as regulators reacted immediately by organizing many leadership summits and issuing new regulations to limit bonuses in the banking sector and control risk-taking. Details of these reactions will be referred in the following section.

### **1.2.2 The legal context – Changes in regulation on remuneration policy since 2008**

In order to prevent new collapses in the banking sectors at that moment, governments in one hand considered using the public sources to capitalize banks; while on the other hand, they urgently looked for solutions to control bank risks. One of the first solutions given out is making changes in regulation on executive remuneration. In this section, we explore these changes in different countries since the end of 2008.

#### **1.2.2.1 United States**

Soon after Lehman Brothers filed for bankruptcy and the hasty marriage between Merrill Lynch and Bank of America which was arranged in September 2008, the “Emergency Economic Stabilization Act” (EESA”) was passed by Congress on October 3<sup>rd</sup>. ESSA at that moment was known as the most restrictions on executive pay. However, after information over bonuses of Lehman Brothers, Merrill Lynch and AIG was revealed, Congress demanded for new and more-stringent limits on executive compensation at the bailout firms. The “American Recovery and Reinvestment Act” (“ARRA”) signed on 17 February 2009 imposed

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<sup>12</sup> « Bank bonuses fuel French outrage” (Mar. 28, 2009), available at <http://news.smh.com.au/breaking-news-business/bank-bonuses-fuel-french-outrage-20090328-9egu.html>



even more draconian restrictions on executive than ESSA. Table 3 compares the pay restrictions under these two regulations:

**Table 3 Pay restrictions in EESA (October 2008) vs ARRA (February 2009)**

|  | <b>ESSA (2008)</b>  | <b>ARRA (2009)</b>   |
|--|---|--|
| Limits on pay levels and deductibility | <ul style="list-style-type: none"> <li>- Limits deductibility<sup>(*)</sup> of payment to top-5 executives are \$500,000, with no exceptions for performance-based pay.</li> </ul>                | <ul style="list-style-type: none"> <li>- Limit deductibility<sup>(*)</sup> of payment to top-5 executive is \$500,000, with no exceptions for performance-based pay.</li> <li>- Disallows all incentive payments, except for restricted stock capped at no more than one-half base salary. No caps on salary.</li> </ul> |
| Golden Parachutes                      | <ul style="list-style-type: none"> <li>- No new severance agreement for top-5 executives.</li> <li>- No payments for top-5 executives under existing plans exceeding 3 times base pay.</li> </ul> | <ul style="list-style-type: none"> <li>- No payments for top-10 executives.</li> </ul>   |
| Clawbacks                              | <ul style="list-style-type: none"> <li>- Applied to top-5 executives in both public and private firms.</li> </ul>   | <ul style="list-style-type: none"> <li>- Applied to 25 executives for all TARP participants.</li> </ul>  |

<sup>\*</sup>/ Limits the amount of deductible compensation that a firm can pay to the executive.

Source: Conyon, Fernandes et al. "The executive compensation controversy: a transatlantic analysis" (Feb. 13, 2011).

The United States was not the only country which imposes restrictions on banker's pay in the recipients of the government bailouts. Demand on new reforms over executive compensation became widespread in Europe as well.

#### *1.2.2.2 United Kingdom*

With regards to the crisis situation, the U.K. Treasury issued a report that highlighted bonus-driven remuneration structures as the main factor of encouraging excessive risk taking<sup>13</sup>. In February 2009, the "Financial Services Authority" ("FSA") published an industry-wide comprehensive Code on remuneration initially applied to banks asking for government aids but subsequently it was extended to all institutions in the banking sector<sup>14</sup>. For the special cases of Lloyds Bank and Royal Bank of Scotland, both banks received public aid under the condition that limit the remuneration paid to senior executives. No cash bonuses were paid for 2008. In the following years, incentive pay had to be linked to long-term value of institutions, taking risks into account. In November 2009, the United Kingdom issued new reforms requiring banks to disclose the number of employees being paid more than £1 million. On 9 December, plan imposing a one-time 50% corporate tax on all banking bonuses exceeding £25,000 was announced<sup>15</sup>.

#### *1.2.2.3 Germany*

The "Financial Market Stabilization Act" of October 2008 in Germany established the "Financial Markets Stabilization Fund" ("SoFFin") with the purpose of refinancing instruments issued by German banks until the end of 2009<sup>16</sup>. According to the agreement with SoFFin, banks receiving public aid were imposed restrictions on compensation plan and dividend policies while receiving the state's help aid. In addition to the annual salary cap fixed at €500,000, executives of these banks were prohibited from exercising stock options or receiving option grants, bonuses payment and compensation upon termination until the government was paid back. Commerzbank was the first institution demanding for the government assistance.

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<sup>13</sup> House of commons treasury committee, "Banking Crisis: reforming corporate governance and pay in the City: Government, UK Financial Investments Ltd and Financial Services Authority Responses to the Ninth Report from the Committee" (Jul. 21, 2009), available at <http://www.publications.parliament.uk/pa/cm200809/cmselect/cmtreasy/462/462.pdf>

<sup>14</sup> Press Release, Her Majesty's Treasury, "Statement on the Government's Asset Protection Scheme" (Jan. 19, 2009), available at [http://collections.europarchive.org/tna/20090321195843/http://www.hm-treasury.gov.uk/d/press\\_18\\_09.pdf](http://collections.europarchive.org/tna/20090321195843/http://www.hm-treasury.gov.uk/d/press_18_09.pdf)

<sup>15</sup> NBC news, "U.K. slaps 50 percent tax on bankers' bonuses" (Dec. 9, 2009), available at [http://www.nbcnews.com/id/34343180/ns/business-world\\_business/t/uk-slaps-percent-tax-bankers-bonuses/#.VL4ctEff870](http://www.nbcnews.com/id/34343180/ns/business-world_business/t/uk-slaps-percent-tax-bankers-bonuses/#.VL4ctEff870)

<sup>16</sup> Freshfields Bruckhaus Deringer, « Financial Market Stabilisation Act and Financial Market Stabilisation Fund Regulation come into force" (Oct. 2008), available at [http://www.freshfields.com/uploadedFiles/SiteWide/Knowledge/Financial\\_Market\\_Stabilisation%20Act\\_24372.pdf](http://www.freshfields.com/uploadedFiles/SiteWide/Knowledge/Financial_Market_Stabilisation%20Act_24372.pdf)

#### *1.2.2.4 France*

Banks applying for guarantee schemes in France were subject to these following conditions: 1/ they had to assured to keep financing the economy (such as making loans to small- and medium-sized firms); 2/ they had to agree with certain requirements over executive compensation (Petrovic and Tutsch, 2009). In October 2008, French business leaders adopted a regulation to prevent severance payments for failed executives. On 30 March 2009, the Government imposed a ban on all option grants in the recipients of government assistance until at least the end of 2010. Several months after, new rules for controlling banking bonuses were announced on August 26. According to these new rules, traders cannot receive more than one-third of their bonus in cash at the current year. The remaining two-thirds must be paid in part in restricted shares, staggered over the following two years, and be subject to forfeiture if they loses banks' money over that time. On December 11, following rules adopted in the U.K., France set a similar one-time 50% corporate tax on banking bonuses above €27,500<sup>17</sup>.

#### *1.2.2.5 The Netherlands*

The Dutch government required banks who wished to receive the guarantee program had to comply with certain conditions related to corporate governance and compensation plan. In detail, financial institutions benefiting from the assistance scheme of the Government could not pay bonuses until a new rule over compensation was established. As Fortis and ING were two of the largest Dutch banks applied for the guarantee scheme, top executives of these banks agreed to forego bonuses in 2008 and limit severance payments.

#### *1.2.2.6 Switzerland*

The UBS asked the Swiss government to come to its rescue by transferring its' nine percent stake in UBS to the federal government. Although the Government imposed no restriction over executive pay, the UBS voluntarily changed its remuneration policy (implemented in 2009) by employing a new compensation model which were subsequently adopted globally by regulators:

- Awards depend on achievement of performance targets that is linked to long-term and risk adjusted value creation;
- Three-year deferral period for bonuses is applied;
- Application of clawback;
- Equity plans are linked to the performance of the bank for three-year period;

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<sup>17</sup> Bloomberg news, "Bonuses take a beating around the globe: Sarkozy plans bonus tax for France" (Dec. 11, 2009) available at <http://www.nydailynews.com/news/money/bonuses-beating-globe-sarkozy-plans-bonus-tax-france-article-1.433594>

- Executives are required to retain at least seventy-five percent of their shares for five years;

#### *1.2.2.7 The international standards*

On 2 April, the “Group of 20” (G20) leading economies decided to establish the “Financial Stability Board” (“FSB”) to monitor and make recommendations about the global financial system. On 24 September 2009, at the Pittsburgh G2 summit, the regulations over compensation proposed by the FSB were passed. The FSB Principles and Standards would apply only to the finance sector. Under these proposals, 1/ at least 40% of executive’s bonuses or 60% for the bonuses of most senior executives would be deferred over a number of years; 2/ the deferral period should be more than three years and at least half paid should be in the form of restricted shares; 3/ Clawback provisions should be applied.

The FSB’s proposals were recommended as a framework, leaving each country to decide its own legislation to implement. Most EU countries followed these recommendations and committed their legislation would be effective in 2010. The situation of United State was not the same. Although President Obama had agreed to the FSB framework at the Summit Pittsburgh, the United States’ Federal Reserve – the most important banking regulator in the U.S.- rejected the FSB’s recommendations, arguing that “for most banking organizations, the use of a single formulaic approach to making employee incentive compensation arrangements appropriately risk sensitive is likely to provide at least some employees with incentives to take excessive risks”<sup>18</sup>.

Based on the assumption that “excessive and imprudent risk-taking in the banking sector has led to the failure of individual financial institutions and systemic problems in Member States and globally”<sup>19</sup>, the “Committee of European Banking Supervisors” (“CEBS”) then issued its final rules over compensation in banking sector on the 10 December 2010. Table 4 details contents of the CEBS’s rules.

<sup>18</sup> Braithwait, Guha and Farrell, “Fed rejects global plan for bonus payments”, <http://www.ft.com/cms/s/0/24fe00a2-bf6d-11de-a696-00144feab49a.html#axzz3PHIA1O4>.

<sup>19</sup> Analysis in Recital 1 (CRD III), <http://www.eba.europa.eu/documents/10180/37070/Association-of-Private-Client-Investment-Managers-and-Stockbrokers-%28APCIMS%29.pdf>.

**Table 4 Details of CEBS's rules**

|              |                       |   |
|--------------|-----------------------|---|
| Restrictions |                       | <ul style="list-style-type: none"> <li>- Minimum of 40% to 60% of variable pay must be deferred over three to five years, subject to forfeiture based on future banks' performance.</li> <li>- At least 50% of the variable pay (deferred or not) must be paid in the form of equity-based instruments subject to retention periods.</li> <li>- The upfront cash portion of bonuses is limited at 20% of the total variable pay.</li> </ul> |
| Scope        | In general            | <ul style="list-style-type: none"> <li>- Apply to senior executives, managers, most traders and credit officers, all employees whose activities have certain effects on the institution's risk profile;</li> </ul>  |
|              | Banks based in EU     | <ul style="list-style-type: none"> <li>- Apply to all staff (not just those working in Europe)</li> </ul>   |
|              | Bank based outside EU | <ul style="list-style-type: none"> <li>- Apply to all EU-based employees;</li> <li>- Apply to executives who have responsibilities in Europe (even if they are based outside of Europe).</li> </ul>   |

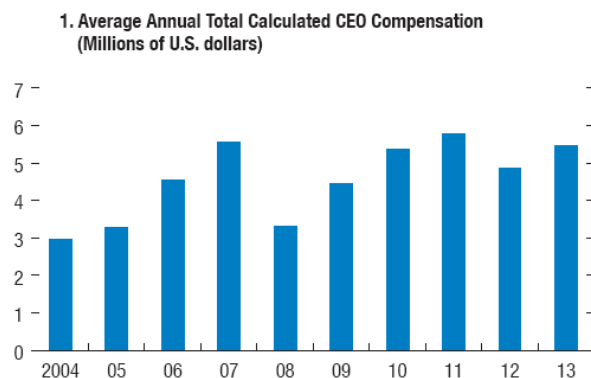
Source: Conyon, Fernandes et al. "The executive compensation controversy: a transatlantic analysis" (Feb. 13, 2011).

#### *1.2.2.8 Influences of the changes in regulations on remuneration policy in the banking sector*

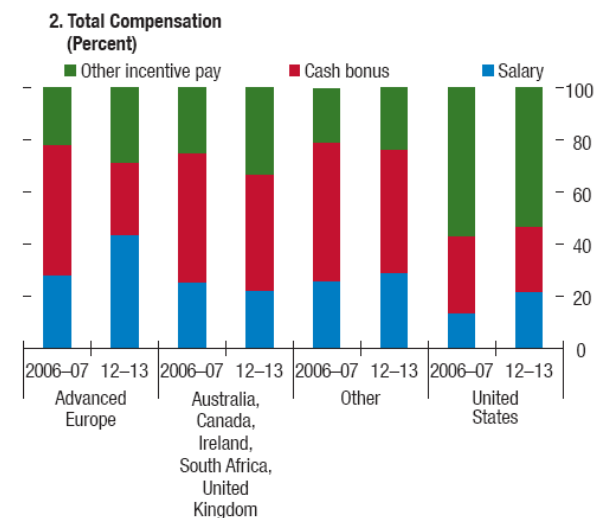
The appearance of new regulations on compensation policy has created certain changes in the actual executive pay.

**Figure 6 Trends in compensation practices in banking sector**

Total bankers' pay has recovered...



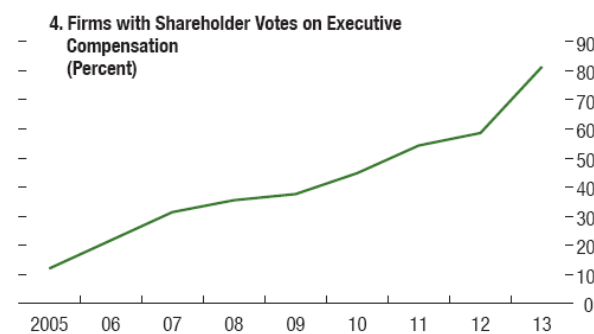
... and fixed pay has increased, mostly in Europe...



... but the vesting periods are becoming longer...



... and say-on-pay is becoming more widespread.



Note: CEO = chief executive officer; "Advanced Europe" comprises Austria, Belgium, Cyprus, Denmark, France, Germany, Greece, Iceland, Italy, Liechtenstein, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland; "Other" comprises China, Hong Kong SAR, India, Israel, Japan, Malaysia, Pakistan, Singapore, and South Africa. Only banks with assets of more than \$10 billion are included. Panel 2 shows the share of the sum (across all banks in each region) of total compensation that was paid in salary, cash bonuses, and other incentive pay.

Source: "Global financial stability report: Risk taking, liquidity, and shadow banking – curbing excess while promoting growth", IMF, Oct.2014, P.115

According to an annual report of IMF, conducted in 2014, the average annual total CEO compensation in banking sector significantly decreased in 2008. Bankers' pay then recover very soon. In 2009, total CEO compensation was at the same level of the one in 2006. Since 2010, the level of CEO pay has totally recovered. Compensation structure is one of the most important issues that were referred to in all recent suggested amendments of regulations on compensation. The report of IMF compares the compensation structures of the period 2012-2013 and those of the period 2006-2007. Except increase in fixed pay in advanced European banks, there have had insignificant changes in compensation structure in other regions. Two other issues that have been considered as instruments to control executive compensation are *vesting period* and *say-on-pay*. The figure 6 illustrates that the vesting periods are becoming longer and say-on-pay is becoming more widespread.

On the view that executive compensation is one of the important reasons leading managers to take excessive risk, which in turn is the root of the financial crisis happened in 2008, regulations on remuneration policy have been issued firstly with the purpose of tightening executive compensation in banks who received the government's aids, secondly with the aim of adjusting remuneration structure in the banking sector to control risk level. However the report of IMF which details the evolution of CEO compensation in the banking sector for the period 2004-2013 illustrates that influence of changes in regulations on remuneration policy in the banking sector seems to be insignificant. CEO compensation under both the level and the structure perspective has not changed so much after the appearance of these regulations. It seems that these changes in regulation are only to appease social psychology in the crisis period but not really have a positive impact on control of risk-taking.

## 2 Key Concepts

Since the association between executive compensation and risk-taking behavior of managers in the banking sector is still controversial, this dissertation is conducted in the hope of contributing to elucidate this relationship. To facilitate the monitoring of our research, we imply in this section the key concepts that are repeated often throughout this dissertation. The first concept is reserved to describing the way that CEO and executives of a bank may affect the risk level of their bank. The next concept is the capital asset pricing model (CAPM) which is a basic model about the relationship between risk and performance of an asset or portfolio of assets in the economy. We then continue by presenting executive compensation. Measures of bank risk and agency theory in corporation are the other two important concepts that will be mentioned after executive compensation.

### 2.1 By what way CEO and executives may affect the risk level of the bank?

There have been many empirical studies about relationship between CEO compensation and risk-taking of firm from which the relationship is accepted (if the results illustrated a statistically significant coefficient of CEO compensation) or rejected (in case no significant coefficient of CEO compensation could be found). However most of these studies do not specify by what way a CEO – a real person with a small group of executives (normally less than 10 real people) may affect the risk level of the bank which may operate in many countries and employ about over 100,000 people. In this section, we try to describe more detail about how can CEO and executives adjust or intervene in risk level of the bank.

Apparently, CEO and executives are not people who directly participate into the process of decision making or sign in contract for each individual project. That is the work of managers and staffs at branch-level. Actually executives' behavior of risk-taking should not be understood as action that directly related to an increase in bank risk such as a risky

investment or a risky loan. However it should be based on the orientation that the CEO and executives lead the development of the bank. As CEO and his executive team are responsible for leading the development and execution of a bank's long term strategy with a view to creating shareholder value, they have lots of power in hands to ensure their duties are completed. In general, basic roles and responsibilities of CEO and executive team in a bank are as follows:

- They, together with the Board of directors, are responsible to lead the development of the bank's strategy;
- They are responsible to lead and oversee the implementation of the bank's short as well as long term plans in accordance with the bank's strategy;
- They ensure the bank is appropriately organized and staffed. They have the authority to hire and terminate staff if necessary to enable the bank to achieve the approved strategy;
- They ensure that expenditures of the bank are within the authorized annual budget of the bank;
- They have authority to access the principal risks of the bank and to ensure that these risks are being monitored and managed;
- They ensure that internal controls are effective and management information systems are in place;
- They ensure that the bank conduct its activities both lawfully and ethically;
- CEO act as a liaison between executives and the Board;
- CEO is person who is responsible to communicate with shareholders, employees, Government authorities, other stakeholders and the public;
- They ensure that processes and necessary systems are in place so they will be adequately informed;
- They ensure that Directors are properly informed with sufficient information to enable the Board has appropriate judgments;

More than anyone else, CEO and executive team are the most aware of the whole bank' risk level at any given time. In case they realize that the risk level exceeds the one that is appropriate for the bank's strategy, they must do something to reduce bank risk such as tightening conditions towards high-risky loans or investments. Conversely, if they still want to induce risk-taking, they may loosen conditions to facilitate the high-risky clients to access the bank's capital. We can consider the increase of mortgage-based assets of Lehman Brother



in the period 2004-2006 as an example. These assets initially offered very attractive rates of return due to the higher interest rates on the mortgage-based assets such as commercial real estate, residential whole loans, residential mortgage-backed securities, collateralized debt obligations. However under risk management perspective, as these assets were lower credit quality one, the bank apparently had to accept higher level of risk. The mortgaged-based assets accounted for a certain proportion in the total assets of Lehman Brother as Lehman was the largest underwriter of property loans in 2007 with over \$60 billion invested in commercial real estate and another large proportion of subprime mortgage-loans to risky homebuyers (D'Arcy, 2009). With such great value, the development of the mortgage-based assets must be appropriated with the whole bank's strategy and not be an upsurge at small-scale level. CEO and executives in this case must support this orientation. As a result they are blamed to take excessive risk-taking.

## 2.2 The capital asset pricing model (CAPM)

We based on the capital asset pricing model (CAPM) throughout this dissertation when mentioning the relationship between return and risk of any asset. This model was introduced by Sharpe (1964), Lintner (1965), and Mossin (1966) independently, based on the earlier study of Markowitz on diversification and modern portfolio theory. Given by certain level of risk, each asset is expected to bring back to investor certain return. The CAPM is a simple equation that describes the calculation of expected return for all assets or portfolios of assets in the economy.

$$R_i = R_F + \beta_i(R_M - R_F) \quad (1)$$

Where

$R_i$  is the expected return on the asset

$R_F$  is the risk-free rate of interest (such as interest arising from government bonds)

$R_M$  is the expected return of the market

$B_i$  is the sensitivity of the expected asset returns to the expected market returns, or to be considered as asset's level of risk

$$\beta_i = \frac{Cov(R_i, R_M)}{Var(R_M)} \quad (2)$$

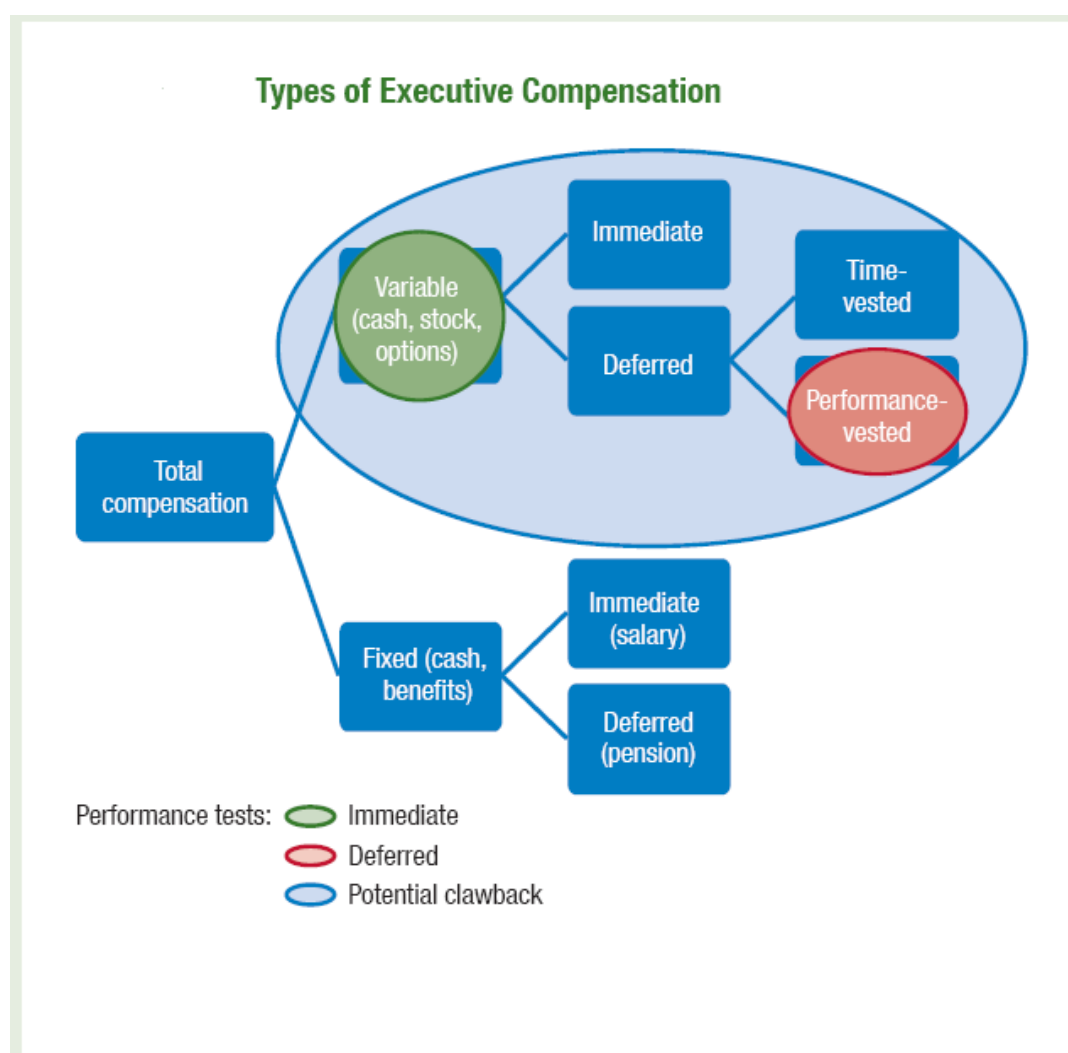
Thus, the relationship between the expected return and the risk of each asset or portfolios of assets is linear. Higher-risk assets are expected to give higher returns. However this does not mean that a riskier asset will give higher return over all intervals of time. The reason is that if one asset always gives a higher return than the others, it will be automatically

considered as less risky. Consequently, Beta ( $B_i$ ) will decrease leading to the decline in the expected return on the asset. Nevertheless, over long periods of time, riskier assets should on the average produce higher returns (Elton, Gruber et al.).

## 2.3 Executive Compensation

As we referred above, executive compensation is the total pay or financial compensation an executive officer within a company receives within a corporation, including salary, bonus, fee, severance, benefit in kinds and so on. This section would like to clarify the characteristic and the impact of each component to executives' behavior as well as the operation (performance/risk) of a bank. We divide all components of executive compensation into two groups as follow: Fixed components and Variable components.

**Figure 7 Types of executive compensation**



Source: "Global financial stability report: Risk taking, liquidity, and shadow banking – curbing excess while promoting growth", IMF, Oct.2014, P.108

### 2.3.1 Fixed components

When people work for a company, they expect to receive from the company something in return for their efforts. The first part (normally referred in the employment contract) is fixed pay. A fixed pay is the component that is independent of the performance levels of individual or groups of employee. The fixed pay may be paid in different forms and under different names: basic salary, dearness allowance, city compensatory allowance, and house rent allowance. How large the fixed pay should be? It should be sufficiently high to remunerate the professional services rendered, in line with the level of education, the degree of seniority, the level of expertise and skills required, the constraints and job experience, the relevant business sector and region. Due to its independence of the performance, employee receives the same amount of pay monthly, no matter how he has finished the work. Based on only the fixed payment, employees in general and executives in specific have no need to look for risky projects; they just focus on risk-free investment and are certain of a stable activity of the bank.

Besides the aforementioned monetary compensation, bank/company also provides their employees with other kinds of compensation, under the form of job facilities.

**Table 5 Other components of executive compensation**

| <b>Element of benefits</b> | <b>Delivery</b>                     | <b>Policy</b>   | <b>Purpose</b>   | <b>Timing</b>                 |
|----------------------------|-------------------------------------|---|--|-------------------------------|
| Pension                    | Deferred cash or cash allowance     | Employer contributions based on percentage of salary                                  | Provides market competitive post retirement benefits     | During the year               |
| Golden parachute           | Cash, severance, stock options .... | Executive will receive certain significant benefits if employment is terminated       | Provides market competitive benefits to attract a talent | When employment is terminated |
| Others                     | In kind or cash allowance           | Provision of medical and other insurance, accountancy advice and travel assistance... | Provide market competitive benefits                      | During the year               |

These tools can be provided in physical form such as company cars, company planes or in non-physical form: payment for expenses like travel, medical, and advice on accounting or borrowing...

### **2.3.2 Variable components**

If the main objective of a fixed remuneration is to guarantee employee to live comfortably, a variable pay, as a pay linked to the performance of individual or groups of employee, was originally designed as a huge incentive for an employee to exceed expectations, thus increasing profitability of the company. The variable pay is paid by companies under different names like incentive, commission, and bonus. The variable components can be linked to different performance indicators such as achievement of sales targets, production levels achieved, and achievement of required targets. Thus variable remuneration provides an incentive for employees to pursue the goals and interests of the firm as its success will be shared to all staff members. Indeed, in one hand, a variable component can have a positive effect on “risk sharing” and incentivize safe and sound performance. However, an inappropriately balanced variable component could also have negative effect under certain circumstances. Under those cases, employees may be incentivized to follow too risky investments to be able to reap more benefits. Recently, it is often appeared on the press, the term “excessive risk-taking” – used to describe the behavior of banking executives. It is said that “excessive risk-taking” has been one of the most important reasons of causing the recent financial crisis which started in 2008. In this section, in order to have more perception of this issue, we consider each component of the variable compensation, which includes: non-equity-based compensation (in cash) and equity-based compensation (stock options, restricted share, performance share).

#### **2.3.2.1 Non-equity-based compensation**

This is a part of variable remuneration which is paid to executives in cash or cash equivalent, known as bonus. No matter what happens with the company in the future, the value of bonus awarded will not be affected. Consequently, this kind of remuneration has been blamed for incentivizing executives to focus on creating benefits in short-term rather than long-term. Since the debate on compensation started, payment in cash has been considered and limited as much as possible in order to further align the personal objectives of managers with the long-term interest of the company.

Apparently each bank has its own compensation policy; however some certain points in the policy are almost identical in most of banks. One of these points is related to the way to determine executive directors’ bonus. In almost all policies, executive directors’ bonus awards are made based on both Group and individual performance. We take an example of Standard Chartered’s compensation policy in 2006 to illustrate in more detail the process of determining annual performance bonus.

Standard Chartered confirmed that its success depends mostly upon the performance and commitment of talented employees. Through the remuneration policy, Standard Chartered on one hand wants to support a strong performance-oriented culture (i.e. individual rewards and incentives relate directly to the performance of individual), on the other hand to retain talented executives of the highest quality internationally by competitive rewards. Following this policy, executive directors are eligible to receive a discretionary annual bonus. The target of the annual bonus is to incentivize the managers to focus on the achievement of annual objectives.

### ***Plan Mechanics***

The target and maximum award levels for executive directors are stated at 125 percent and 200 percent of base salary respectively. Two thirds of the annual bonus payment is payable immediately in cash to the managers. The rest is deferred into shares in the bank. Executive will be released these shares after one year unless he/she leaves the bank voluntarily during that period.

### ***Bonus pools***

The Compensation Committee looks at the Group's performances to determine the bonus pool size. To assess the Group's performances, the Committee employs both "quantitative and qualitative measures including earnings per share; revenue growth; cost and costs control; bad debts; operating profits; risk management; cost to income ratio; total shareholder return; corporate social responsibility and customer service"<sup>20</sup>.

### ***Determining individual awards***

After defining the bonus pool size, the Committee considers personal performance through the results achieved by the individual at the year-end (which is then compared with the objective planned at the start of the financial year) as well as their support of the Group's value and contribution to the success of the Group's leadership. Depending on individual performance, the variation of actual bonus awards made to executive directors in year 2005 and 2006 is as follows:

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<sup>20</sup> Standard Chartered, "Annual report 2006 – Directors' remuneration report".

**Table 6 Illustrates the variation of actual bonus awards level made to executive directors in year 2005, 2006**

|      | Min award<br>actually made<br>(as % of base<br>salary) | Max award<br>actually made<br>(as % of base<br>salary) | Target award<br>(as %<br>of base salary) | Max award<br>permitted (as %<br>of base salary) |
|------|--|--|--|---|
| 2006 | 161  | 191  | 125                                      | 200   |
| 2005 | 154  | 200  | 125                                      | 200   |

*Source:* Standard Chartered Bank “Annual report 2006”, P. 63

#### **2.3.2.2 Equity-based compensation**

Different from the annual bonus which is structured to align the short-term performance of the Group with the creation of shareholder value, the equity-based compensation (i.e. long-term incentives) is designed to make executives focus on the long-term performance targets of the Group. Under the equity-based compensation policy, each bank may choose a different name for the long-term compensation scheme such as “Performance share plan”, “Executive share option scheme” or “Restricted share scheme”. However, by their nature, these long-term incentives can be categorized as stock-based scheme or stock-option-based scheme. Executive stock options are used to acquire the Group’s ordinary shares. The exercise price is the share price around the date of grant. This type of awards can only be exercised if these two following conditions are satisfied: 1/ The time when the stock options are exercised is between the third and the tenth anniversary of the date of the grant; 2/ The performance condition pre-defined by the Compensation Committee is satisfied. With the stock-based scheme (e.g. the Restricted share scheme), executives will not receive the awards immediately at the date of grant but normally after two or three years. Table 8 and Table 9 are an example of the performance condition which must be satisfied to exercise the option awards, following the Standard and Chartered’s compensation policy. To determine the awards under the “Performance share plan” – a stock-option-based scheme, the Compensation Committee of Standard Chartered assessed the Group’s performance through the total shareholder return (TSR) and the earnings per share (EPS). Half of the awards were subject to the Group’s TSR position within the comparator group (Table 7) at the end of a three-year period (Table 8). The rest of the awards depended on an EPS growth target applied over the same three-year period (Table 9).

**Table 7 The constituents of the TSR Comparator Group**

|                   |                                      |
|-------------------|--------------------------------------|
| ABN AMRO          | HSBC                                 |
| Bank of America   | JP Morgan Chase                      |
| Bank of East Asia | Lloyds TSB                           |
| Barclays          | Overseas Chinese Banking Corporation |
| Citigroup         | Royal Bank of Scotland               |
| DBS Group         | United Overseas Bank                 |
| Deutsche Bank     | Standard Chartered                   |
| HBOS              |                                      |

*Source:* Standard Chartered Bank, Annual report 2006, P.63

**Table 8 The percentage of award which will be exercisable at the end of the relevant three-year performance period based on the TSR element**

| Position within Comparator Group | Percentage of award exercisable |
|----------------------------------|---------------------------------|
| 9th – 15th                       | Nil                             |
| 8th                              | 15                              |
| 7th                              | 22                              |
| 6th                              | 29                              |
| 5th                              | 36                              |
| 4th                              | 43                              |
| 1st – 3rd                        | 50                              |

*Source:* Standard Chartered Bank, Annual report 2006, P.64

**Table 9 The percentage of award which will be exercisable at the end of the relevant three-year performance period based on the EPS element**

| Increase in EPS | Percentage of award exercisable |
|-----------------|---------------------------------|
| Less than 15%   | Nil                             |
| 15%             | 15                              |
| 30% or greater  | 50                              |

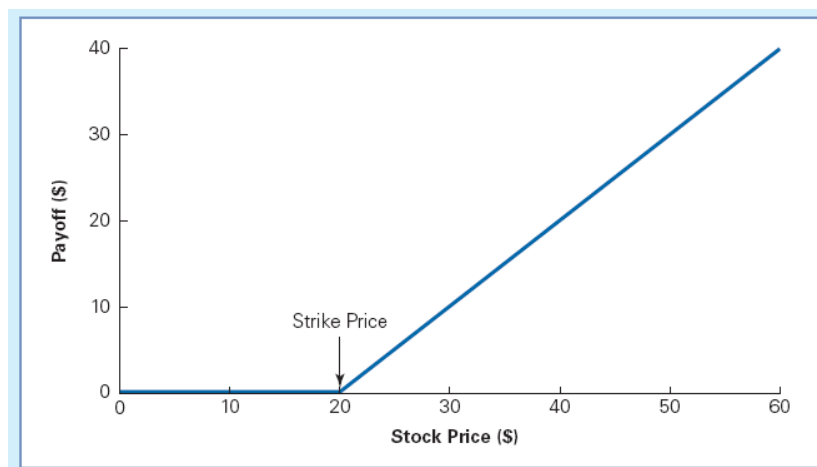
Source: Standard Chartered Bank, Annual report 2006, P.64

We now look at the characteristics of each program.

- **Stock-option-based program**

In theory, there are two types of options: call option and put option. If we adopt the definition of options provided by Hull (2006), then “a call option gives the holder the right to buy the underlying asset for a certain price by a certain date”; “a put option gives the holder the right to sell the underlying asset by a certain date for a certain price”. The date which is specified in the contract is known as the *expiration date* or the *maturity date*. The price which is specified in the contract is known as the *exercise price* or the *strike price*. For a call option, difference between the underlying stock’s price and the exercise price is named *intrinsic value*. For a put option, conversely, the *intrinsic value* is the difference between the underlying stock’s price and the exercise price. An option is called *at the money* option if its exercise price is identical to the price of the stock. In case the option has some intrinsic value, it is *in the money* option. The last situation is *out of the money* which means the option has no intrinsic value. As an option is a right to buy or sell the underlying stocks in the future, the option is then said to have *time value*. The total value of an option is the sum of its intrinsic value and its time value.

**Figure 8 Payoff of a call option with a strike price = \$20 at expiration day**





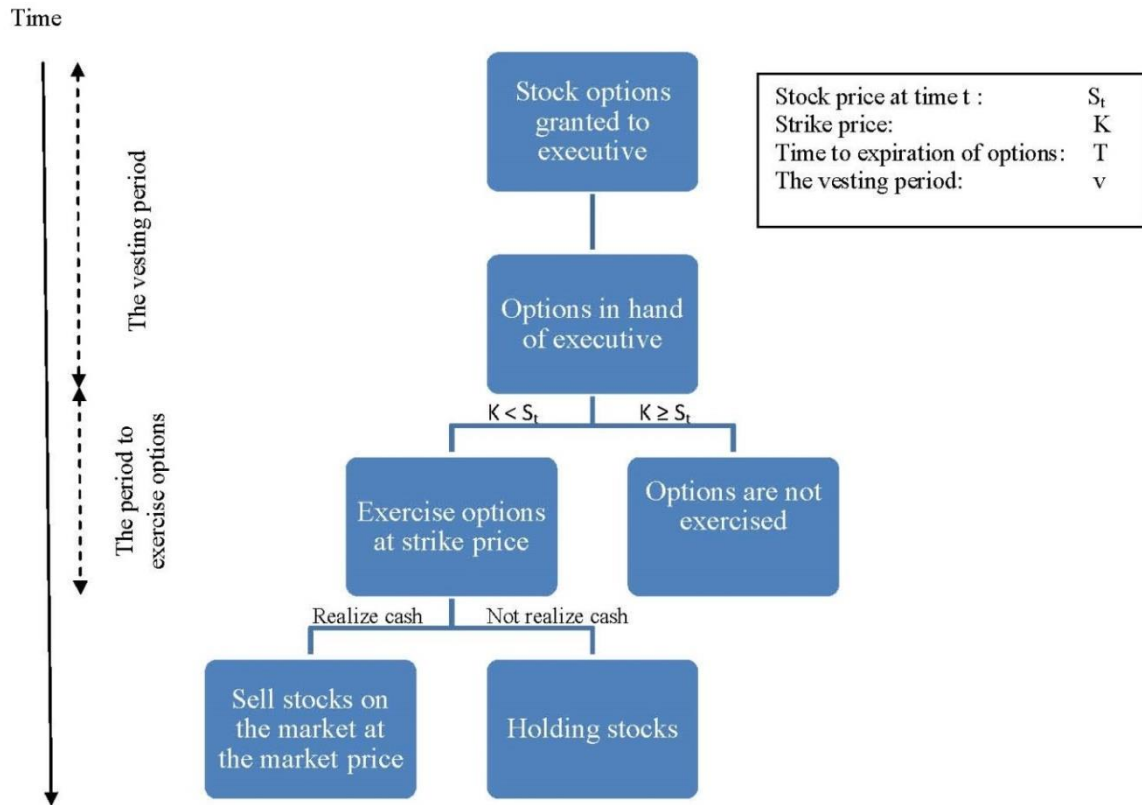
The call will be exercised if the stock price exceeds the strike price (\$20) and the holder's payoff is the difference between the stock price and the strike price. Conversely, if the stock price is smaller than the strike price, the call will not be exercised.

Since this study concentrates on options that are used to compensate executives, we consider only “the executive stock options”. Executive stock options (from now on we call “stock options”) are call options which give the holder (the executives) the right to buy the stocks of his company by the expiration date for the exercise price. The cycle of a stock option is illustrated in the following figure 9. When the expiration date comes, if the executive decides to exercise the stock options, the company is obligated to sell stocks to him at the exercise price. In order to fulfill this obligation, the company can use stocks that are available in its hands or buy stocks from the market to re-sell to the holder. This process therefore does not relate to the dilution of the existing shareholders' rights. Another kind of stock options that has been used widely to compensate employees is “Share subscription rights”. When these rights are exercised, the company satisfies the holder by issuing more of its own stocks and selling them to the option holder for the exercise price. As this exercise leads to an increase in the number of shares of the company's stock that are outstanding, the existing shareholders' rights is diluted.

Following the introduction on executive stock options of Hull (2006), stock options became an increasingly popular type of compensation in the 1990s and early 2000s. In a typical way, the options are normally at the money on the grant date. They often last for 10 years or even longer and the vesting period of these options is about 3 to 5 years. During the vesting period, the options cannot be exercised, however after the vesting period ends, the holder can exercise at any time he wants. During the vesting period, if the executive leaves the company he will lose rights of exercising options. However if he leaves the company after the end of the vesting period, his rights depend on the situations of options. If the options are in the money, they have to be exercised immediately, while if they are out of the money the options are all forfeited. As executive is not permitted to sell options to another party, if he wants to realize cash from the options, the only way is to exercise the options to get the stocks and then sell them on the market.

In order to understand the reason why stock options are so attractive both to employers and employees, we consider what factors affect the value of options and how to define options' value.

**Figure 9 Cycle of stock option compensation**



We start with a study of upper and lower bounds for call option prices at time zero. For this part, we use the following notation:

$S_0$ : Current stock price

$K$ : Strike price of option

$S_T$ : Stock price at maturity

$r$  : Continuously compounded risk-free rate of interest for an investment maturing in time  $T$   
 $C$  : Value of European call option to buy one share

About the upper bounds, no matter what happens, the option can never be worth more than the stock. Hence the upper bound is  $S_0$ :

$$C \leq S_0$$

The lower bound for call options will be:

$$C \geq \max(S_0 - Ke^{-rT}, 0) \quad (\text{Hull 2006})$$

With these bounds, six following factors which affect the value of stock option can be observed are:

- 1/ The volatility of underlying security ( $\sigma$ ).
- 2/ The price of underlying security ( $S$ ).
- 3/ The exercise (strike) price ( $K$ ).
- 4/ The time remaining until the option expire ( $T$ ).
- 5/ The risk-free interest rate ( $r$ ).
- 6/ The dividends expected during the life of the option.

Effects of each factor are considered in the assumption that all the others remain fixed.

We will start with the volatility of a stock price ( $\sigma$ ). “This is a measure of how uncertain we are about future stock price movements. As volatility increases the chance the stock will do very well or very poorly increases” (Hull, 2006). For the owner of a call option, he/she benefits from price increasing but has limited downside risk in the event of price decreasing. The most the owner of a call option can lose is the price of the option (in case of executive stock options, the managers lose nothing). As a result, stock option is one of the few financial instruments whose value is positively correlated to its underlying asset volatility, or in other words, a stock option will be more valuable if the underlying security’s risk is high.

Since this is a call option, it will be exercised sometime in the future at the amount by which the stock price exceeds the strike price. Call option will therefore be more valuable if the stock price increases ( $S$ ). With the assumption that all the others remain fixed, a call option with lower strike price ( $K$ ) will be more valuable.

Considering the effect of the expiration date ( $T$ ), a call option becomes more valuable as the time to expiration increases because the owner of the long-life option has all the exercise opportunities open to the owner of the short-life option.

The risk-free interest rate ( $r$ ) affects the price of an option in two ways. Firstly, as the interest rate in the economy increases (decreases), the expected return required by investors from the stock tends to increase (decrease) as well. For this reason, the stock price being the present value of all the future cash flow received will decrease (increase) (through the effect of discounted rate). Moreover, the present value of any future return of the owner of the options decreases (increases). By these two effects, the value of a call options will decrease (increase).

While  $r$  is determined by the global market,  $K$  and  $T$  are probably unchangeable factors, the options value (here is a call option) will go up if  $S$  and  $\sigma$  increase or/and  $d$  decrease. As managers, they have some control over the two main determinants of option value  $\sigma$  and  $d$  by reducing dividend as much as possible and raising volatility of equity remarkably. Basically, there are two ways that managers can affect the volatility of the firms: a/ increase the firm leverage (the ratio of equity on total assets), which means raising the risk on the right-hand side of the balance sheet; b/ take on riskier projects, i.e increasing risk on the left-hand side of the firm’s balance. No matter how higher riskier is implemented on the left or right-hand side of the balance sheet, the objective of managers is still to get higher stock’s future price through the effect of higher earnings per share – the most important

determinant of pricing stock value, which is gained from the risky projects or the growth of total assets. In short, the possession of options creates an additional incentive for the managers to take actions to increase the company's stock price and its volatility, which is the primary reason that shareholders approve options plan. Using stock options in the compensation package is therefore a choice of firm to incentivize managers' risk taking.

As the above factors have certain effects on an option's value, in principal, they will be present in the formula of valuing an option. Within the scope of this study, we only discuss the method to calculate a call option.

To define the value of options, several models can be used: Binomial options pricing model, the Black-Scholes model, or the Black-Scholes-Merton model (the development of the Black-Scholes model). The binomial model is a diagram representing different possible paths that might be followed by the stock price over the life of options. The assumption is that in each time step, the probability of moving up by a certain percentage amount of stock price as well as the probability of moving down by a certain percentage amount can be predicted. However, for long-life options, the prediction of these parameters is quite difficult. For this reason, the Black-Scholes-Merton model which allows us to price the options with all observable parameters is used in most all of empirical studies on options. The Black-Scholes formulas used for pricing European options non - dividend - paying are as follows:

$$c = SN(d_1) - Ke^{-rT}N(d_2) \quad (3)$$

Where

$$d_1 = \frac{\ln(S/K) + (r + \sigma^2/2)T}{\sigma\sqrt{T}} \quad (4)$$

$$d_2 = \frac{\ln(S/K) + (r - \sigma^2/2)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T} \quad (5)$$

The Black-Scholes model developed by Merton is used to evaluate a European option on stock providing a dividend yield:

$$c = Se^{-qT}N(d_1) - Ke^{-rT}N(d_2) \quad (6)$$

Where

$$d_1 = \frac{\ln(S / K) + (r - q + \sigma^2 / 2)T}{\sigma\sqrt{T}} \quad (7)$$

$$d_2 = \frac{\ln(S / K) + (r - q - \sigma^2 / 2)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T} \quad (8)$$

The function  $N(x)$  is the probability that a variable with a standard normal distribution,  $\phi(0,1)$ , will be less than  $x$ . The stock provides a dividend yield at rate  $q$ . The remaining variables are all defined above. The variable  $c$  is the European call value,  $S$  is the stock price at the time that the value of options needs to be calculated,  $K$  is the strike price,  $r$  is the continuously compounded risk-free rate,  $\sigma$  is the stock price volatility, and  $T$  is the time to maturity of the option.

We place here an example of calculating a stock option of Danske Bank Group. Danske Bank Group is one of very few European banks which discloses sufficient information for valuing its call options.

We will calculate the value of a call option based on the above formula at two points of time: at the end of 2005 and at the end of 2009.

The call option considered is the one awarded in early 2005 with the exercise price ( $K$ ) of 190,2 DKr<sup>21</sup>.

### **Option value at the end of 2005**

The value of option will be calculated according to a dividend-adjusted Black & Scholes formula based on the following assumptions at December 31, 2005: Share price ( $S$ ) 221,18; Dividend payout ratio ( $q$ ) 3,7%; Rate of interest ( $r$ ) 2,9%-3,2%; Volatility ( $\sigma$ ) 15%; Average time of exercise 1,13-4,25 years. The lifetime of share options is seven years from allotment, consisting of a vesting period of three years and an exercise period of four years, which means the time remaining until the option expire in this case ( $T$ ) is 6 years. The volatility is estimated on the basis of historical volatility.<sup>22</sup>

<sup>21</sup> Danske Bank Group, Annual report 2005, P. 89

<sup>22</sup> Danske Bank Group, Annual report 2005, P. 88

**Table 10 Option value calculated based on the dividend-adjusted Black & Scholes formula**

|            | 2005     | 2009     |
|------------|----------|----------|
| S          | 221.18   | 118      |
| K          | 190.2    | 190.2    |
| r          | 3.20%    | 2.70%    |
| $\sigma$   | 15%      | 52%      |
| T          | 6        | 2        |
| q          | 3.70%    | 0%       |
| d1         | 0.5128   | -0.2080  |
| d2         | 0.1453   | -0.9434  |
| $Ke^{-rT}$ | 156.9734 | 180.2016 |
| $Se^{-qT}$ | 177.1465 | 118.0000 |
| N(d1)      | 0.6960   | 0.4176   |
| N(d2)      | 0.5578   | 0.1728   |
| c          | 35.7358  | 18.1446  |

#### **Option value at the end of 2009**

Calculation of the fair value at the end of 2009 is based on the following assumptions: Share price (S) 118; Dividend payout ratio (q) 0%; Rate of interest (r) 1,6-2,7%, equal to the swap rate; Volatility ( $\sigma$ ) 52%; Average time of exercise 1-3 years; The time remaining until the option expires in this case (T) is 2 years. The estimated volatility is based on historical volatility.<sup>23</sup>

<sup>23</sup> Danske Bank Group, Annual report 2009, P. 83

Table 10 illustrates the results based on the dividend-adjusted Black & Scholes formula. Accordingly, the value of a stock option awarded in early 2005 is 35,7358 DKr on 31 December 2005. The market value for the same 146.754 stock options on 31 December 2005 was 5.200.000 DKr, which means 35,4335 DKr per stock option.<sup>24</sup> So the simulated value is closed to the market value. In the crisis period, as stock prices decrease sharply, stock options lose much value. In the case of Dansk Bank Group, the value of a share option allotted in 2005 reduced to 18,1446 DKr on 31 December 2009. In some cases such as Dexia, shares fell more than 90%<sup>25</sup>. Options then lose most of their value.

In theory, the strike price of a stock option is fixed in the contract and it is set at the stock price of the company on the market around that granted date. However, in practice, the “options backdating” which has been called a cheat in order to give the managers more money has been increased in the economy. Options backdating is the practice of altering the date at which a stock option was awarded to an earlier (or sometimes later) date at which the underlying stock price was lower. As lower strike price makes a call option more valuable, the options backdating is so attractive to the managers.

Following a hypothetical case of undisclosed backdating in the study of J-M.Bickley and G.Shorter (2008), we can see how “easily” and “effectively” (from the perspective of the managers) the options backdating makes an option more valuable: “Assume that ABC, Inc. is a publicly held corporation whose stock is selling for \$50 a share on December 31, 1998. As a part of his compensation plan, ABC, Inc.’s chief executive officer (CEO) is granted options on that date to buy 10,000 shares of stock for \$50 a share (at the money). But, without disclosure, the CEO knowingly selects a prior grant date on August 15, 1998, when the stock price was at its low for the year (\$30). In other words, the grant date has been backdated, resulting in a reduced exercise price of \$30. Because of backdating, in 1998, the CEO received an undisclosed gain on paper of \$20 (\$50 — \$30) per share for a total of \$200,000 (\$20 X 10,000).”

Lehman Brother is one of many other examples which were accused to use options backdating. In early 2007, one year before its collapse, Lehman Brother was sued by a shareholder for alleged stock option backdating to “secure a huge financial windfall” for executives. According to this allegation, 22 executives and directors manipulated stock option grants from 1998 to 2001 and received improperly hundreds of millions of dollars.<sup>26</sup>

#### - **Stock-based program**

<sup>24</sup> The value of 146.754 stock options allotted in 2005 to the CEO Peter Straarup is 5.200.000 DKr, source: Danske Bank Group, Annual report 2005, P.89.

<sup>25</sup> F. Valentini & J. Martens, “Dexia Breakup may make investors losers holding little value”, (Oct. 6, 2011) available at <http://www.bloomberg.com/news/articles/2011-10-05/dexia-breakup-may-make-shareholders-losers-holding-little-value>

<sup>26</sup> J.Stempel, “Lehman is sued for alleged stock option backdating”, (Apr. 13, 2007) available at <http://www.reuters.com/article/2007/04/13/us-lehman-stockoptions-idUSN1322332120070413>

Companies also use stocks to compensate their executives. Based on different conditions, various stock-based programs are constructed to incentivize executives. Programs that have been widely adopted by institutions are *Restricted Share* or *Performance Share*.

A restricted share is a share that a company offers to its employees with some restriction which goes away over time. The restriction here could be the right of selling the stocks granted on the market, the requirement to sell them back to company, the vestment period or voting rights, and so on. Restricted stock cannot be sold without the approval of the Securities and Exchange Commission (SEC). This kind of payment gives employees reasons to work hard for a successful company in the sense that the better result the company gets, the higher the prices of employees' stocks are. It also helps increasing employee royalty, encouraging employees to stay with the company long enough to reach the vesting.

A performance share of company is given to executives only if certain company-wide performance criteria, such as earnings per share targets, are met. Similar to the other equity-based payment, the goal of performance share is to tie managers to the interests of shareholders. An example of HSBC's performance share program will be described below: based on three independent performance measures 1/ Total Shareholder Return (TSR) (40% of the award), 2/Economic Profit (40%), 3/ Growth in earnings per share (EPS) (20%), the awards of Performance Shares under the HSBC share plan will be vested. Awards will not be vested unless HSBC Holdings' financial performance has shown a sustained improvement since the award date. To define if HSBC has achieved such sustained improvement, the Remuneration Committee will take account of all the following factor comparisons against the comparator group in areas such as revenue growth, cost efficiency, credit performance, cash return on cash invested, dividends and TSR.

One important feature of this kind of compensation is that the share has value like any other share of the company. This makes the program much safer than the stock options one. For example, stock options granted with a strike price of €10 have no value when the stock traded on the market at €8. Whereas a restricted stock awarded at the time where the stock price was at €10, is still worth €8 when the price goes down. In that case, the stock option has lost 100% of its value while the restricted stock has lost only 20%.

Why awards of shares incentivize employees to take riskier action? To see the main reason, we consider the Gordon growth model which is most widely used to value a company's stock price:

$$P = \frac{D_1}{r - g} \quad (9)$$

Where

$P$  is the current stock price



$g$  is the constant growth rate in perpetuity expected for the dividends

$r$  is the constant cost of equity capital for the company

$D_1$  is value of the next year's dividends

This formula is based on the theory that a stock is worth the sum of all the future dividend payments, discounted back to their present value. Consequently, dividends are considered the main important determinant of stock price. This means that investors select a stock for what they can gain from it. In fact, they only get two things out of a stock: dividends and the ultimate sales price, determined by what the future investors expect to receive in dividends.

$$\text{Total dividends} = \text{Earnings} - \text{Retained Earnings} \quad (10)$$

We now divide both sides of the above equation by the number of equity shares

$$\text{DPS} = \text{EPS} - \text{Retained Earnings} / \text{number of equity shares} \quad (11)$$

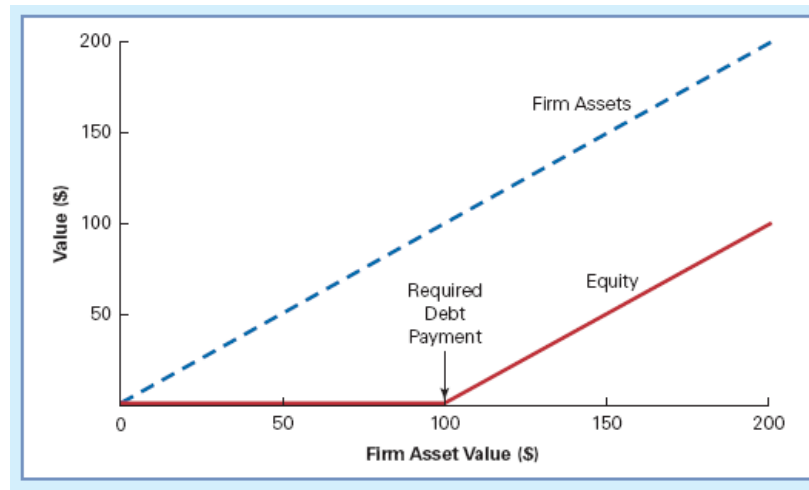
In which DPS: dividend per share; EPS: earnings per share.

As a result, if executives want stock price to be increased, there are two ways that managers can affect the dividend per share: 1/ In case not any increase in total earnings achieved, dividends can only be increased if retained earnings are reduced; 2/ Growth in total earnings of a company leads to improved dividends. By the former way, executives can realize the goal of higher stock price; however, the investment in the future would be negatively affected. In other words, managers focus on short-term benefits by ignoring long-term benefits of company. Whereas with the latter way, they can get two objectives at the same time: higher dividend and future investments are not affected. Therefore, when executives hold in hand a number of stocks, they will have incentives to look for and implement investments with profitability as high as possible. The problem is that “no risk, no return”, which means this kind of awards incentivizes managers to take more risky actions to get higher stock price. For this reason, their interests are aligned with the ones of real shareholders.

Another way to explain an incentive for risk-taking of shares awarded is using the Real option model. Black & Scholes (1973) consider equity a call option on the assets of the firm with a strike price equal to the value of debt outstanding. The option expires when the firm is liquidated. At the liquidated time, if the firm's total value ( $S$ ) is smaller than the value of debt outstanding ( $K$ ), the firm must declare bankruptcy and the equity holders receive nothing. On the contrary, if the firm's value exceeds the debt outstanding value, the equity holders get whatever is left once the firm repays all debt obligations. The payoff to equity therefore looks the same as the payoff of a call option (figure 10). We know that a call option

will be more valuable if the risk of the underlying stock is high. In the same way, the riskier the firm's assets are, the more valuable the firm's stock is.

**Figure 10 Payoff to Equity with the value of debt outstanding at \$100**



#### **A comparison between the stock-based program and the stock-option-based program**

Now we do a small comparison between the restricted share program and the stock options program. They all have a common characteristic that provides an incentive for executives to improve the benefits of company (as much as possible), since their wealth much depends on the movement of company's stock. However, it is difficult to say that level of incentive of these two programs are the same. With the stock options program, in case the company's stock price moves up (stock price is larger than the strike price), executive has to pay a certain cost (strike price) to have stocks then sells them on the market to get the difference between the two prices (pay off of options). However, if the stock price on the market is smaller than the strike price, he gets nothing from these options. Whereas, with the restricted share program, executive pays nothing to have stocks and no matter what the trend of stock price on the market is, they always have certain value. Imagine that you have two awards at the same day from company A and company B. Company A offers you a restricted stock traded at €10 today, vesting after 2 years. The offer of company B is a stock option with strike price of €5 vesting after 2 years. The market price at the same day of stock B is also €10. Is your behavior the same in these two companies? Naturally, you will work harder for the company B where it takes you €5 to have a stock. If the company works ineffectively, after 2 years, stock price may fall down less than €5, which means you will get nothing from the award today. In other direction, if the company succeeds, the price goes up, say €15, you will get in return €10 for each stock. In the situation of company A, it is certain that you prefer the price to move up; however, no matter what happens, you still get a certain amount of money. The price increases to €14, you get €14 for each stock; the price drops down to €5,

you still get €5 in return. Therefore a stock options program seems to incentivize executives more strongly than the other one.

## **2.4 Risk**

Risk in doing business normally is defined as unpredictable variability of present value of firm. Typically, the major sources of value loss are identified as:

- Credit risk, which is a risk of loss arising from a borrower who does not make payments as promised;
- Market risk, which is a risk of loss due to the change in value of the market risk factors such as interest rates, exchange rates, and equity and commodity prices;
- Liquidity risk, which is a risk that a given asset cannot be traded quickly enough to prevent or minimize a loss.
- Operational risk, a risk stemming from execution of a firm's business functions;
- Reputational risk, a risk of loss resulting from damages to a firm's reputation;
- Systemic risk, a risk of collapse of an entire financial system or entire market caused by idiosyncratic events in certain financial intermediaries;

In doing empirical researches, it is necessary to have a set of accurate and sufficiently large data. Since the measure of risk as well as available information on the latter four types of risk is limited, in this research, we focus on the theoretical underpinnings of market risk and credit risk.

To capture the variability of present value of firm, two ways of value measurement which have been widely used are: 1/ Measurements based on the market value; 2/ Measurements based on the book value. The market-based measurements of risk capture a risk of a firm's loss due to the change in value of the market factors such as equity prices or due to factors that affect overall performance of the financial market such as recessions, political turmoil, changes in interest rates and terrorist attacks. The accounting-based measurements of risk capture a firm's health through information reflected on the balance sheet such as a loss arising due to the non-payment loan or the distance of a firm to default.

### **2.4.1 Market-based measures of risk**

We start with the group of market-based risks. How can the total risk, the systematic risk and the idiosyncratic risk explain the unpredictable variability of value of firm? To measure the value of firm, no matter what method are used: the market value or the book value, in theory, we can approach by assets side or liabilities side because these two sides of a firm always balance. However, as accurate measures of market value of assets are lacking, normally the market value of firm is calculated through firm's liabilities. The most important component of firm's liabilities in general is the common stocks. This component also has the greatest exposure to changes in the present value of a firm while the value of the others is

rather steady. As a result, the changes in value of a firm's common stocks become a natural approach to capture the variability of the firm's market value.

Different from enterprises in other sectors, in the banking sector, the equity plays a very important role as it accounts for less than 10% of the total assets (Figure 3 and Figure 4). Shareholders in this situation have to face significant risk due to the very high degree of financial leverage. The effects of financial leverage are presented as follows:

We begin the explanation by considering the major categories of an accounting balance sheet at time  $t_0$  which are Assets ( $A_o$ ), Liabilities ( $L_o$ ) and Owner's Equity ( $E_o$ ). We always have the equation

$$L_o + E_o = A_o \quad (12)$$

We assume that

$$\frac{E_o}{A_o} = m\% \quad (13)$$

$$\Leftrightarrow E_o = m\% A_o \quad (14)$$

Or

$$A_o = \frac{1}{m\%} E_o \quad (15)$$

We substitute  $m\%A_o$  into equation (12) for  $E$

$$\Rightarrow L_o + m\% A_o = A_o \quad (16)$$

$$\Leftrightarrow L_o = (1 - m\%) A_o \quad (17)$$

Considering at time  $t_1$ , we have

$$L_1 + E_1 = A_1 \quad (18)$$

As Liabilities cannot be changed so

$$L_1 = L_o \quad (19)$$

Assume that Assets decreases  $n\%$  at time  $t_1$ , then

$$A_1 = (1 - n\%) A_o \quad (20)$$

Substitute equation (16) and (19) into equation (17):

$$(1 - m\%) A_o + E_1 = (1 - n\%) A_o \quad (21)$$

$$\Leftrightarrow E_1 = (1 - n\%) A_o - (1 - m\%) A_o \quad (22)$$

$$\Leftrightarrow E_1 = (m\% - n\%)A_o \quad (23)$$

Substitute equation (15) into equation (23) :

$$\Rightarrow E_1 = (m\% - n\%) \left( \frac{1}{m\%} \right) E_o \quad (24)$$

$$\Leftrightarrow E_1 = \left( 1 - \frac{n}{m} \right) E_o \quad (25)$$

So in case Assets decreases  $n\%$  at time  $t_1$ , Equity will decrease  $\frac{100n}{m}\%$ . Considering some examples of  $m\% = 10\%; 50\%$  and  $n\% = 1\%; 10\%$  respectively. Table 11 presents the effects of financial leverage to owner's equity. According to Table 11, in case the ratio of equity on assets of a bank equals 10%, a 1% change in bank assets results in a 10% change in equity. The bank may lose all of its equity (-100%) in case the value of assets decreases 10%. Considering a firm which retains the ratio of equity on assets at 30% level, a 1% change in its assets results in 3,3% change in equity. A drop of 10% in the value of assets may lead to a decrease of 33% in owner's equity. The bankruptcy risk of a bank, therefore, is much stronger than that of a normal business.

**Table 11 Effect of financial leverage to owner's equity**

| Equity/Assets (m%) | Assets decrease (n%) | Equity decrease |
|--------------------|----------------------|-----------------|
| 10                 | 1                    | 10%             |
| 10                 | 10                   | 100%            |
| 30                 | 1                    | 3,3%            |
| 30                 | 10                   | 33%             |

Several empirical researches have focused on the banking systems in the developed countries and found significant relations between accounting and market risk measures such as Jahankhani and Lynge (1980), Lee and Brewer (1985), Mansur et al. (1993), Elyasiani and Mansur (2005). As a result, it is not difficult to find a study on bank risk based on market-based measurements. Other explanations can be based on the market discipline. Under this discipline, two notions are implied: 1/ Private investors have the ability to understand a financial firm's true condition; 2/ Private investors have the ability to influence, in return, managerial actions in appropriate ways. Since private investors are not only the bank's equity holders but also the lenders of funds in the economy (the depositors or savers), their impacts on both the bank's equity and liabilities may be conducted. Consequently the market-based

measurements of risk are used widely in studies on bank risk, especially the ones based on data from the developed countries.

Changes in value or price ( $P_t$ ) of a firm's common stocks from one day to another day are easily observed by stock returns calculated by  $(P_t - P_{t-1})/P_{t-1}$ . The total risk, computed by the standard deviation of stock returns of firm in a certain period, therefore is a very good way to capture the variability of a firm's stock returns. Applying the single index model which has received widespread attention, the total risk is split into two following component risks: *the systematic risk (the market risk)* and *the idiosyncratic risk (the unique risk)*. The original equation of this model is expressed as follows:

$$\text{Where} \quad R_{it} = \alpha_i + \beta_i R_{Mt} + e_{it} \quad (26)$$

$R_{it}$  is the vector of stock returns of the firm i;

$\alpha_i$  is the stock's alpha which is the abnormal return;

$R_{Mt}$  is the vector of returns on the market index;

$\beta_i$  is the stock's beta which measures the sensitivity of the firm's stock returns to stock market movements;

$e_{it}$  is vector of the random error terms;

$\alpha_i, \beta_i, e_{it}$  are pulled out from regression of stock returns ( $R_{it}$ ) on market returns ( $R_{Mt}$ ).

If securities are only related in their common response to the market then covariance of the two securities i and j will be written as:

$$\sigma_{ij} = \beta_i \beta_j \sigma_M^2 \quad (27)$$

In mathematics, the variance of a random variable X can also be thought of as the covariance of that variable with itself. Since variance is typically designated as  $\text{Var}(x)$  or  $\sigma_x^2$ , the expression for the variance of stock returns of firm i can be written as:

$$\sigma_i^2 = \beta_i^2 [\sigma_M^2] + \sigma_{e_i}^2 \quad (28)$$

Where

$\sigma_i^2$  is the variance of stock returns of firm i;

$\sigma_M^2$  is the variance of market index;

$\sigma_{e_i}^2$  is the variance of the random error terms;

The single index model stems from the fact that the stock price has a tendency to move along with the market index. If  $\beta = 1$ , the stock price tends to fall (rise) in the same proportion that the market falls (rises). In another case, for example if  $\beta = 1.5$ , the stock price tends to fall (rise) proportionally by one and a half times as much as the market falls (rises). Beta reflects the relationship between the market index and the stock returns of firm. It lets investors know how much a change in the market index affects firm's stock returns. As a result, beta is called "the market risk" or "the systematic risk". This risk is called "the systematic risk" for the reason that changes in the market index are results of shocks or

uncertainty that have effects on all agents in the market, such as shocks arising from government policy, international economic forces, or acts of nature.

Return to the equation (28), the total risk ( $\sigma^2_i$ ) is split into two components. The first component is the systematic risk ( $\beta^2_i[\sigma^2_M]$ ) as we referred above. The second one relates to the random error terms ( $\sigma^2_{ei}$ ), which is specific to each firm. For this reason, it is named “the unique risk” or “the idiosyncratic risk”.

#### 2.4.2 Measures of risk based on the book value

Based on the book value measurement, to consider the risk of a financial institution, the following ratios have been referred: the proportion of the loan loss provision and the proportion of the non-performing loan and the Z-score.

##### - Credit risk

Different from firms doing business in the other fields, loan item accounts for a significant proportion in assets side of banks and returns from this activity are very important. In this field of business, however, banks have to either face the risk of loss of principal or loss of financial reward stemming from a borrower’s failure to repay a loan. This kind of risk is labeled “the credit risk”. A loan that is in default or close to being in default is named “non-performing loan”. In order to prevent bad consequences from the bad loans, banks need to set aside an expense called “loan loss provision”. Both of these items are disclosed in the balance sheet of each institution. To capture the credit risk of firms, we consider the proportion of the non-performing loan over the total loan and the proportion of the loan loss provision over the total loan. The former ratio shows the actual situation of bank’s bad debt while the latter gives the idea of the situation of the potential bad debt. These two formulas are as follows:

$$LLP_{i,t} = \frac{VLLP_{i,t}}{TL_{i,t}} * 100\% \quad (29)$$

$$NPL_{i,t} = \frac{VNPL_{i,t}}{TL_{i,t}} * 100\% \quad (30)$$

Where

$LLP_{i,t}$  is the percentage of loan loss provision to total loan

$NPL_{i,t}$  is the percentage of non-performing loan to total loan

$VLLP_{i,t}$  is the value of loan loss provision of bank  $i$  in year  $t$ .

$VNPL_{i,t}$  is the value of non-performing loan of bank  $i$  in year  $t$ .

$TL_{i,t}$  is the value of total loan of bank  $i$  in year  $t$ .

##### - Distance-to-Default: Z-score

Z-score: Financial analysts as well as investors want to know how far the firm's financial situation is from the point of default (which is a point where the firm's own capital is not enough to cover its loss) formula of Z-score is as follows:

$$Z_t = \frac{ROA_t - (-KOA_t)}{\sigma_{ROA}} \quad (31)$$

or

$$Z_t = \frac{ROA_t + KOA_t}{\sigma_{ROA}} \quad (32)$$

Where

$ROA_t$  measured by Returns on Assets (%) of firm at time t ;

$KOA_t$  measured by Equity on Assets (%) of firm at time t;

$\sigma_{ROA}$  is the standard deviation of firm's ROA;

This indicator will let us know how many standard deviations the  $ROA$  of firm at time t is away from the point  $(-KOA)$  (meaning firm's loss is equal to firm's own capital) or in another words, how different the firm's financial situation is from the point of bankruptcy. As a result, the higher Z-score is the better financial situation is. Because of its nature, Z-score is normally used to capture firm's risk of bankruptcy. It is considered a measure of bank insolvency risk (Ivicic et al., 2008).

### 2.4.3 Other measures of risk

Besides these above measures, we add the two following indicators as proxies of risk in the period of crisis: rate of sharp drop in stock returns and change in bank's rating. The sharp drop in stock returns is measured by the difference between the maximum return and the minimum return over the maximum return in the crisis period. Our objective is to concentrate on the maximum value lost that firm had to suffer due to the crisis. A bank's rating is usually an assignment of a letter grade or numerical ranking based on formulas that synthesize the bank's situation on capital, assets quality, management, earnings, liquidity, and sensitivity to market risk. As a result, change in bank's ratings is also a mirror of the change in value of bank over a certain period.

## 2.5 Agency theory in corporate governance

The objective of this research is to investigate the influence of each component in the existed compensation package for executives on risk-taking in the banking sector. We therefore have mentioned about the important concepts of executive compensation as well as measurements of bank risk. In this section, we switch to looking at the agency theory applied in corporate governance, which will help us to understand the reason for appearance of the current compensation package.

Agency is the relationship between two parties: the principals and the agents – who are the representatives of the principals in transactions with a third party. As the principals hire the agents to perform a service on the principals' behalf, the principals delegate the



authority of decision-making to the agents. Agency problems can appear due to incomplete information and inefficiencies. Agency theory then aims to solve problems that can exist in the agency relationship. Two agency relationships which are mostly referred in corporate governance are those between stockholders and managers, and between stockholders and creditors. In the scope of this research, we only pay attention to the relationship between stockholders and managers.

The self-interested human behavior presented by Adam Smith (1776) is considered as the root of the Agency theory. According to Smith, humans are most likely to act in their own self-interest at the expense of others. In the modern corporation where the ownership and the control of enterprise are separated, managers are interested in maximizing their own wealth while the self-interest of the owners is to optimize the operation of the firm. Consequently the self-interests of the owners and managers come into conflict (Berle & Means, 1932).

Since managers are hired to oversee operations in enterprise, they are expected to act in the best interest of the owners of the enterprise. However managers are always in temptation to take opportunistic actions which reflect their own objectives rather than those of the owners of the enterprise (Berle & Means, 1932, Fama, 1980, Jensen & Meckling, 1976). Examples of divergent interests between these two groups are presented in Table 12. Berle & Means (1932) and Holstrom (1979) labeled this fact a “moral hazard”.

**Table 12 Divergent interest between the Principals and Agents**

| <b>Owners (Principals)</b>                    | <b>Managers (Agents)</b>                   |
|---|--|
| Profits and dividends for earning             | Growth for prestige and wages              |
| Moderate risk for higher returns              | Minimal risk for security, résumé strength |
| Research & development for long-term          | Sure projects for assure current success   |
| Competitive market position                   | Safe market position                       |
| International diversity for stability, growth | Narrow focus for reduced complexity        |

*Source:* Dissertation of Ray W. Atchinson, II, P.30

Given this moral hazard, it is necessary to have a means to align the self-interested objective of the agents (managers) with the objectives of the principals (the owners) (Fama, 1980; Fama & Jensen, 1983, Jensen & Meckling, 1976). Jensen & Meckling (1976) are the first authors who proposed an explanation to resolve the conflict by presenting the agency theory. The agency theory is directed to resolve two problems. The first one is the agency problem arising when the goals of principals and agents conflict and it is difficult for the

principals to verify what the agents are doing. The second one is the problem of risk sharing which arises when principals and agents have different attitudes toward risk. There are three articles on the agency theory which have been particularly influential. The research of Jensen & Meckling (1976) studied the ownership structure in enterprise then explained clearly how equity ownership by managers could align the interests of principals with those of agents. Research on corporate governance in general and research on compensation in specific have been predominately based on this theory (Lyndall, Golden & Hillman, 2003; Aguilera & Jackson, 2003; Gomez-Mejia & Wiseman, 1997; Gomez-Mejia, 1994). Then, in the research of Fama (1980), the role of efficient capital and labor market are considered as information mechanisms that are used to control the self-serving behavior of top executives. Fama and Jensen (1983) studied on the role of the board of directors. They concluded that the stockholders within large corporations could use the board of directors to monitor the opportunism of top executives.

Based on the agency theory, compensation schemes are primary means of converging the interests of principals and agents ( Jensen & Meckling, 1976; Fama & Jensen, 1983; Boyd, 1994; Tosi & Gomez-Mejia, 1989). While firm decisions regarding salary levels which are related to factors such as responsibility, complexity, scope and effort (Gomez-Mejia, 1994) and are not sufficient to motivate managers to maximize the owners' wealth, performance-contingent forms of payment are more likely to influence managers' actions toward the objectives of the owners (Jensen & Meckling, 1976).

The importance of agency theory can be seen in its huge number of applications both in real life and in research. Regarding the application in real life, agency theory is omnipresent in different fields, such as business schools, management literature, academic and practitioner journals, and corporate proxy statements (Shapiro, 2005 cited by Stefan Mitzkus). Scientific research has also applied this theory on numerous domains such as accounting, economics, finance, politics, organizational behavior and sociological sciences (Eisenhardt, 1989 cited by Stefan Mitzkus). However in the scope of this research, we typically focus on agency theory applied in Pay for Performance in corporate governance. There has been abundant empirical research related to this subject, however conclusions from these studies have many contradictions. For example Murphy (1986) illustrated an evidence of efficient compensation contract as top executives are worth every nickel they get. Conversely, some other evidence indicates that compensation contracts are not optimal. They proposed that because CEOs do not receive enough monetary rewards for firm performance, CEOs actually do not bear more risk than other employees (Jensen and Murphy, 1990). In a study conducted in 2004, Jensen, Murphy and Wruck found evidence that it is CEO compensation which leads to failed governance and failed incentives. More specifically, the crisis of 2008 sparked the debate on executive compensation which led to the suspicions against agency theory. Yao and Magnan (2009), through showing invalid assumptions of agency theory, concluded that "agency theory does not provide a relevant and reliable underlying theory for executive compensation".

Given the fact that agency theory currently is the most widely accepted in the academic environment as well as in providing guidance for corporate governance in large companies and the large regulatory agencies (e.g. Central banks, Fed, IMF), this dissertation is still based on agency theory to conduct the empirical research about the effects of executive compensation on risk-taking behavior of managers in the banking sector.

## 3 Literature review

This section aims to review the previous research to position the present dissertation in terms of existing knowledge in the executive compensation field. The literature review begins with the traditional approaches to managerial compensation in general. Then it is followed by the review on executive compensation and its influence on risk-taking in the banking sector.

### 3.1 Approaches to managerial compensation

We follow the review of Devers, Cannella et al (2007) on executive compensation to understand the development in this subject. Their review is based on 99 articles from management journals, finance journals, accounting journals and other journals for the period between 1997 and 2006. Traditionally, executive compensation mostly is studied in the relationship with performance (Finkelstein & Hambrick, 1996). However, since 1997, the behavioral consequences of compensation have grown significantly. For this reason, in their review, Devers and his colleagues organized research on executive compensation into two main categories: 1/Relationship between pay and performance and 2/ Relationships between pay and behaviors. In each main category, literature then is classified into two sub-categories, with one set treated compensation as dependent variable and the other treated compensation as an independent variable. The structure is as follows:

- A. Relationships between pay and performance
  - 1. The influence of performance on pay
  - 2. The influence of pay on performance
- B. Relationships among pay and behaviors
  - 1. The influence of pay on executive actions
  - 2. The influence of executive actions and other factors on pay

We summarize the results of Devers and his colleagues in the following paragraphs.

#### 3.1.1 Relationships between pay and performance

##### *3.1.1.1 The influence of performance on pay*

Research on the influence of performance on executive pay generally considers compensation as a reward for prior performance. There are two way to examine this relationship. The first one is that executive compensation is depicted as the dependent

variable while performance is an independent variable (Kumar, 1998). This kind of model lets us know directly the effects of performance on compensation through the coefficient. The second one that has been used quite often refers to this relationship as the sensitivity of pay to performance. To examine which factors have effects on the pay-performance sensitivity, in the model of research, this sensitivity is treated as dependent variable. The pay-performance sensitivity is conceptualized as the dollar change in executive wealth (pay) associated with each dollar change in shareholder wealth (performance). In the research of Jensen and Murphy (1990) the pay-performance sensitivity is at 3.25. Given that greater this sensitivity should indicate greater alignment of executive and shareholder's wealth, they concluded that the relationship between CEO pay and firm performance was low. However this indicator varies widely through studies. For example, using different time frame, Hall and Liebman (1998) found the pay-performance sensitivity that was about four times higher than Jensen and Murphy's study had showed. The difference in pay-performance sensitivity observed in studies notably dues to the sample used, the time frame and the variable included. As a result, Devers, Cannella et al concluded in their review that "the link between firm performance and executive compensation becomes more or less elusive, depending on the variables examined and the pay elements considered". They also stressed that most of the research on this area are based on the agency theory or sociopolitical/power theories. For this reason, the authors suggested an examination on influences of labor market on the pay-performance sensitivity for future research. Another factor which had received little attention in that category, following the authors, is the effect of regulation on executive compensation. The last suggestion in this area to future researcher from this review is considering "how performance and other factors affect the actual structuring of executive pay packages".

### *3.1.1.2 The influence of pay on performance*

Studies on "the influence of pay on performance consider compensation as a motivational tool, thus in the research model, it is the predictor, rather than the predicted variable" (Devers, Reilly and Yoder, 2007). The theory behind this approach is the motivational theories in psychology which believe that motivation is the force that initiates, guides and maintains goal-oriented behaviors. In this context, researchers want to examine if executives are motivated to maximize firm's performance because of rewards or not. Devers et al. categorized research on the influence of pay on performance into three groups: Pay plans, individual pay elements, top management team pay and pay dispersion.

In the group of pay plan adoption, depending on which plans scholars want to examine their effects on firm performance, results are different from one to another. For example, Wallace (1998) after examining the adoption of residual income-based compensation plans concluded that this compensation plans were not significantly related to the increases in shareholder's wealth. The adoption of proposals for executive pay-for-performance plans were examined in the research of Morgan and Poulsen (2001). The results illustrated that plan proposals were significantly related to shareholder wealth. Core and Larcker (2002) then

examined the effects of plans which required executives to own minimum levels of firm stock and found that both excess accounting and stock returns of firms increased after plan adoption.

Studies in the group of elements of pay have examined the effect of distinct pay elements on performance. Notably the elements that were examined are stock and stock options. Hanlon, Rajgopal, and Shevlin (2003) found from the results that stock option grants positively influenced firm's performance in future. In another research, Kato, Lemmon, Luo and Schallheim (2005) examined the effect of stock option compensation adoption on performance of Japanese firms. Results illustrated that there were abnormal returns of 2% around announcement dates and the stock option plan increased operating performance of firms.

The majority of compensation research focuses on CEOs, however some scholars have broadened their focus to top management team pay. Most of this work examines the effects of pay dispersion (including vertical differentiation and horizontal differentiation) on performance. The vertical dispersion is the pay disparity across hierarchical levels, whereas the horizontal one is the differences in pay among executives of the same hierarchical level. In general, the literature in the group of vertical dispersion suggests that the vertical pay dispersion has positive effect on individual motivation; however it can also decrease productivity and collaboration which leads to shorter tenures, higher turnover, and then lower firm performance (Lazear & Rosen, 1981; Main, O' Reilly, & Wade, 1993, Carpenter and Sanders, 2002). The results of research on the effect of horizontal dispersion are mixed. For example, Festinger, 1954 and Adams, 1965 stressed that "executives who believe they are paid less than their peers will be characterized by perceptions of inequity, jealousy, and decreased satisfaction, all of which threaten both individual and firm performance". However, the evidence from the study of Peck & Sadler (2001) illustrated that no relationship existed between pay dispersion and firm performance.

### **3.1.2 Relationships among pay and behaviors**

#### ***3.1.2.1 The influence of pay on executive actions***

Agency theory suggests that incentive pay is a primary mean to align the interests of executives and shareholders by controlling executive opportunism and discouraging risk aversion. To examine the interest alignment, many studies have been focusing on the direct relationship between pay and performance with the expectation that incentive pay increases performance of firm. However as we referred above, results from research on influence of pay on performance are mixed. Tosi et al. (2000) explained that it was not surprising for these equivocal results because firm performance is in fact a function of both actions of executives and exogenous forces (McGahan & Porter, 1997; Yermack, 1997). As a result, scholars have recently examined behavioral outcomes of compensation with the assumption that pay

influences behavior, which, in turn increases performance of firm. The review of Devers et al. categorized research on the influence of pay on executive actions into six subcategories which are: Risk preference alignment; Strategic choices; Individual choices; Goal misalignment; Contextual influences; and Stock-based payment.

*Risk preference alignment:* Scholars consider risk preference under the assumption that the risk appetite of shareholders and executives inherently diverge. While shareholders can diversify their personal wealth across firms with varying prospects (Milgrom, Roberts, 1992), executives are tied directly to their employing firms both in personal wealth and human capital. As a result, shareholders are suggested to be risk-neutral, whereas executives are assumed to be risk-averse (Jensen, Meckling, 1976). The difference attitudes toward risk increase agency costs because executives are likely to avoid risk at the expense of returns which are an important objective of shareholders. Holmstrom (1979) stressed that though complete risk preference alignment between managers and shareholders can never be achieved, incentive pay can reduce the extent of risk preference misalignment between these two groups. Many other studies have examined relationship between incentive pay and executives' risk taking. For example, evidence from Datta, Iskander-Datta, and Raman (2001) showed that stock option pay reduces risk preference misalignment by encouraging CEOs to take riskier investment. Rajgopal and Shevlin (2002) also supported this suggestion when examining the relationship between stock options and risk taking in oil and gas companies.

*Strategic choices:* Compensation research mostly is grounded in positive agency theory which suggests that incentive pay will motivate executives to engage in actions that maximize firm performance, thus, better aligning goals of agents and principles. The strategic choice is the most recommended choice that aligns more with company objectives. For this reason, the group of strategic choices includes studies which examined effect of incentive pay on executive actions leading to better aligning goals (e.g., information disclosures and liquidations that increase shareholder value). We found in this group the research of Nagar, Nanda, and Wysocki (2003) which illustrated that both the CEO's ratio of stock-based to total compensation and the CEO's average value of shareholdings positively influenced information disclosures. Supporting for the prediction that incentive pay increases goal alignment, Mehran, Nogler, and Schwartz (1998) showed the positive relationship between voluntary liquidations that increased shareholder value and the percentage of share owned by the CEO.

*Individual choices:* Some scholars have considered influence of compensation on individual actions of executives such as the effort levels, decisions to select into firms, and decision to remain with their firms or leave. Dunford, Boudreau, and Boswell (2005) examined the effect of underwater stock options (which are options that immediate exercise would bring no net proceeds to the holder) on executives' effort. Their evidence showed that executives were more likely to search for better employment than to expend more effort when

their stock options were underwater. Similarly, Carter and Lynch (2004) studied on relationship between stock option repricing and employee turnover. They found that repricing stock options helped prevent employee turnover because of underwater options. Research of Banker, Lee, Potter, and Srinivasan (2001) suggested that shareholder value creation related more to self-selection and effort of executives than to their strategic choices. Their results illustrated that as capable executives always look for jobs where superior skills are rewarded, they are drawn to jobs with greater levels of incentive pay. As a result, firms with better incentive pay plan attract better capable executive, which, in turn, creates more value to its shareholder.

*Goal misalignment:* The majority of research on compensation has focused on goal alignment, however the review helped Devers et al. recognized that goal misalignment might be one of the most reliable outcomes of executive pay. The studies suggested that even when incentive pay adopted, executives still take opportunistic actions to maximize the value of their compensation. Examining the effects of CEO stock option awards on stock returns, Yermack (1997) found that although stock returns prior to award dates were normal, returns after this event exceeded market returns by over 2% for 50 continuous trading days. He then concluded that CEOs actively scheduled awards prior to anticipated stock price increases. Similarly Aboody and Kaswnik (2000) found negative abnormal returns prior to scheduled awards, whereas abnormal returns over the subsequent 30 days were positive. Considering the effect of stock option awards on abnormal returns before and after the appearance of 2-business-day reporting rule for option grants (August 29, 2002), Heron and Lie (2007) illustrated that abnormal returns around option awards were mostly because of option backdating.

Research has also demonstrated that executives may manipulate information to take opportunistic actions. Evidence of Guidry, Leone, and Rock (1999) showed that in order to maximize the short-term bonuses, executives would emphasize short-term value creation at the expense of long-term value of firm. Coles, Hertz, and Kalpathu (2006) found that in an effort to secure options granted at the lowest possible price, managers would control earnings around the stock option award dates. Also studying the influence of information manipulation, Burns and Kedia (2006) demonstrated that the sensitivity of CEOs' stock options to stock price is significantly related to misreporting. Callaghan, Saly, and Subramaniam (2004) suggested that managers have control over option repricing as they found that repricing is systematically timed to coincide with the period of favorable movements of stock price. Sanders and Carpenter (2003) stressed that because repurchases lead to stock price increases, which in turns positively affect stock option value, stock options appear to motivate executives to redirect funds away from long-term investments toward repurchases.

*Contextual influences:* With the main objective of examining effects of incentive pay on executive risk-taking, scholars have also considered contextual influences. For example,

Carpenter (2000) especially focused on the effect of extremely out-of-the-money options. She found that extremely out-of-the-money options induce executives to take risk. Conversely, options deep in the money increases executive risk aversion, therefore they lead to decreases in risk-taking action. Cadenillas, Cvitanic, and Zapatero (2004) considered leverage as a contextual factor when exploring effects of incentive pay. Their evidence showed different attitudes toward risk between high-ability and low-ability managers. The higher-ability managers are likely to take greater risks in high levered firms (high levered stock) because they can use their abilities to correct for negative outcomes. In contrast, the low-ability managers appear to avoid risk as they are not confident in their abilities.

*Stock-based payment:* In most compensation research, restricted stock, stock option and long-term performance plan have been considered as substitutable incentives with similar risk properties, therefore they are commonly grouped into a single measure of incentive pay. Some scholars have suggested that the individual elements of compensation (e.g., restricted stock, stock option, salary, and bonus) might have different implications for risk taking. For this reason, they specifically examined effect of individual element (mostly stock option, restricted share) on executive behaviors. Since stock options contain limited downside risk (Sharpe, 1970) Sanders (2001) expected in his research that stock options should positively influence risk taking while stock ownership should negatively influence risk taking. Empirical results supported his prediction. Some others argued that stock options do not always lead to behavior as it is predicted. Bergman & Jenter (2005) illustrated that “stock option valuation is too complex to have much effect on executive behavior with respect to the timing of exercise”.

Recently, efforts to restructure executive compensation have led scholars focus on another element of incentive pay, which is restricted stock. Bebchuk & Fried (2004) suggested that restricted stock is a more effective interest alignment solution than stock options. Other works argued that restricted stock should decrease executive risk bearing. Bryan, Hwang, and Lilien (2000) illustrated from their evidence that “restricted stock likely exacerbates the CEO’s unwillingness to take risky”. Supported for this argument, Devers et al. showed that accumulate value of restricted stock held by CEOs decreases strategic risk investments.

### *3.1.2.2 The influence of executive actions and other factors on pay*

Scholars have also considered behavioral influences on executive compensation. To examine the effects of executive actions on incentive pay, we have research on executive behaviors required by specific jobs (Bernardo, Cai and Luo, 2001); on executive behaviors related to acquisitions (Bliss and Rosen, 2001); on executive rank, wealth, and star power (Barron and Waddell, 2003; Becker, 2006; Wade, Porac, Pollock, and Graffin, 2006).



Other factors such as contextual or governance factors have been also examined as they should have certain influences on executive compensation. In the group studying on contextual influences on incentive pay, we have research of Finkelstein and Boyd (1998) which examined the effect of managerial discretion. Their evidence showed that the relationship between managerial discretion and CEO compensation is positive. Balkin, Markman, and Gomez-Mejia (2000) investigated the influence of innovation in high-technology firms and they found that innovation will influence both long-term and short-term CEO compensation. Finally, Miller, Wiseman, and Gomez-Mejia (2002) examined the effects of market and specific risk in the relationship of them with executive compensation. The result illustrated a curvilinear relationship between specific risk and incentive pay. Conversely, the relationship between market risk and contingent pay is null.

In the tendency of examining effect of governance factors on executive pay, Daily, Johnson, Ellstrand, and Dalton (1998) found no relationship between board compensation committee composition and CEO pay. However, Deutsch (2005), in his recent meta-analysis on effects of outside directors, found that “the proportion of outside directors was generally negatively associated with the use of CEO performance contingent pay”. Also considering the effects of inside and outside directors, Core, Holthausen, and Larcker (1999) concluded that under weak governance structures, CEOs are able to earn more. Furthermore, their evidence showed that CEO pay decreases with the percentage of inside directors, however increases with the percentage of outside directors appointed by the CEO, the board size, and the percentage of outside directors over age 69.

Based on the review, Devers et al. provided recommendations for future research in three directions: Performance, Risk and Risk perceptions, and other Methodological issues. Related to the Risk and Risk perceptions direction, the authors suggested that due to difficulties in obtaining data on executive compensation, research on effect of certain compensation structures on risk-taking actions is “perhaps more guesswork than science”. Moreover, influences of individual elements of pay on executive behaviors have not yet attracted much attention. Though researchers have begun to illustrate that each element of pay might effect on executives’ risk preferences differently (Devers et al., in press), majority of research aggregates the individual elements of CEO pay into a single measure or just focuses on stock/stock option elements. “Accordingly, the influence of executive compensation on risk taking remains an open question” (Devers et al. , 2007).

The current dissertation addresses the call of Devers et al., (2007) for the study of the relationship between individual elements of compensation on executive risk-taking in the banking sector. Thus the next section will present the review of literature of executive compensation in banking sector.

### **3.2 Executive compensation and its influence on risk-taking in the banking sector**

In this section, we do a literature review of studies on executive compensation specialized in the banking sector. The research comes from both academic research and the research department of the control agencies such as IMF, OECD... Executive compensation has generated a spirited debate among academics since early XX century. One of the earliest studies on this issue is the research on the relationship between executive pay and firm performance of Taussig and Baker (1925). Since then, hundreds studies have been conducted both to examine which factors effect on executive compensation as well as to explore the effects of executive pay on firm. There are two important reviews of literature on executive compensation. The first one is the study of Gomez-Meija and Wiseman (1997) which review research on the same topic up to 1997. The second one is the study of Devers and Cannella Jr., et al. (2007) which cover studies from 1998 to 2007. From these two reviews, we found not many research focusing on compensation issue in banking sector. Consequently, to realize this section, we gathered both publications and working papers studying on executive compensation in financial institutions. We then categorized all the studies into four main groups: 1/Relationship between executive compensation and risk, 2/Responsibility of executive compensation in the financial crisis, 3/Differences in executive compensation policy, 4/Relationship between executive compensation and performance.

#### **3.2.1 Relationship between executive compensation and risk**

The agency theory suggests that incentive compensation can reduce difference in risk preference of principal (shareholders) and agents (executives) by increasing executives' risk-taking. However since the financial crisis happened, CEO pay at banks has been blamed for inducing excessive risk-taking, which, in turn leads to the crisis. For this reason, much of research has examined the relationship between executive compensation and risk-taking in banking industry. Prior to the crisis, scholars considered this relationship mostly to the extent that risk is a factor that has effect on executive compensation. One of the first studies on this topic is the research of Houston and James (1995). Their objective is to answer the question "Is compensation in banking structured to promote risk-taking?". Using data base on 134 bank holding companies in United States from 1980-1990, they found no evidence to support for the hypothesis that compensation policies in banking sector are designed to encourage risk-taking. Related to the same issue, Brewer, Hunter, et al. (2003) still used sample of banks in United States but for the more recent period (1992-2000). The results demonstrated a significantly positive effect of bank risk on the equity-based compensation. Harjoto and Moullineaux (2003) also supported for the result of Brewer, Hunter, et al. (2003) because they found a positive effect of bank risk (reflected in return variability) on each component of compensation (salary, bonus, and equity-based payment). Different from the previous research, Chen, Steiner, et al. (2006) treated bank risk as the dependent variable while

compensation was one of independent variables in the research model. The results are inconsistent with the conclusion of Houston and James (1995). They showed that the equity-based payment induces risk-taking and that the executive compensation structure promotes risk in banking industry.

Since the financial crisis happened, scholars have focused on examining the influences of individual compensation on risk in banking sector (risks are treated as dependent variable in the model). Exploring the relationship between CEO incentives and risks, Suntheim (2010) found the evidence of significant effects of CEO incentives on almost measures of risk. He therefore concluded that high sensitivity of CEO compensation to the change in volatility of stock return increases the total risk, the idiosyncratic risk as well as the systematic risk and decreases values for the distance-to-default of firm. Consistent with the result of Suntheim (2010), DeYoung, Peng, et al. (2009), Hagendorff and Vallasas (2011) also illustrated that bank with CEOs having high pay-risk sensitivity more invest on risky projects and take more credit risk.

While the influences of CEO incentives on bank risk are robust, results of research examining the ability of bonuses to effect on risk have produced equivocal evidences. For example, bonuses are illustrated to induce executive to take greater risks in research of Salami (2009), Kaplanski and Levy (2012), and Fortin, Goldberg, et al. (2010). However Ayadi (2011) in studying a sample of 53 European banks from 1999-2009 showed the evidence that annual bonuses negatively related to bank risk. Vallasas and Hagendorff supported for this result by showing that banks where CEOs receive large bonus payments display lower level of default risk. They further separate “highly risky” banks out of “least risky” banks and found that at highly risky banks, both CEO cash bonuses and stock option holdings increase bank risk-taking, whereas at the least risky bank, CEO bonuses lower risk and stock options do not induce risk-taking.

Some scholars have used very different measures of compensation from the previous research to examine the relationship between bank risk and executive pay. Fortin, Goldberg, et al. (2010), besides considering influences of bonus payments, they also studied the effects of executive salary. Results demonstrated that banks where CEOs being paid higher base salaries take less risk. Cheng, Hong, et al. (2009) used residual compensation which is calculated by residual of total annual compensation after controlling for firm size and finance sub-industry classifications in their research model. They found that residual pay is highly correlated with price-based risk (e.g. market risk, total risk, idiosyncratic risk) but weakly correlated with balance-sheet-based measures of risk (e.g. book leverage). Bolton, Mehran, et al. (2011) in the first theoretical part of research demonstrated that “excess risk taking can be addressed by basing compensation on both stock price and the price of debt (proxied by the CDS spread)”. In the second empirical part, they examined the effects of deferred

compensation on bank risk (measured by CDS). From their results, deferred compensation is believed to reduce risk for financial institutions.

### **3.2.2 Responsibility of executive compensation in the financial crisis**

The most recent financial crisis has drawn much attention to the CEOs payment in the banking industry. Without empirical evidence, the level and structure of executive compensation packages in the banking sector have been blamed by the financial press and public for causing excessive risk-taking behavior, which lead to this crisis. Scholars therefore have conducted some empirical research to examine if the executive compensation has to take responsibility for the financial crisis.

Considering a sample of 51 banks including largest 14 banks and 37 banks no-TARP in the United States for the period from 2000 to 2008, Bhagat and Bolton (2013) stressed that incentive compensation programs led to excessive risk-taking, which, in turn lead to the current financial crisis. With a database of 44 Danish banks from 1995 to 2009, Benchmann and Raaballe (2009) also found that “banks where the CEO received incentive-based compensation have performed worse during the financial crisis and generally have taken more risk than other banks”. Gande and Kalpathy (2013) examined the relation between the amount as well as duration of financial assistance receiving from Fed Reserve during the crisis and the CEO incentive compensation in the pre-crisis period. Significantly positive relations were illustrated. Suntheim (2010) also supported for the result that executive compensation have certain influences on bank performance during the financial crisis. The evidence from an international sample showed that banks relying on stock payment plan performed better than banks where CEOs received option-based payment.

In contrast to the above results, Fahlenbrach and Stulz (2009) demonstrated from their evidence that banks where CEO had received higher option compensation and larger cash bonuses did not perform worse during the crisis. Furthermore they categorized all banks into two groups: TARP banks who received the financial assistance of Fed Reserve and non-TARP banks. The objective was to examine differences in relation between bank performance and CEO incentives of these two kinds of banks. Results showed no difference between these two groups. This means that CEO incentive compensation cannot be blamed for the crisis or for the performance of banks during that crisis. Tung and Wang (2010) extend Fahlenbrach and Stulz (2009) by offering a new compensation approach, CEOs’ inside debt, which includes pension and other deferred compensation of executives. They investigated the link between CEOs’ inside debt holdings preceding the crisis and bank performance as well as bank risk-taking during the crisis. Results showed that CEOs’ inside debt holdings are significantly positive with bank performance and significantly negative with bank risk during the period of the crisis.

### **3.2.3 Differences in executive compensation policies**

Differences in executive compensation policy between bank industry and other fields have attracted scholars. Houston and James (1995) are two of the first authors mentioning this issue. Using panel data from 1980 to 1990, their evidence showed that though factors influencing compensation and turnover policies in banking sector were remarkably similar to the factors influencing such policies in other industries, executive compensation packages tended to be structured differently. Bank managers received less cash compensation and fewer equity-based incentives compared with their colleagues in other industries. Following Houston and James, differences in the structure of compensation between banks and non-banks or even within banking industry could be explained by the contracting hypothesis (Smith and Watts, 1992), meaning the nature of firm's assets and investment opportunity. Focusing on stock-option based executive compensation, Chen, Steiner, et al. (2006) also implied the differences in compensation policy between banks and industrial firms for the period 1992-2000. They demonstrated that the use of stock option-based compensation has become more widespread in the banking sector and the percentage of stock option-based relative to total compensation has also increased. Recently, Suntheim (2010) examined the managerial compensation with a data sample of 76 international banks from 1997-2008. The results illustrated that while cash compensation and bonuses are at the same level in almost countries, equity-based compensation are to be used more in American banks than banks from any other country. Furthermore, in countries with strong regulators, executive compensation in banking industry relates more to equity-based compensation than those from countries with weaker shareholder protection.

Over recent five decades, we have witnessed nearly 20 financial deregulations in United States (Sherman, 2009). These deregulations directly effect on daily activities as well as opportunities of banks. Scholars therefore would like to examine the effects of deregulations on compensation policy. The evidence of Crawford (1995) demonstrated that no relation between CEOs compensation and firm performance existed prior to the deregulation in 1982; however the pay-for-performance sensitivity has significantly increased after this deregulation. Related to the same topic, Brewer III, Hunter, et al. (2003) and Haijoto and Mullineaux (2003) all concluded that higher percentage of equity-based payment were used in compensation policy in the period after the deregulation. This result is still supported by the most recent research such as Hagendorff and Vallascas (2011) or DeYoung, Peng, et al. (2009).

### **3.2.4 Relationship between executive compensation and performance**

Examining the relationship between executive compensation and firm performance from the sample of 74 Bank holding companies (BHCs) in United States from 1992-2000, Haijoto (2003) stressed a strong relation between compensation incentive and performance. In more recent research, Salami (2009) also found from his empirical results that performance

has significantly positive relation with CEO compensation. His research was conducted with a database of the big six banks in Canada. However related to the main topic, results are not always the same. For example the evidence of Burghof (2000) demonstrated that though pay-for-performance sensitivity has a positive impact on bank performance, the impact is not significant.

### **3.2.5 Summary of research on executive compensation in banking sector**

Since the financial crisis happened, authorities as well as the public believe that executive compensation is an important reason of this crisis. According to them the pre-crisis compensation policies too focused on short-term achievements and much of excessive remuneration were not justified by performance. Many regulations therefore have been launched (without ample theoretical and empirical backing) to set limit for the short-term incentive compensation (bonuses) and to encourage remuneration which promote the long-term sustainability. For this reason, earlier banking executive compensation research has primarily focused on the relationships between executive pay and bank risks in general and the relationships between executive pay and bank risks/performance in the crisis period in specific. Results of these empirical works however are mixed. Consequently, the influences of executive pay on risks in banking sectors are still elusive.

There are some reasons of the differences in the above empirical results. First, while only some studies used database of non-U.S. banks (Burhof and Hofmann, 2000; Suntheim, 2010; Vallascas and Hagendorff, 2012; Ayadi, Arbak, et al., 2011; Benchmann and Raaballe, 2009; Salami, 2009), the rest basing on samples of U.S. banks. The difference is that a rather full database on compensation of U.S. banks could be collected from the Execucomp database, whereas studies on non-U.S. executive compensation based on hand-collected data from annual reports which mostly disclosed not all detail of compensation package. This problem evidently biased the results of studies. Second, the way scholars operationalize variables also might influence the results of studies. Scholars have used many different measures to refer bank risks (e.g. market-based risks, distance-to-default, z-score) and executive compensation (e.g. total compensation, annual bonuses, equity-based compensation, incentive compensation, inside debt). Finally, time frame also is a reasonable explanation for differences in research. For example Houston (1995) used a sample for the year 80s and found no evidence for relationship between compensation policies and bank risks. Chen, Steiner, et al. (2006) also examined the same relationship by using the database of the year 90s. Their results illustrated a significant effect of compensation structure on bank risk-taking in banking industry. Related to the most recent studies, using a time frame with or without the crisis-period also has certain impact on results. Fortin, Goldberg, et al. (2010) using a sample of 83 U.S. banks in 2005 concluded that both CEOs bonuses and CEOs stock options increase bank risks. Whereas Ayadi, Arbak, et al. (2011) had an opposite conclusion as their study based on the database from 1999-2009. Since the appearance of the financial crisis (2007 – 2008), executive compensation has been strictly controlled by regulations (low

level of compensation), whereas bank risks remain high. This issue therefore may distort the result of research which based on the database that covers both the pre-crisis period and the crisis period.

**Table 13 Studies on executive compensation and risks in banking sector**

| Year | Reference  | Sample                  | Years studied | Pay measures  | Performance or Risk Measures | Principle results  |
|------|--|-------------------------|---------------|---|------------------------------|--|
| 2000 | Burghof, H.-P. and C. Hofmann<br><br>“Executive’s compensation of European Banks – Disclosure, sensitivity, and their impact on Bank performance”. | 52 large European banks | 1995-1997     | Annual compensation (cash compensation, stock options, credit to board members) | ROE                          | <ul style="list-style-type: none"> <li>- “Bank size has a positive impact on the executive’s compensation”;</li> <li>- Disclosure level and ROE are highly positive correlated (0.01 significance level); Disclosure and compensation are positively associated also;</li> <li>- “Performance-pay-sensitivity (PPS) has a positive but non-significant impact on bank performance”;</li> <li>- “Disclosure level and higher pay-for-performance sensitivity are substitutes and not complements as stated in”;</li> <li>- “State owned banks show a lower performance”;</li> </ul> |



| Year | Reference   | Sample      | Years studied | Pay measures  | Performance or Risk Measures                                    | Principle results  |
|------|---|-------------|---------------|---------------|---|--|
| 2006 | Chen, C. R., T. L. Steiner, et al.<br><br>“Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry”. | 68 US banks | 1992-2000     | Stock options | Total risk, idiosyncratic risk, market risk, interest rate risk | -“Compare to a sample of industrial firms, the use of stock option-based compensation has become more widespread in the banking industry, and the % of stock option-based compensation relative to total compensation has also increased”;<br><br>-“The structure of executive compensation induces risk-taking in the banking industry ; risk also impacts compensation structure”;<br><br>-“The stock of option-based wealth induces risk-taking in the banking industry”. |

| Year | Reference   | Sample      | Years studied | Pay measures  | Performance or Risk Measures | Principle results   |
|------|---|-------------|---------------|---|------------------------------|---|
| 1995 | Houston, J. F. and C. James<br><br>“CEO compensation and bank risk – Is compensation in banking structured to promote risk taking?” | 134 US BHCs | 1980-1990     | Equity-based compensation (stock and stock options) | Variance in stock returns    | <p>- “No evidence to prove that compensation policies in banking are designed to encourage excessive risk taking”;</p> <p>- “Factors influencing compensation and turnover policies in banking are remarkably similar to the factors influencing such policies in other industries”;</p> <p>- Compensation packages tend to be structured differently in the banking industry:</p> <ul style="list-style-type: none"> <li>+ Bank managers receive less cash compensation/ fewer equity-based incentives;</li> <li>+ Cash compensation of bank managers is more sensitive to firm performance;</li> <li>+ The differences in the structure of compensation between banks and nonbanks /within the banking industry can be explained by the nature of the firm’s assets and investment opportunity</li> </ul> <p>Conclusion: Support to the contracting hypothesis.</p> |

| Year | Reference  | Sample      | Years studied | Pay measures   | Performance or Risk Measures                                | Principle results  |
|------|--|-------------|---------------|--|---|--|
| 2009 | Cheng, I.-H., H. G. Hong, et al.<br><br>“Yesterday’s Heroes: compensation and creative risk-taking”. | 95 US banks | 1992-2008     | Residual compensation calculated by:<br><br>residual of total annual firm compensation (bonus, salary, equity and option grants, other direct annual compensation) controlling for firm size and finance sub-industry classifications. | Market risk, total risk, tail cumulative return performance | <ul style="list-style-type: none"> <li>- “There are substantial cross-firm differences in total executive compensation residualized for firm size”;</li> <li>- “Residual pay is correlated with price-based risk taking measures including firm beta; return volatility, tail cumulative return performance, the sensitivity of firm stock price to the ABX subprime index”;</li> <li>- “Residual compensation is weakly correlated with balance-sheet based risk-taking measures”;</li> <li>- “Compensation and risk-taking are not related to governance variables but covary with ownership by institutional investors”;</li> </ul> |

| Year | Reference  | Sample      | Years studied | Pay measures               | Performance or Risk Measures  | Principle results  |
|------|--|-------------|---------------|----------------------------|---|--|
| 2010 | Tung, F. and X. Wang<br><br>“Bank CEOs, Inside debt compensation, and the global financial crisis” | 82 US banks | 2006-2008     | CEOs’ inside debt holdings | Idiosyncratic risk, annual provision for loan, mortgage-backed securities, bank-specific default risk | -“Bank CEOs’ inside debt holdings preceding the Crisis are significantly negatively associated with bank risk taking during the Crisis, but we again find no consistent empirical evidence suggesting that default risk has a significant impact on the disciplining role of inside debt”. |

| Year | Reference  | Sample      | Years studied | Pay measures | Performance or Risk Measures                | Principle results  |
|------|--|-------------|---------------|--------------|---|--|
| 2010 | Core, J. E. and W. R. Guay<br><br>“Is there a case for regulating executive pay in the financial services industry?” | 92 US banks | 2006          |              | Review and critique the regulation of TARP. | <p>-“Firstly they review the long-standing debate over executive pay and incentives in USA and the concern that US CEO pay is excessive and that US CEOs have too little performance incentive” =&gt; lead to the appearance of the recent regulation of TARP to curb CEOs’ compensation.</p> <p>- This research criticize the recent regulation with the following reasons:</p> <ul style="list-style-type: none"> <li>+ “US executives hold much more equity performance incentives than executives in any other country, so it is difficult to see that they have too little incentives”;</li> <li>+”There is no evidence that US executives are systematically over paid”;</li> <li>+ “Some risk-taking is necessary to compete effectively within the industry, so should we control tightly the risk-taking incentives of executives?”</li> <li>+”Many of the principals (TARP) are already engrained in the typical executive compensation plan”</li> </ul> |

| Year | Reference  | Sample      | Years studied | Pay measures   | Performance or Risk Measures         | Principle results  |
|------|--|-------------|---------------|--|--------------------------------------|--|
| 2009 | Fahlenbrach, R. and R. M. Stulz<br><br>“Bank CEO Incentives and the Credit Crisis” | 95 US banks | 2006-2008     | Short-term incentives (related to cash bonus and salary) and equity incentives (related to stock, stock options) | Performance: stock returns, ROA, ROE | <p>- “We find some evidence that banks with CEOs whose incentives were better aligned with the interests of shareholders performed worse and no evidence that they performed better”</p> <p>-“Banks with higher option compensation and a larger fraction of compensation in cash bonuses for their CEOs did not perform worse during the crisis”.</p> <p>Therefore, stock options had no adverse impact on bank performance during the crisis.</p> <p>-“ The relation between bank performance and CEO incentives does not differ between TARP and non-TARP banks”</p> <p>-“Bank CEOs did not reduce their holdings of shares in anticipation of the crisis or during the crisis”. =&gt; they “suffered extremely large wealth losses in the wake of the crisis”.</p> |

| Year | Reference   | Sample                 | Years studied | Pay measures   | Performance or Risk Measures                                    | Principle results  |
|------|---|------------------------|---------------|--|---|--|
| 2010 | Suntheim, F.<br><br>“Managerial Compensation in the Financial service industry” | 76 international banks | 1997-2008     | CEO incentives (the sensitivity of CEOs’ stock, option and restricted stock portfolio to a one percent change in stock price (delta) and to a 0.01 increase in volatility (sigma)) | Total risk, idiosyncratic risk, market risk, interest rate risk | <p>- “High vega contracts lead to higher volatilities, higher idiosyncratic and systematic risk and lower values for the distance-to-default”;</p> <p>- “Banks with high vega CEOs obtain a higher proportion of total income from non-interest activities (which are presumably riskier than the traditional lending business)”;</p> <p>- “High vega, low delta contracts are associated with lower capital ratios”;</p> <p>- “No effect of CEO incentives on Tier 1 capital”;</p> <p>- “Cash compensation and bonuses have reached similar levels in most countries; nevertheless CEOs from the US rely far more on equity based compensation than banks from any other country”;</p> <p>- “Banks from countries with strong regulators rely more on equity based compensation than those from countries with weaker shareholder protection”;</p> <p>- “CEO risk taking incentives (before crisis) had effect on the equity returns of banks during the period of the crisis in an international sample”;</p> <p>- “Accounting performance seems to depend strongly on the incentives provided to the CEO. Banks relying on option based compensation performed worse than banks whose CEOs held a large share in stocks”.</p> <p>- “CEOs did either not foresee the events or if they did they did not react to this insider information by selling their assets (Stulz)”</p> |

| Year | Reference  | Sample                            | Years studied | Pay measures                                   | Performance or Risk Measures | Principle results   |
|------|--|-----------------------------------|---------------|--|------------------------------|---|
| 2012 | Vallascas, F. and J. Hagendorff<br><br>“CEO remuneration and bank default risk: evidence from the U.S. and Europe” | 76 US banks and 41 European banks | 2000-2008     | Total bonus, total compensation, stock options | distance-to-default          | <p>- “They find that banks where CEOs receive large bonus payments display lower levels of default risk”.</p> <p>- “CEO stock option grants, whose payoffs structure is highly-convex, induce CEOs to prefer a higher level of default risk”;</p> <p>- “When banks are highly risky both CEO cash bonuses and stock option holdings are associated with higher bank risk-taking. By contrast, at the least risky banks, the payment of CEO cash bonuses lowers risk and stock options do not induce risk-shifting”.</p> |



| Year      | Reference   | Sample       | Years studied | Pay measures                 | Performance or Risk Measures       | Principle results  |
|-----------|---|--------------|---------------|------------------------------|------------------------------------|--|
| 2009      | DeYoung, R., E. Y. Peng, et al.<br><br>“Executive compensation in business policy choices at U.S. Commercial banks” | 134 US banks | 1994-2006     | CEO incentives (Vega, Delta) | Total risk, market risk, idio risk | <p>-“Bank CEOs respond to risk-taking incentives by taking more risk, and bank boards determine CEO risk-taking incentives conditional on extant bank business policies”.</p> <p>-“Banks in which CEOs have high pay-risk sensitivity (high vega banks) generate a larger percentage of their incomes from noninterest activities, invest a larger percentage of their assets in private mortgage securitizations and a smaller percentage of their assets in portfolios of real estate loans; and take more credit risk”.</p> <p>-“Compensation committees provided high-delta contracts as incentives for bank CEOs to exploit post-deregulation growth opportunities, as well as to shift from traditional on-balance sheet portfolio lending to less traditional investments and nontraditional fee generating activities”.</p> <p>- “Bank boards managed excessive risk-taking incentives at these banks by establishing complementarily high values of delta, particularly after industry deregulation expanded the scope of bank managers to take risk”.</p> <p>- “Banking executives were aware of the risks associated with their investments in private issue MBS (linking between high vega and MBS) (contrary to Kaplan and others claim that banks were misled by over optimistic ratings on MBS) as well as the increased risks associated with transactions banking business strategies (through linking high-vega to non-interest income)”.</p> <p>-“Optimal contract incentives are likely to vary substantially across firms and CEOs, while government prescriptions almost by necessity tend to be one size fits all”.</p> |
| 87   Page |   |              |               |                              |                                    | <p>- Contractual incentives designed by boards to mitigate principal-agent problems; contractual incentives imposed via regulation are presumably aimed at providing public goods (financial market stability, fairness) =&gt; they work far differently.</p>  |

| Year | Reference   | Sample | Years studied | Pay measures | Performance or Risk Measures | Principle results  |
|------|---|--------|---------------|--------------|------------------------------|--|
| 2009 | Phelan, C. and D. Clement<br><br>« Incentive compensation in the banking industry : Insights from Economic theory » |        |               |              | Theoretical research         | <p>Scenario review:</p> <p>1.”The original scenario was one of no debt and unlimited liability for stockholders. That resulted in an optimal compensation scheme because the bank paid its full costs and accrued its full benefits”.</p> <p>2.”The second scenario was one of limited stockholder liability; debt was not guaranteed by government and the interest rate stockholders must pay to bondholders for this nonguaranteed debt “=&gt; the bank paid its full costs and accrued its full benefits=&gt; choose efficient compensation plan.</p> <p>3.”The third one with limited stockholder liability and government guaranteed debt; the government charged a varying insurance premium depending on the compensation plan chosen by the stockholders” =&gt; bank chooses the efficient compensation scheme.</p> <p>4. “The fourth one, a government guarantees of bank debt with default insurance premiums that are fixed, unrelated to compensation” =&gt; bank choose an inefficient compensation scheme because government essentially subsidizes employee wages, and does so more when things go badly than when things go well.</p> |

| Year | Reference   | Sample                                    | Years studied | Pay measures                              | Performance or Risk Measures | Principle results   |
|------|---|---|---------------|---|------------------------------|---|
| 2011 | Celerier, C.<br><br>« Compensation in the Financial sector: Are all bankers superstars? » | Survey to employees in investment banking | 1983-2008     | Total compensation, variable compensation |                              | <p>-“Employees in investment banking are paid 60% more than they would be in other sectors of the economy”;</p> <p>-“Competition for industry specific talent may account for this premium”;</p> <p>-“Regulating the structure of compensation in the financial sector, restricting bonuses for example; may have no impact on the level of compensation. Progressive income taxation may rather be a solution to the problems of talent misallocation or wage inequalities”.</p> |

| Year | Reference  | Sample       | Years studied | Pay measures       | Performance or Risk Measures   | Principle results   |
|------|--|--------------|---------------|--------------------|--|---|
| 2009 | John, K., H. Mehran, et al.<br><br>“Outside monitoring and CEO compensation in the banking industry” | 126 US banks | 1993-2003     | Total compensation | Outside monitoring: subordinated debt ratio, subordinated debt rating, non performing loan ratio, BOPEC rating (Bank subsidiaries, Other nonbank subsidiaries, Parent company, Earnings, and Capital adequacy) | -“Pay-for-performance sensitivity of bank CEO compensation decreases with total leverage”;<br><br>-“The pay-for-performance sensitivity of bank CEO compensation increases with the intensity of the outside monitoring by regulators and subordinated debt holders”; |

| Year | Reference   | Sample            | Years studied | Pay measures   | Performance or Risk Measures   | Principle results  |
|------|---|-------------------|---------------|--|--|--|
| 2013 | Gande, A. and S. L. Kalpathy<br><br>“CEO compensation at Financial firms”                       | 69 US banks       | 2007          | CEO incentives (Vega)  |  | “Positive relation between financial assistance from Fed Reserve during the crisis and CEO risk-taking incentives in the pre-crisis period”.   |
| 2011 | Ayadi, R., E. Arbak, et al.<br><br>“Executive compensation and risk taking in European banking” | 53 European banks | 1999-2009     | Annual bonus on total pay.<br><br>Dummy of option, dummy of long-term bonus. | Z-score, total risk, market risk, interest rate risk, idiosyncratic risk | - “Option plans and annual bonuses do not increase risk (in relation to fixed pay)”<br><br>- “Long-term performance bonus plans have a deteriorating impact on the likelihood of failure”<br><br>- “Annual bonuses negatively correlated with bank risk” |

| Year | Reference   | Sample          | Years studied | Pay measures   | Performance or Risk Measures  | Principle results  |
|------|---|-----------------|---------------|--|---|--|
| 1995 | Crawford, A. J., J. R. Ezzell, et al.<br><br>“Bank CEO pay-performance relations and the effects of deregulation”   | 37 US banks     | 1976-1988     | Salary and bonus, stock options holdings, insider stock ownership                                | Performance: shareholder wealth   | <p>“Prior to deregulation: no relation between CEOs compensation and firm performance”.</p> <p>“After deregulation: the pay-performance sensitivity increases significantly”.</p> <p>Conclusion: “Bank CEO compensation became more sensitive to performance as bank management became less regulated “</p>  |
| 2009 | Bechmann, K. L. and J. Raaballe<br><br>“Bad Corporate Governance and Powerful CEOs in Banks: Poor Performance, Excessive Risk-taking, and a Misuse of Incentive-based Compensation” | 44 Danish banks | 1995-2009     | <p>Cash payment</p> <p>Equity-based payment (explaining how to pick data from annual report)</p> | <p>Performance: ROE</p> <p>Risk: loans divided by deposits, losses on loans/ total loans.</p> | <p>1. “Is it the case that banks where the CEO received incentive-based compensation have performed worse during the financial crisis and generally have taken more risk than other banks?” =&gt; Yes</p> <p>2. “Does the risk-taking in banks increase when incentive-based compensation is introduced to the CEO?” =&gt; No</p> <p>3. “Can poor performance and excessive risk-taking in some banks be explained by a lack of shareholder monitoring in combination with certain individual characteristics of the CEOs revealed by whether the CEOs receive incentive-based compensation or not?” =&gt; Yes</p> |

| Year | Reference  | Sample  | Years studied | Pay measures   | Performance or Risk Measures   | Principle results  |
|------|--|---|---------------|--|--|--|
| 2013 | Bhagat, S. and B. J. Bolton<br><br>“Bank Executive Compensation and Capital Requirements Reform” | Largest 14 US banks and other 37 US banks no-TARP | 2000-2008     | Salary, bonus, equity-based pay  | Risk: Z-score, the bank’s asset write-downs, the amount of Fed bailout programs. | <p>Their evidence illustrated that “managerial incentives matter -incentives generated by executive compensation programs led to excessive risk-taking by banks leading to the current financial crisis”.</p> <p>Compensation structure suggested: “only consist of restricted stock and restricted stock options (the executive cannot sell the shares or exercise the options for two to four years after their last day in office)”</p>   |
| 2011 | Bolton, P., H. Mehran, et al.<br><br>“Executive Compensation and Risk Taking”                    | 27 US banks                                       | 2007          | <p>sum of the value of stock holdings, options</p> <p>and restricted stock holdings, pensions, and deferred compensation</p> | CDS  | <p>Part 1:</p> <p>“A theoretical model of shareholders, debt holders, depositors and an executive demonstrates that (i) excess risk taking (in the form of risk-shifting) can be addressed by basing compensation on both stock price and the price of debt (proxied by the CDS spread), (ii) shareholders may not be able to commit to design compensation contracts in this way, and (iii) they may not want to due to distortions introduced by either deposit insurance or trusting debt holders”.</p> <p>Part 2:</p> <p>“Firms with larger investments in CEO deferred compensation experience a reduction in the CDS spreads at proxy announcements. A plausible reason for this reduction may be that banks are likely to be more conservative in terms of the riskiness of their investment choices.”=&gt; reduce risk for financial institutions.</p> |

| Year | Reference  | Sample       | Years studied | Pay measures   | Performance or Risk Measures   | Principle results  |
|------|--|--------------|---------------|--|--|--|
| 2003 | Brewer III, E., W. C. Hunter, et al.<br><br>"Deregulation and the relationship between bank CEO compensation and risk-taking." | 100 US banks | 1992-2000     | Cash-based (salary plus bonus) and Equity-based compensation | Performance: Market to book value of equity, ROA.<br><br>Risk: variance of daily stock return within a year. | -“EBC is significantly and positively correlated to the market-to-book value ratio”.<br>-“A negative but insignificant correlation between leverage and <i>EBC</i> ”.<br>- “Positive coefficient on the risk variable”.<br>- “Higher percentage of equity-based compensation in the period after deregulation”.<br>- “Positive correlation between the nontraditional noninterest sources of revenue, including revenue from Section 20 activity, and the use of equity-based compensation”. |
| 2010 | Fortin, R., G. M. Goldberg, et al.<br><br>"Bank Risk Taking at the Onset of the Current Banking Crisis."                       | 83 US banks  | 2005          | Salary, Option, Bonus  | Total risk, market risk, idiosyncratic risk  | -“Bank CEOs with greater power, achieved through share ownership or other corporate governance mechanisms, take less risk”.<br>-“Bank CEOs who are paid higher base salaries also take less risk”<br>-“Bank CEOs who are paid more in bonuses or in stock options take more risk”.   |



| Year | Reference  | Sample                            | Years studied | Pay measures   | Performance or Risk Measures        | Principle results  |
|------|--|-----------------------------------|---------------|--|-------------------------------------|--|
| 2011 | Hagendorff, J. and F. Vallasas<br><br>"CEO Pay Incentives and Risk-Taking: Evidence from Bank Acquisitions." | 172 US bank acquisitions          | 1993 - 2007   | CEO pay incentives (Vega, Delta – show clearly formulas) | Distance to default (clear formula) | <ul style="list-style-type: none"> <li>- “Contractual risk-taking incentives (vega) are higher following deregulation for the largest bank”.</li> <li>- “Higher pay-risk sensitivity causes CEO to engage in risk-increasing deals”.</li> </ul>  |
| 2003 | Harjoto, M. A. and D. J. Mullineaux<br><br>"CEO Compensation and the Transformation of Banking."             | 74 US BHCs (bank holding company) | 1992-2000     | Salary, bonus, options, stock.                           | Variability of returns              | <ul style="list-style-type: none"> <li>- “BHCs rely more on incentive compensation in the 1990s than in the 1980s”.</li> <li>- “Total CEO compensation at large BHCs equals or exceeds that of investment bank CEOs”.</li> <li>- “Strong relation between incentive compensation and performance”.</li> <li>- “Pay-for-performance sensitivity declines with total risk (variability of returns)”</li> <li>- “BHC compensation is closely related to risk”</li> <li>- “No relation between all types of CEO compensation and growth options”.</li> </ul> |

| Year | Reference   | Sample      | Years studied | Pay measures           | Performance or Risk Measures | Principle results   |
|------|---|-------------|---------------|------------------------|------------------------------|---|
| 2012 | KAPLANSKI, G. and H. LEVY<br><br>"Executive short-term incentive, risk-taking and leverage-neutral incentive scheme"                        |             |               | Bonus                  | Extremely leverage           | <p>- "Typical bonus incentive schemes do not necessarily induce the agent to take greater risks Ross (2004)".</p> <p>- "In most cases the typical bonus incentive schemes do, in fact, induce the agent to take greater risks. Therefore, we suggest a delicate structure for the bonus scheme, such that there is no incentive to change risk via a change in leverage".</p> <p>- "Agents should be compensated for efficient managing, but not according to random performance induced by leverage-taking, which may randomly increase or decrease the rate of return on equity".</p> <p>Conclusion: Optimal bonus scheme should be a "leverage-neutral bonus scheme"</p> |
| 2009 | Krause, R.<br><br>"Does "long-term compensation" make CEOs think long-term? A study of CEO compensation in the commercial banking industry" | 27 US banks | 2007          | Long-term compensation |                              | <p>- "No statistically significant evidence to suggest that the long-term portion of a CEO's pay is correlated with the percentage change in either a bank's net income or its allowance for loan losses, taken as a percentage of total loans".</p> <p>- "Some evidence that long-term compensation plans that incorporate preset performance goals may improve the chances of long-term stability".</p>   |

| Year | Reference   | Sample  | Years studied | Pay measures              | Performance or Risk Measures                                 | Principle results   |
|------|---|---|---------------|---------------------------|--|---|
| 2009 | Salami, F. O.<br><br>"CEO compensation and bank risk: empirical evidence from the Canadian banking system." | Canadian Big six banks  | 2000-2008     | Salary and annual bonus   | Performance: ROA<br><br>Risk: variance of daily stock return | - "Financial leverage of the six banks has no relationship with the banks' CEO compensation".<br><br>- "Banks' performance and riskiness have a significant relationship with the CEO compensation".  |
| 2011 | Victoravich, L., W. L. Buslepp, et al.<br><br>"CEO Power, Equity Incentives, and Bank Risk Taking."         | Different observations for different components of compensation | 2005-2009     | Equity-based compensation | Idiosyncratic risk, total risk, systematic risk              | - "CEO has more power, they can influence the board's decision-making to their benefit in reducing risk".<br><br>- "When CEO wealth is more tied to firm value, they are less likely to take on high risk projects as these projects could detriment their levels of personal wealth".<br><br>- "Powerful CEOs are more likely to take on risk when their personal wealth is tied to long-term firm value as opposed to short-term firm value". |

## 4 Conclusion of Part 1

In Part 1 we presented the background information based on which our research is conducted. In this part, we firstly introduced roles of banks in the economy in general before referring to the research context in the crisis period in particularly. We then discussed the important concepts which will be presented throughout this dissertation including *Executive compensation*; *Risk* and *Agency theory*.

Mentioning about executive compensation, we considered different components of a compensation package. For each component, we introduced its definition, the way to measure its value and its possible impact towards risk-taking. With regards to bank risk, different kinds were mentioned in this part. For each kind of bank risk, we presented its definition before coming to different measures (formulas of calculating) of risk. The objective of this dissertation is to investigate the influence of each component in the existed compensation package for executives on risk-taking in the banking sector. Since compensation schemes, following the agency theory, are primary means of converging the interests of principals and agents, it has been supposed mostly to be built based on this theory. As a result, the agency theory plays an important role in this research. We mentioned its definition and its origin in this part of dissertation.

Finally we reviewed the previous research to position the present dissertation in terms of existing knowledge in the executive compensation field. The literature review began by the traditional approaches to managerial compensation in general. Then it was followed by a review on executive compensation and its influence on risk-taking in the banking sector. As we would like to consider the effects of all important components in the executive compensation package to the risk-taking, this dissertation, regarding to the hypotheses, is particularly influenced by the work of Kaplanski and Levy (2012) which investigates the impact of annual bonus on bank risk; the work of Fortin, Goldberg et al. (2010) specialized on effects of executive salary on risk-taking; and the work of Bhagat and Bolton (2013) which focuses on relationship between incentive compensation programs and the current financial crisis. Mentioning about the methodology, we are mostly impacted by the research of Ayadi et al. (2012) which studies on the relationship between executive compensation and risk taking in European banks and the research of factors that determine European bank risk of Haq and Heaney (2012).

In summary, Part 1 provides us a very good background to conduct our own empirical research on relationship between executive compensation and bank risk-taking. Detail of methodology, database and results will be presented in Part 2: *Empirical research*.

## PART 2. EMPIRICAL RESEARCH

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We have mentioned in Part 1 of this dissertation the background information including research context, key concepts and literature review. Part 1 therefore provides us necessary knowledge to conduct empirical research with the aim of further investigating the effects of executive compensation on risk-taking in the banking sector. We present in Section 5 of this part our methodology of research which includes research questions, hypotheses and detail of methodology. Section 6 shows results of research as well as analysis. Section 6 includes two independent empirical research based on the same database. The former investigates effects of CEO annual compensation on bank risk during the period 2004-2008 by using panel data. The latter examines effect of CEO compensation on changes of bank risk during the financial crisis by using cross-sectional data.

### 5 Methodology of research

#### 5.1 Scope of research

Before going into details regarding the methodology of empirical research, we would like to present in this section the scope of research under which our studies will be operating.

Our first objective was to investigate effects of different components in compensation packages on risk-taking behavior of executives in the European banking sector. However in the process of conducting research we had a lot of difficulty gathering information on executive compensation. With limited time constraints, we must narrow the scope of study as follows:

In this dissertation, we only focus on CEO compensation but not executive compensation as originally planned. Our objective then is: 1/ To examine the impact of different modes of CEO compensation on bank risk-taking; 2/ To define responsibility of CEO compensation for the recent financial crisis.

Since our study focuses on a sample of European banks, we need as much information on CEO compensation as possible. It took us a lot of time to look for a professional database which provided this information. Most of the databases which are known as source of information on executive compensation can provide sufficient detail about remuneration of U.S. but not European banks. Executive remuneration of enterprises in some other sectors can be found at BoardEx, however the same information for banking sectors is very limited. Finally we decided to manually collect information on CEO compensation from the public documents of banks such as the annual reports, management proxy circulars or registration documents. Yet we still could not get large enough samples to test the hypotheses because this

type of information is only available for large banks. Our solution then is to add to the obtained sample of European banks other North American banks (U.S. and Canadian banks) which are the same size.

With regards to the theory which is based throughout this dissertation, it is Agency theory. Agency is the relationship between two parties: the principals and the agents – who are the representatives of the principals in transactions with a third party. As the principals hire the agents to perform a service on the principals' behalf, the principals delegate the authority of decision-making to the agents. Agency problems can appear due to incomplete information and inefficiencies. Agency theory then aims to solve problems that can exist in the agency relationship. Two agency relationships which are mostly referred to in corporate governance are those between stockholders and managers, and between stockholders and creditors. In the scope of this research, we only pay attention to the relationship between stockholders and managers.

Based on samples of large banks coming from Europe, U.K., U.S., and Canada, our research about the effect of CEO compensation on bank risk-taking as well as responsibility of CEO compensation towards the crisis has brought results that make a certain contribution to the current understanding of executive compensation. Details of research methodology and analysis of findings are presented in the next sections.

## 5.2 Research question

Since the financial crisis happened, authorities as well as the public believe that executive compensation is one of the reasons for this crisis. According to them, the pre-crisis compensation policies were too focused on short-term achievements and much excessive remuneration was not justified by performance. Many regulations therefore have been launched to set limits for the short-term incentive compensation (bonuses) and to encourage remuneration which promotes long-term sustainability. For this reason, earlier banking executive compensation research has primarily focused on the relationships between executive pay and bank risks in general and the relationships between executive pay and bank risks/performance in the crisis period more specifically. Results of these empirical works however are mixed. Consequently, the influences of executive pay on risks in banking sectors are still elusive.

With reference to the mixed results of the influence of executive pay on bank risks as well as the responsibility of compensation packages in the recent financial crisis, this dissertation is conducted with the objective of *investigating the effects of each component in the CEO compensation package on bank risk-taking*. The detail of research questions therefore are as follows:

- i/ How do CEO bonuses in the banking sector impact on bank risk?
- ii/ How do salaries of CEOs in the banking sector affect bank risk?

iii/ What are the effects of the other annual compensation of CEOs on risk-taking in the banking sector?

iv/ How does stock options awarded to CEOs in the banking sector influence bank risk in the crisis period?

v/ How does restricted stock awarded to CEOs affect bank risk in the crisis period?

vi/ Which components in the CEO compensation package should be regulated to control bank risk?

### 5.3 Hypotheses

This dissertation has two main objectives. The first one is to investigate the relationship between CEO compensation and bank risk-taking and the second one is to examine the responsibility of CEO compensation before the crisis for the financial crisis.

We learned from the previous studies the way to approach and handle problems. However in this dissertation, we consider a more diversified sample including banks from Europe, Canada and U.S. We take into account the effect of each component in CEO annual compensation package on bank risk-taking. Studies on the impact of CEO compensation on bank risk have focused mostly on equity-based compensation whereas CEO annual compensation is rarely concerned.

Following Kaplanski and Levy (2012), we deduce that because the annual bonus accounts for a large proportion in total annual compensation and is allocated based on a mostly short-term definition of bank performance, it tends to provide bank executives with myopic incentives. Since the executives are under pressure to chase the best results or complete the business expected annual forecasts, they will focus on near-term performance at the expense of long-term sustainability. This leads to the following hypothesis:

a. Hypothesis 1: CEO annual bonus increases with bank risk-taking.

Bank risks that are taken into account in this part of research are measured through market-based risks (total risk, systematic risk and idiosyncratic risk), credit risks (ratio of loan loss provision to total assets, ratio of non-performing loan to total loan) and z-score. Hypothesis 1A therefore is divided into these followings:

*Hypothesis 1.1: CEO annual bonus increases with bank's total risk.*

*Hypothesis 1.2: CEO annual bonus increases with bank's systematic risk.*

*Hypothesis 1.3: CEO annual bonus increases with bank's idiosyncratic risk.*

*Hypothesis 1.4: CEO annual bonus increases with bank's ratio of loan loss provision to total assets.*

*Hypothesis 1.5: CEO annual bonus increases with bank's ratio of non-performing loan to total assets.*

*Hypothesis 1.6: CEO's annual bonus decreases with z-score.*

b. Hypothesis 2: Percentage of annual bonus awarded to CEO in total CEO annual compensation increases bank risk-taking.

Hypothesis 2 is detail by the following sub-hypotheses:

*Hypothesis 2.1: Percentage of annual bonus awarded to CEO in total CEO annual compensation increases with bank's total risk.*

*Hypothesis 2.2: Percentage of annual bonus awarded to CEO in total CEO annual compensation increases with bank's systematic risk.*

*Hypothesis 2.3: Percentage of annual bonus awarded to CEO in total CEO annual compensation increases with bank's idiosyncratic risk.*

*Hypothesis 2.4: Percentage of annual bonus awarded to CEO in total CEO annual compensation increases with bank's ratio of loan loss provision to total assets.*

*Hypothesis 2.5: Percentage of annual bonus awarded to CEO in total CEO annual compensation increases with bank's ratio of non-performing loan to total assets.*

*Hypothesis 2.6: Percentage of annual bonus awarded to CEO in total CEO annual compensation decrease with bank's z-score.*

With regards to executives' fixed pay, it is a component that is independent from the performance of individuals or of the bank. The fixed pay may be paid in different forms and under different names: basic salary, dearness allowance, city compensatory allowance, house/car rent allowance, pension... In the report on executives' compensation, normally the fixed compensation is classified under two main groups: salary and other annual compensation. As they do not depend on bank performance, executives receive the same amounts in a certain period regardless of their contribution. Consequently they have no motivation to take risky projects but prefer risk-free investments which certainly bring stability to the bank. Based on a sample of 83 U.S banks, research of Fortin, Goldberg, et al. (2010) is one of very few studies that examine the influence of executive salary on bank risk. Their results show that banks where CEOs are being paid higher base salaries take less risk. We then establish the next hypothesis related to the effect of CEO salary as follows:

c. Hypothesis 3: CEO salary decreases with bank risk-taking.

Hypothesis 3 is divided into the sub-hypotheses:



*Hypothesis 3.1: CEO salary decreases with bank's total risk.*

*Hypothesis 3.2: CEO salary decreases with bank's systematic risk.*

*Hypothesis 3.3: CEO salary decreases with bank's idiosyncratic risk.*

*Hypothesis 3.4: CEO salary decreases with bank's ratio of loan loss provision to total assets.*

*Hypothesis 3.5: CEO salary decreases with bank's ratio of non-performing loan to total assets.*

*Hypothesis 3.6: CEO salary increases with bank's z-score.*

d. Hypothesis 4: Percentage of CEO salary in total CEO annual compensation decreases with bank risk-taking.

Hypothesis 4 is divided by the following sub-hypotheses:

*Hypothesis 4.1: Percentage of CEO salary in total CEO annual compensation decreases with bank's total risk.*

*Hypothesis 4.2: Percentage of CEO salary in total CEO annual compensation decreases with bank's systematic risk.*

*Hypothesis 4.3: Percentage of CEO salary in total CEO annual compensation decreases with bank's idiosyncratic risk.*

*Hypothesis 4.4: Percentage of CEO salary in total CEO annual compensation decreases with bank's ratio of loan loss provision to total assets.*

*Hypothesis 4.5: Percentage of CEO salary in total CEO annual compensation decreases with bank's ratio of non-performing loan to total assets.*

*Hypothesis 4.6: Percentage of CEO salary in total CEO annual compensation increases with bank's z-score.*

To our knowledge, we have not seen any study on the other annual compensation of CEO in the banking sector. In general, the main components of CEO other annual compensation are define-benefit pension plans which guarantee that a CEO will receive a definite amount of benefit upon retirement; various perquisites such as free use of a company car or company aircraft or house rent allowance...; severance payments in case of a CEO's departure; dividends of shares which have been granted but have not yet vested. Since this is an annual payment without any condition of bank performance, we suppose that it does not induce managers to take more risky activities. However, in case the other annual compensation of CEO accounts for a significant proportion in CEO's total annual

compensation (this is very common in U.S. and Canadian banks), problems may occur. As a CEO can get significant payments even if his decisions in leading bank are right or wrong, the making-decision therefore may be not conservative enough. From this perspective, we suppose that CEO's other annual compensation may increase bank risks due to imprudent decisions. Consequently the hypothesis 5 is:

e. Hypothesis 5: CEO other annual compensation increases with bank risk-taking.

The sub-hypotheses are as follows:

*Hypothesis 5.1: CEO other annual compensation increases with bank's total risk.*

*Hypothesis 5.2: CEO other annual compensation increases with bank's systematic risk.*

*Hypothesis 5.3: CEO other annual compensation increases with bank's idiosyncratic risk.*

*Hypothesis 5.4: CEO other annual compensation increases with bank's ratio of loan loss provision to total assets.*

*Hypothesis 5.5: CEO other annual compensation increases with bank's ratio of non-performing loan to total assets.*

*Hypothesis 5.6: CEO other annual compensation decreases with bank's z-score.*

f. Hypothesis 6: Percentage of CEO other annual compensation in total CEO annual compensation increases with bank risk-taking.

Hypothesis 6 is divided as followings sub-hypotheses:

*Hypothesis 6.1: Percentage of CEO other annual compensation in total CEO annual compensation increases with bank's total risk.*

*Hypothesis 6.2: Percentage of CEO other annual compensation in total CEO annual compensation increases with bank's systematic risk.*

*Hypothesis 6.3: Percentage of CEO other annual compensation in total CEO annual compensation increases with bank's idiosyncratic risk.*

*Hypothesis 6.4: Percentage of CEO other annual compensation in total CEO annual compensation increases with bank's ratio of loan loss provision to total assets.*

*Hypothesis 6.5: Percentage of CEO other annual compensation in total CEO annual compensation increases with bank's ratio of non-performing loan to total assets.*

*Hypothesis 6.6: Percentage of CEO other annual compensation in total CEO annual compensation decreases with bank's z-score.*

The second objective of this dissertation is to investigate a possible responsibility of CEO compensation that existed before the crisis towards the recent financial crisis. To quantify the responsibility of CEO compensation, we consider the relationship between CEO compensation which existed before the crisis and the change in bank risk during the crisis period. The reason why we use this relationship to reflect the responsibility of CEO compensation (if any) is presented in Section 5.4. It is a new approach to examine compensation's role in the crisis. We suppose that if a certain component in CEO compensation package is one of the important roots of the crisis, it must also play a significant role in explaining a sharp change in bank risk during the crisis period.

Assuming that a CEO's bonus compensation provides bank executives with myopic incentives, and then it induces bank managers to focus on near-term performance at the expense of long-term sustainability. If that is true, CEO bonus that existed before the crisis (we mean the bonus plan before 2006 that had not yet been modified too much by regulations on executive pay) must be found to augment changes in bank risk during the crisis period. We therefore have a set of hypotheses as follows:

g. Hypothesis 7: CEO bonus that existed before the crisis augments changes in bank risk during the crisis period.

Hypothesis 7 is divided into sub-hypotheses:

*Hypothesis 7.1: CEO bonus that existed before the crisis augments change in bank's total risk during the crisis period.*

*Hypothesis 7.2: CEO bonus that existed before the crisis augments change in bank's idiosyncratic risk during the crisis period.*

*Hypothesis 7.3: CEO bonus that existed before the crisis augments change in bank's ratio of loan loss provision to total assets during the crisis period.*

*Hypothesis 7.4: CEO bonus that existed before the crisis augments change in bank's ratio of non-performing loan to total assets during the crisis period.*

*Hypothesis 7.5: CEO bonus that existed before the crisis augments change in bank's z-score during the crisis period.*

*Hypothesis 7.6: CEO bonus that existed before the crisis augments change in bank's ratings during the crisis period.*

*Hypothesis 7.7: CEO bonus that existed before the crisis augments change in bank's CDS during the crisis period.*

*Hypothesis 7.8: CEO bonus that existed before the crisis augments change in bank's sharp drop in stock price during the crisis period.*

h. Hypothesis 8: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases changes in bank risk during the crisis period.

Sub-hypotheses of Hypothesis 8 are as follows:

*Hypothesis 8.1: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's total risk during the crisis period.*

*Hypothesis 8.2: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's idiosyncratic risk during the crisis period.*

*Hypothesis 8.3: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's ratio of loan loss provision to total assets during the crisis period.*

*Hypothesis 8.4: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's ratio of non-performing loan to total assets during the crisis period.*

*Hypothesis 8.5: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's z-score during the crisis period.*

*Hypothesis 8.6: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's ratings during the crisis period.*

*Hypothesis 8.7: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's CDS during the crisis period.*

*Hypothesis 8.8: Percentage of CEO bonus in CEO total annual compensation that existed before the crisis increases change in bank's sharp drop in stock price during the crisis period.*

CEO salary is not supposed to generate motivation for bank managers to take risk. Moreover, under the agency theory, managers are risk-adverse; consequently they will prefer to retain stability of banks rather than follow risky projects. Following this logic, CEO salary that existed before the crisis should play a role in narrowing or at least have no relation to changes in bank risk during the crisis period.

i. Hypothesis 9: CEO salary existed before the crisis decreases with changes in bank risk during the crisis period.

j. Hypothesis 10: Percentage of CEO salary in CEO total annual compensation existed before the crisis decreases with changes in bank risk during the crisis period.

CEO other annual compensation though is a fixed component, however as we mentioned in Hypothesis 5, it may lead managers to make imprudent decisions when this component accounts for a large proportion of total annual compensation. We therefore investigate these two following hypotheses in this dissertation.

k. Hypothesis 11: CEO other annual compensation existed before the crisis increases with changes in bank risk during the crisis period.

l. Hypothesis 12: Percentage of CEO other annual compensation in CEO total annual compensation existed before the crisis increases with changes in bank risk during the crisis period.

The use of equity-based instruments to compensate managers has been widely applied all over the world. However since the financial crisis in 2008, executive compensation in general and equity-based payments in particular begin to be suspected to induce excessive risk-taking from managers that causes negative effects on firms in the long-term. Following the research of Bhagat and Bolton (2013) which stressed that incentive compensation programs led to excessive risk-taking in banking sector, which, in turn led to the current financial crisis, we have hypotheses 13 and 14:

m. Hypothesis 13: Usage of stock to compensate CEO in the pre-crisis period increases change in bank risk during the crisis period.

*Hypothesis 13.1: Usage of stock to compensate CEO in the pre-crisis period increases change in bank's total risk during the crisis period.*

*Hypothesis 13.2: Usage of stock to compensate CEO in the pre-crisis period increases change in bank's idiosyncratic risk during the crisis period.*

*Hypothesis 13.3: Usage of stock to compensate CEO in the pre-crisis period increases change in bank's ratio of loan loss provision to total assets during the crisis period.*

*Hypothesis 13.4: Usage of stock to compensate CEO in the pre-crisis period increases change in bank's ratio of non-performing loan to total assets during the crisis period.*

*Hypothesis 13.5: Usage of stock to compensate CEO in the pre-crisis period increases the drop in bank's z-score during the crisis period.*

*Hypothesis 13.6: Usage of stock to compensate CEO in the pre-crisis period decreases change in bank's ratings during the crisis period.*

*Hypothesis 13.7: Usage of stock to compensate CEO in the pre-crisis period increases change in bank's CDS during the crisis period.*

*Hypothesis 13.8: Usage of stock to compensate CEO in the pre-crisis period increases bank's sharp drop in stock price during the crisis period.*

n. Hypothesis 14: Usage of stock options to compensate CEO in the pre-crisis period increases change in bank risk during the crisis period.

*Hypothesis 14.1: Usage of stock options to compensate CEO in the pre-crisis period increases change in bank's total risk during the crisis period.*

*Hypothesis 14.2: Usage of stock options to compensate CEO in the pre-crisis period increases change in bank's idiosyncratic risk during the crisis period.*

*Hypothesis 14.3: Usage of stock options to compensate CEO in the pre-crisis period increases change in bank's ratio of loan loss provision to total assets during the crisis period.*

*Hypothesis 14.4: Usage of stock options to compensate CEO in the pre-crisis period increases change in bank's ratio of non-performing loan to total assets during the crisis period.*

*Hypothesis 14.5: Usage of stock options to compensate CEO in the pre-crisis period increases the drop in bank's z-score during the crisis period.*

*Hypothesis 14.6: Usage of stock options to compensate CEO in the pre-crisis period decreases change in bank's ratings during the crisis period.*

*Hypothesis 14.7: Usage of stock options to compensate CEO in the pre-crisis period increases change in bank's CDS during the crisis period.*

*Hypothesis 14.8: Usage of stock options to compensate CEO in the pre-crisis period increases bank's sharp drop in stock price during the crisis period.*

## **5.4 Methodology**

We conduct in this dissertation two independent empirical research though they are based on the same source of database. The former investigates effects of CEO annual compensation on bank risk during the period 2004-2008 by using panel data. Since our objective is to investigate which component in executive compensation package induces bank risk-taking, we treat risk as dependent variables while executive compensation as independent variable in the model of research. In the model we consider also the effects of control variables. The general model therefore is:

$$Risk = f(CEO\ compensation, control\ variables) \quad (33)$$

The latter examines the responsibility of CEO compensation for the financial crisis. Through the crisis period, most of banks were impacted in the direction that all types of risk rapidly increased. The level of change in bank risk is very different from one bank to another. For example with regard to the stock price in the banking market, most of banks suffered a sharp drop in value in the period 2006-2008. While some banks even lost most of their stock value such as Dexia (-90%), Bank of Ireland (-96%) or Fannie Mae (-99%), some other banks suffered a reduction in stock price of less than 50% such as Royal bank of Canada (-44%) or Bank of Nova Scotia (-46%). We assume that changes in bank risk during the crisis period therefore captures better the effect of the crisis on banks than risks under the form of level. As a result, changes in bank risk are placed into the second research model of this dissertation as dependent variables while independent variables are still CEO compensation and control variables (equation 34). The regression is based on cross-sectional data.

$$\Delta Risk = f(CEO\ compensation, control\ variables) \quad (34)$$

Details of research models are presented in Section 5.4.4. However before mentioning details of research models, we discuss the risk calculation in Section 5.4.1; CEO compensation in Section 5.4.2; and the control variables in Section 5.4.3. These are variables which are used throughout the dissertation. Finally a presentation of data and building of a database is referred in Section 5.4.5.

#### 5.4.1 Risk calculation

Bank risk in this dissertation is considered under the form of level. Some examples of bank risk under the form of level are systematic risk, total risk, idiosyncratic risk, z-score, and credit risk. Whereas change in risk ( $\Delta Risk$ ) is under the form of variation during a certain period (e.g, change in systematic risk, change in total risk, change in credit risk, change in z-score, and change in bank ratings and so on)

For the first empirical research which investigates effects of CEO annual compensation on bank risk during the period 2004-2008 by using panel data, risks under the form of level are placed into the research model (equation 48). To capture bank risk under the form of level, we use both the market-based measures and the book value based measures. With regards to the second empirical research, our aim is to examine responsibility of CEO compensation for the financial crisis. As referred above, we consider changes in bank risk as dependent variables in the second research model (equation 49). We discuss therefore in the following sections the calculation of market-based measures of risk, accounting-based measures of risk, and measures of change in bank risk.

#### 5.4.1.1 Market-based measure of risk

To capture the market measures of risk of bank, we use the systematic risk, the idiosyncratic risk and the total risk pulled out from the following equation:

$$R_{jt} = \alpha_j + \beta_j(R_{Mt}) + u_{jt} \quad (35)$$

Where

$R_{jt}$  is the vector of daily returns of bank stock j;

$\alpha_j$  is called the stock's alpha which is the abnormal return;

$R_{Mt}$  is the vector of daily returns on the market index;

$\beta_i$  is called the stock's beta which measures the sensitivity of the bank's stock returns to stock market movements;

$u_{jt}$  is vector of the random error terms;

$\alpha_i, \beta_i, u_{it}$  are pulled out from regression of stock returns ( $R_{it}$ ) on market returns ( $R_{Mt}$ ).

$\sigma_j^2$  is the variance of stock returns of bank j;

$\sigma_M^2$  is the variance of market index;

$\sigma_{ui}^2$  is the variance of the random error terms;

Then

- The total risk is calculated by using the standard deviation of stock returns of bank j ( $\sigma_i$ )
- The systematic risk is measured by  $\beta_i$
- The idiosyncratic risk is calculated by using the standard deviation of the random error terms ( $\sigma_{ui}$ )

These market-based measures of risk are calculated each year for each bank basing on daily data available in that year.

#### 5.4.1.2 Accounting-based measure of risk

##### **The credit risk**

Loan items account for a significant proportion of the assets of banks as well as returns from this activity are very important. In this field of business however banks have to face either the risk of loss of principal or loss of financial reward stemming from a borrower's failure to repay a loan. This kind of risk is labeled "the credit risk". A loan that is in default or close to being in default is named "Non-performing loan". In order to prevent bad consequences from the bad loans, banks need to set aside an expense called "Loan loss provision". These two items are disclosed in the balance sheet of each institution. To capture the credit risk of firms, we consider the proportion of the non-performing loan over the total assets and the proportion of the loan loss provision over the total assets. The former ratio lets us know the actual situation of bank's bad debt while the latter gives the idea of the situation of potential bad debt.



To consider measures of credit risks of banks, we follow these two equations:

$$LLP_{i,t} = \frac{VLLP_{i,t}}{TL_{i,t}} * 100\% \quad (36)$$

$$NPL_{i,t} = \frac{VNPL_{i,t}}{TL_{i,t}} * 100\% \quad (37)$$

Where  $LLP_{i,t}$  is the percentage of loan loss provision to total loan

$NPL_{i,t}$  is the percentage of non-performing loan to total loan

$VLLP_{i,t}$  is the value of loan loss provision of bank  $i$  in year  $t$ .

$VNPL_{i,t}$  is the value of non-performing loan of bank  $i$  in year  $t$ .

$TL_{i,t}$  is the value of total loan of bank  $i$  in year  $t$ .

#### **The z-score, measure of insolvency risk**

Z-score lets us know how many standard deviations the  $ROA$  of bank at time  $t$  is away from the point  $(-KOA)$  (meaning firm's loss is equal to firm's own capital) or in another words, how different the firm's financial situation is from the point of bankruptcy. The formula is as follows:

$$Z_t = \frac{ROA_t + KOA_t}{\sigma_{ROA}} \quad (38)$$

Where

$ROA_t$  measured by Returns on Assets (%) of firm at time  $t$  ;

$KOA_i$  measured by Equity on Assets (%) of firm at time  $t$ ;

$\sigma_{ROA}$  is the standard deviation of firm's  $ROA$ ;

As a result, the higher the Z-score is the better financial situation the bank is in. Because of its nature, Z-score measures the distance-to-insolvency; therefore it is normally used to capture firm's risk of bankruptcy.

#### **5.4.1.3 Measures of change in bank risk**

In the crisis period, most of banks were impacted in the direction that all types of risk rapidly increased. However effects of the crisis on banks reflected by rapid change in each

type of risk did not happen at the same moment. For example a sharp drop in stock price occurred in the period 2006-2008 whereas changes in bank ratings only can be seen in the period 2007-2011. We therefore based on the evolution of each type of risk to identify an estimation period which is suitable for each indicator. We consider in this section general formulas to calculate measures of change in bank risk. Detail of estimation period then is presented in Section 5.4.4.2.

To measure the maximum loss that banks had to suffer during the financial crisis period ( $t_0$ - $t_T$ ) which started at time  $t_0$  and extended to time  $t_T$ , we take into account the changes of the following indicators:

- Sharp drop in stock price: measured by the difference between the maximum stock price and the minimum stock price divided by the maximum stock price during the crisis period. This indicator illustrates how many percent a bank lost in stock value in the crisis period.

$$Sharp\_drop_j = \frac{P_{jmax} - P_{jmin}}{R_{jmax}} * 100\% \quad (39)$$

Where

$P_{jmax}$  is the maximum price of bank stock j during the period crisis ( $t_0$ - $t_T$ ).

$R_{jmin}$  is the minimum price of bank stock j during the period crisis( $t_0$ - $t_T$ ).

$Sharp\_drop_j$  is the difference between the maximum stock price and the minimum stock price divided by the maximum price of bank stock j during the period ( $t_0$ - $t_T$ ).

- Change in a bank rating: A bank rating is usually an assigned letter grade (e.g, AAA, AA+, AA, A, B, CCC...) on formulas that synthesize the bank's situation on capital, assets quality, management, earnings, liquidity, and sensitivity to market risk. As a result, a change in a bank rating is also a mirror of a change in value of a bank over the crisis period ( $t_0$ - $t_T$ ). Since a bank rating is a qualitative indicator, we follow Ferri, Kalmi et al. (2014) to transform it into a quantitative indicator. Detail of this transformation is presented in Section 5.4.4.2. General equation to calculate change in bank's rating is as follow:

$$Change\_bank\_rating_j = BankRate_{jT} - BankRate_{jo} \quad (40)$$

Where

$Change\_bank\_rating_j$  is the change in ratings of bank j over the crisis period ( $t_0$ - $t_T$ ).

$BankRate_{jT}$  is the ratings of bank j at time  $t_T$ .

$BankRate_{jo}$  is the ratings of bank j at time  $t_0$ .

- Change in z-score during the crisis period ( $t_0$ - $t_T$ ): In the crisis period, a banks' z-score most significantly decreases. To capture how many percent a bank's z-score declines, we consider the following:

$$Change\_Z\_score_j = \frac{Z\_score_{j0} - Z\_score_{jT}}{Z\_score_{j0}} * 100\% \quad (41)$$

Where

$Change\_Z\_score_j$  is the change in z-score of bank j over the crisis period ( $t_0$ - $t_T$ ).

$Z\_score_{jT}$  is the z-score of bank j at time  $t_T$ .

$Z\_score_{j0}$  is the z-score of bank j at time  $t_0$ .

$Z\_score$  is an indicator which shows how many standard deviations the  $ROA$  of bank at time  $t$  is away from the point ( $-KOA$ )

$$Z_t = \frac{ROA_t + KOA_t}{\sigma_{ROA}} \quad (42)$$

- Change in credit risk during the crisis period ( $t_0$ - $t_T$ ): Impacted by the crisis, credit risk of banks mostly increased. To measure how many times credit risk augments, we use the two following measures:

$$Change\_LLP_j = LLP_{jT} - LLP_{j0} \quad (43)$$

$$Change\_NPL_j = NPL_{jT} - NPL_{j0} \quad (44)$$

Where

$Change\_LLP_j$  is the change in the loan loss provision ratio of bank j.

$Change\_NPL_j$  is the change in the non-performing loan ratio of bank j.

$LLP_{jT}$  is the rate of loan loss provision to total loan of bank j at time  $t_T$ .

$LLP_{j0}$  is the rate of loan loss provision to total loan of bank j at time  $t_0$ .

$NPL_{jT}$  is the rate of non-performing loan to total loan of bank j at time  $t_T$ .

$NPL_{j0}$  is the rate of non-performing loan to total loan of bank j at time  $t_0$ .

$LLP$  is the percentage of loan loss provision to total loan

$NPL$  is the percentage of non-performing loan to total loan

- Change in total risk during the crisis period ( $t_0$ - $t_T$ ): to capture how many times bank's total risk increased in the crisis period, we calculate the following indicator:

$$Change\_total\_risk_j = \frac{\sigma_{jT}}{\sigma_{jo}} \quad (45)$$

Where

$Change\_total\_risk_j$  is the change in the total risk of bank j.

$\sigma_{jT}$  is the total risk of bank j at time  $t_T$ .

$\sigma_{jo}$  is the total risk of bank j at time  $t_o$ .

- Change in idiosyncratic risk during the crisis period ( $t_o$ - $t_T$ ): to capture how many times bank's idiosyncratic risk increased in the crisis period, we calculate the following indicator:

$$Change\_idio\_risk_j = \frac{\sigma_{ujT}}{\sigma_{uj0}} \quad (46)$$

Where

$Change\_idio\_risk_j$  is the change in the idiosyncratic risk of bank j.

$\sigma_{ujT}$  is the idiosyncratic risk of bank j at time  $t_T$ .

$\sigma_{uj0}$  is the idiosyncratic risk of bank j at time  $t_o$ .

- Change in CDS (credit default swap) during the crisis period ( $t_o$ - $t_T$ ): to capture how many times a bank's CDS increased in the crisis period, we calculate the following indicator:

$$Change\_CDS_j = \frac{CDS_{jT}}{CDS_{jo}} \quad (47)$$

Where

$Change\_CDS_j$  is the change in the credit default swap of bank j.

$CDS_{jT}$  is the credit default swap of bank j at time  $t_T$ .

$CDS_{jo}$  is the credit default swap of bank j at time  $t_o$ .

#### 5.4.2 CEO compensation calculation

CEO compensation can be considered as the most important variable in our research. Actually the collection of information on CEO compensation is the hardest part of our work. It took us a lot of time to look for a source that supplies information on executive compensation, especially for European banks. Initially, we intended to examine effects of executive compensation (including compensation for both CEOs and other executive directors) on risk-taking in the European banking sector. We started by looking for a source

that could supply in detail information on executive compensation for the list of banks on which we focused. We firstly looked in the database that previous studies used to compile compensation data for the banking sector. Sources that were mostly used are Execucomp, Thomson One Banker. However we soon realized that information on executive compensation for European banks is not available in these sources. We then followed research that focused on executive compensation in the Europe area to look for a clue to the source of this information. A source that may supply information on compensation for European firms is BoardEx. We then contacted BoardEx to ask for any available information for our bank list. BoardEx replied to our request and let us know some general information as well as the price for buying data. As we were supported financially by our laboratory, we then had many discussions with the representative of BoardEx via email as well as by telephone on issues of database condition and price. We finally had an appointment through the internet with the aim that the representative of BoardEx could show us the availability of information that we requested. Results were not expected since we could not get information on compensation for most of European banks in our list. Our effort with BoardEx therefore was not successful.

We restarted the process of looking for sources of executive compensation in another way. At that time, as FactSet was supporting our laboratory some of its services, we had the opportunity to use the full service for one month. However, FactSet has no information on executive compensation. We made contact with a representative of FactSet to ask for consultation related to compensation data. She suggested some names of databases that may include this type of information such as IODS, CIQ People Intelligence... However, after sending her our requests in detail, we soon received a result of no available data for our list of banks.

We got by chance information from the website of Harvard Library that Thomson One Banker is another source of executive compensation database. As we cannot afford for buying database from Thomson One Banker, we had to look for more reasonable solution. We contacted the representatives of some university libraries in France to ask for the availability of Thomson One Banker in their list of databases as well as procedure for accessing database of visitors. After receiving the only favorable reply from Dauphine University Paris' Library, we came to work there for one week to exploit Thomson One Banker. The result was not bad since we found there information on executive compensation for most of banks in our list. However after looking closely into the contents of database supplied by Thomson One Banker, we realized some following limits:

- All important components in compensation package are available for Canadian and U.S. banks. In case of European banks we mostly found information on annual compensation (salary, bonus and other annual compensation) whereas equity-based compensations are rarely reported.

- Not as other financial indicators (e.g, bank assets, bank capital....) that can be saved under data tables (e.g, excel format), information on each individual executive compensation appears on the computer's screen and we found no way to save it under table format (excel format) that allows the display of data on compensation of different individuals or different years. We firstly tried to ask for a help from the technical assistant of the library but no solution was found. We then contacted the support service of Thomson One Banker in France to be confirmed the ability of collecting data under table format. The result was not as expected since the representative confirmed that due to the sensitivity of information on executive compensation, Thomson One Banker does not supply instrument to collect this type of data under table format. Consequently, we had to save each screen on compensation information of each individual under image format. After all compensation data was manually inputted together into a table under excel format. Because the time working at the Dauphine University Paris's library was limited, we only took into account information on compensation of CEO.

In this section, we detail the calculation of CEO compensation that suitable to our database under two groups: Annual compensation, and Equity-based compensation.

#### *5.4.2.1 Annual compensation*

We consider CEOs' annual compensation under two forms as follows: 1/ *Log value of each annual component* includes: Total annual compensation, salary, annual bonus and other annual compensation; 2/ *Proportional value of each annual component* includes percentage of salary, percentage of annual bonus, and percentage of the other annual compensation. The proportional value is measured by the value of each component over the total annual compensation which is a sum of salary, annual bonus and the other annual compensation.

#### *5.4.2.2 Equity-based compensation*

As our objective is to investigate the effect of each component in the CEO compensation package on the bank risk, equity-based compensation is the most important because of its ability to incentivize executives to take risk (reference to section Equity-based compensation of Part I).

In the previous studies, the compensation variable in the model research is normally the value of equity-based compensation (stock options' value or stock's value). Since most of these studies were based on the U.S. samples, information about either equity-based compensation's value or parameters needed to calculate a stock option's value is available on professional databases such as Thomson One Banker, Execucomp, BoardEx...

Since this dissertation focuses on a sample of European banks, we need as much information about CEO compensation as possible. It took us a lot of time to look for a professional database which provided this information. Most of the databases which are known as source of information on executive compensation can provide sufficient detail about remuneration of U.S. but not European banks. Executive remuneration of enterprises in some other sectors can be found at BoardEx, however the same information for banking sectors is very limited. Finally we decide to manually collect information on CEO compensation from the public documents of banks such as the annual reports, management proxy circular or registration document... Yet we still cannot get large enough samples to test the hypotheses. Our solution then is to add to the obtained sample of European banks other North American banks which have the same size (detail of the sample is illustrated in the section *Sample of selection*). As executive compensation in Europe is not disclosed under a common standard and not obligated during the pre-crisis period, the amount of information on this subject is very different from one country to the other and from one bank to the other. In order to exploit as much as possible the detail related to CEO compensation, especially the equity-based compensation, we apply the following solutions:

- Separately examine the effect of stock options compensation and share-based compensation. That means in the model, each time we only use either stock options compensation or share-based compensation as the compensation variable. Because many banks in the sample don't disclose at the same time sufficient information on both stock options and share-based compensation, simultaneously using two of them in a model will reduce the number of observation.

- Due to the lack of information, we cannot calculate the value of stock options or stocks awarded to CEO for all cases in our sample. Even the number of stock or stock options awarded to CEO is only disclosed by some European banks. As a result, we use the dummy of usage stock options/ stock to capture effect of equity-based compensation on changes in bank risk during the crisis period. A dummy variable is to account for whether equity-based compensation in banks is used or not. For example, in year  $t$ , if stock options compensation is used to compensate CEO, then *Dummy\_options* is 1, if not is 0. Likewise, if restricted stock are awarded in year  $t$  to CEO, then *Dummy\_stock* is 1, if not is 0.

#### 5.4.3 Control variables

Following the research of Haq and Heaney (2012) which studies about the factors determining European bank risk, we take into consideration the effects of bank size, bank's capital, and bank's charter value as determinants of bank risk. We then add GDP growth rate as it measures the changes in the economy environment and bank's loan as it captures assets structure of banks into our model of research.

#### *5.4.3.1 Bank size*

Bank size is measured by natural logarithm of total assets. Bank size may have certain effect on bank risk. Following Konishi and Yasuda (2004), because large banks have more chance to be internally diversified than small banks, the idiosyncratic risk of large banks is possible smaller than the one of small banks. In this extent, bank size reduces the idiosyncratic risk. Large banks, under regulatory protection, are considered “too big to fail”, as a result they may prefer to undertake riskier activities (Saunders et al., 1990, De Haan and Poghosyan, 2011, Demsetz and Strahan 1997). In the study of Anderson and Fraser, 2000, large banks are illustrated to be more sensitive to the market movements than small banks. Consequently, the impact of bank size may be positive to this measure of risk but negative to the other one.

#### *5.4.3.2 Bank capital*

Bank capital is measured by capital adequacy ratio which is calculated by a bank's core capital expressed as a percentage of its risk-weighted assets. Using information for 117 European banks, Haq and Heaney (2012) found that bank capital has a negative effect on both bank equity risk and credit risk. This conclusion is consistent with prior research (Furlong and Keeley, 1989; Besanko and Kanatas, 1996). However when a bank capital squared is add-on, the results then illustrate no relation between the new factor and systematic risk or credit risk (Haq and Heaney, 2012). This non-linear (i.e. U-shaped) relationship is explained by the possibility that banks with high level of capital may choose to undertake riskier activities after they were forced to further increase their capital buffer. We follow Haq and Heaney (2012) in considering the effect of bank capital on bank risk.

#### *5.4.3.3 Charter value*

Charter value is measured as a market to book value of bank assets. The calculation is a sum of market value of equity and book value of liabilities then divided by book value of total assets. The effect of charter value on bank risk is concluded to be negative following Keeley 1990, Park and Peristiani, 2007, Anderson and Fraser, 2000. Their explanation is that banks possibly choose to avoid risk to protect their charter values. However evidence of positive relation between charter value and bank risk also exists (Saunders and Wilson, 2001). The authors suppose that as charter value captures growth opportunities which originate from taking on more risky but profitable activities, then both bank risk and charter value tend to move in the same direction. Using a sample of only European banks, Haq and Heaney, 2012 found a negative effect of charter value on bank credit risk, however the relationship between charter value and bank equity risk is significant positive.



#### *5.4.3.4 Bank loan*

Bank loan is calculated as the ratio of net loans of a bank to total assets, expressed in percentage. This factor aims to capture the bank's assets structure because it measures the portion of assets which are held in outstanding loans (Mansur and Zitz, 1993). Evidence of positive relationship between bank loan and bank risk is illustrated. The explanation is that the issuance of loans may reduce the amount of capital available to meet short-term or unexpected obligations, therefore increase liquidity issues (Agusman et al., 2008; Mansur and Zitz, 1993). However in another study, banks with a large loan portfolio are shown to prefer reducing banks risk to prevent possible liquidity shocks (Jokipii and Milne, 2010).

#### *5.4.3.5 GDP*

We consider the effect of GDP growth rate of each country. As GDP growth reflects changes in the economic environment, banks therefore face greater risk during periods of contracting economic activity (Salkeld, 2011). Following the previous conclusion, we expect a negative effect of GDP on bank risk in our model but positive effect of GDP on z-score as z-score measures the distance to bank failure.

### *5.4.4 Regression analysis*

In order to deeply understand possible effects of executive pay on risk-taking in the banking period, we firstly examine impact of CEO compensation for the period 2003-2007 on bank risk of the period 2004-2008 by using a panel data. We choose this time frame because information on compensation was not widely disclosed before 2003. Since 2008, after the bankruptcy of Lehman Brothers along with the financial distress of many other banks, executive compensation immediately has been strictly controlled by authorities. We suppose that research based on executive compensation database after 2007 therefore cannot reflect the nature of executive pay's impact on risk-taking.

We then use a set of cross sectional data to investigate relationship between CEO compensation which existed before the crisis and bank risk at the time of the crisis period. This empirical research will help us to answer the questions related to CEO compensation's responsibility in the financial crisis.

#### *5.4.4.1 Examine effect of CEO compensation on bank risk during the period 2004-2008 by using panel data*

We firstly investigate the relationship between each component in the annual compensation package and bank risk by using panel data. Based on the research of Ayadi et al. (2012) which studies on the relationship between executive compensation and risk taking in European banks and the research of factors that determine European bank risk of Haq and Heaney (2012), we use the following model to empirically test our hypotheses:

$$Risk_{i,j,t} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j,t-1} + \beta_2 Size_{i,j,t-1} + \beta_3 BC_{i,j,t-1} + \beta_4 BC_{i,j,t-1}^2 \\ + \beta_5 CV_{i,j,t-1} + \beta_6 LOAN_{i,j,t-1} + \sum \phi_i Y_{i,t} + \varepsilon_{i,j,t} \end{cases} \quad (48)$$

Where

Subscripts  $i$  denotes individual banks ( $i = 1, 2, \dots, 63$ ),  $j$  denotes country ( $j = 1, 2, \dots, 16$ ) and  $t$  denotes time period ( $t = 2004, 2005, \dots, 2008$ ).

$\varepsilon$  denotes the error term.

*Risk*: three types of risk are considered, including *Market measures of risk*, *Measures of credit risk*, and *Z-score* in which:

- Market measures of risk include: total risk (*TOTARISK*), systematic risk (*SYSTRISK*), idiosyncratic risk (*IDIORISK*).
- Measures of credit risk include: loan loss provision ratio (*LLP*) and non-performing loan ratio (*NPL*).

*Compensation*: We consider CEOs' compensation under two forms as follow: 1/ *Log value of each annual component* includes: Total annual compensation (*TOTALCOMP*), salary (*SALARY*), annual bonus (*BONUS*) and other annual compensation (*OTHERS*); 2/ *Proportional value of each annual component* includes percentage of salary (*SALARYPER*), percentage of annual bonus (*BONUSPER*) and percentage of the other annual compensation (*OTHERPER*). The proportional value is measured by value of each component over total annual compensation which is a sum of salary, annual bonus and the other annual compensation.

*Size*: is measured by natural logarithm of total assets.

*BC*: is bank capital, measured by a bank's core capital expressed as a percentage of its risk-weighted assets.

$BC^2$ : is square of bank capital.

*CV*: is charter value, measured by market to book value of bank assets which is a sum of market value of equity and book value of liabilities then divided by book value of total assets.

*LOAN*: is bank loan, measured by ratio of net loans of a bank to total loan.

*Y*: year dummies for period 2005-2008.

The definition of the variables in the above model is as mentioned in Section 2 and also as summarized in Appendix 5.

We follow the method for estimation that Haq and Heaney (2012) used to do regression of bank risk on CEO compensation. That is two-step system generalized method of moments (GMM) which introduced by Arellano and Bover (1995) and Blundell and Bond (1998). In the above equation, bank specific variables such as bank capital, charter value, and bank size may be endogenous. In addition, our sample is small and contains unobserved bank and country level heterogeneity. In this case we suppose that the system GMM is the most suitable method to estimate the equation (48) as it is considered to display the best features in terms of small bias and precision (Soto, 2009). Appendix 8 provides a brief description of the system GMM.

#### *5.4.4.2 Examine effect of CEO compensation on bank risk at the time of financial crisis by using cross-sectional data*

Since 2008, executive compensation in the banking sector has been considered as one of the main reasons leading to excessive risk-taking decisions which are the root of the banks' financial distress. The objective of this dissertation is to examine responsibility of CEO compensation package which existed in the pre-crisis period towards the recent financial crisis. Through the crisis period, most of banks were impacted in the direction that all types of risk rapidly increased. We therefore investigate the responsibility of CEO compensation towards the crisis through relation between each component in the compensation package in the pre-crisis period and sharp changes in all types of bank risk during the crisis period. If a compensation component has responsibility towards the crisis, it must have some certain effects on these changes in bank risk. Our work is based on the multiple regression model with a cross-sectional data. The general model of research is as follow:

$$\Delta Risk_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases} \quad (49)$$

Where

Subscripts  $i$  denotes individual banks ( $i = 1, 2, \dots, 63$ ),  $j$  denotes country ( $j = 1, 2, \dots, 16$ )

$\varepsilon$  denotes the error term.

$\Delta Risk$ : is the change of each bank risk measure during the crisis period. We define the estimation period based on the evolution (Figure 12) of each measure of bank risk. Our principal is to take into account the period in which including the year 2008 and the indicator studied has unique trend. Consequently,  $\Delta Risks$  are calculated as follows:

- Sharp drop in stock price (*SHARDROP*): measured by the difference between the maximum price and the minimum price over the maximum price during the crisis period (2006-2008).

$$SHARDROP_j = \frac{P_{jmax} - P_{jmin}}{P_{jmax}} * 100\% \quad (50)$$

Where

$P_{jmax}$  is the max price of bank stock j during the period 2006-2008.

$P_{jmin}$  is the min price of bank stock j during the period 2006-2008.

$SHARDROP_j$  is the difference between the maximum price and the minimum price divided by the maximum price of bank stock j during the period 2006-2008.

- Changes in bank's rating ( $\Delta RATING$ ):

$$\Delta RATING_j = BankRate_{j2011} - BankRate_{j2007} \quad (51)$$

Where

$\Delta RATING_j$  is the change in ratings of bank j over the period 2007-2011.

$BankRate_{j2011}$  is the ratings of bank j at the end of year 2011.

$BankRate_{j2007}$  is the ratings of bank j at the end of year 2007.

As an assessment of a bank's health to give its rating has a certain lag, we do not use the time frame as the same as the crisis period (2006-2008) but we based on the later time frame (2007-2011) to calculate this factor. In this dissertation, we use Fitch ratings both for long-term rating scale and short-term rating scale. We follow the research of Ferri, Kalmi et al. (2014) which mentions about switching from letter-based ratings to number-based ratings to calculate change in bank ratings. However the numeric equivalent of notes on bank ratings in our research is based on suggestion of database FactSet. Appendix 3 provides numeric equivalent of notes on bank ratings suggested by FactSet and Appendix 4 presents numeric equivalent of notes on bank ratings for our data).

- Drop in z-score ( $\Delta ZSCORE$ ).

$$drop\_ZSCORE_j = \frac{Z\_score_{j2006} - Z\_score_{j2008}}{Z\_score_{j2006}} * 100\% \quad (52)$$

Where

$Drop\_ZSCORE_j$  is the change in z-score of bank j over the crisis period 2006-2008.

$Z\_score_{j2008}$  is the z-score of bank j at the end of year 2008.

$Z\_score_{j2006}$  is the z-score of bank j at the end of year 2006.

- Change in credit risk during the crisis period:

Based on the evolution of banks' credit risk (figure 12), we define the period that banks had to suffer the most due to banks' loan activities is 2006-2009.

$$\Delta LLP_j = LLP_{j2009} - LLP_{j2006} \quad (53)$$

$$\Delta NPL_j = NPL_{j2009} - NPL_{j2006} \quad (54)$$

Where

$\Delta LLP_j$  is the change in the loan loss provision ratio of bank j.

$\Delta NPL_j$  is the change in the non-performing loan ratio of bank j.

$LLP_{j2009}$  is the rate of loan loss provision to total loan of bank j at the end of year 2009

$LLP_{j2006}$  is the rate of loan loss provision to total loan of bank j at the end of year 2006.

$NPL_{j2009}$  is the rate of non-performing loan to total loan of bank j at the end of year 2009.

$NPL_{j2006}$  is the rate of non-performing loan to total loan of bank j at the end of year 2006.

- Change in total risk ( $\Delta TOTARISK$ ) during the crisis period 2006-2008 (based on the evolution of total risk illustrated in Figure 12).

$$\Delta TOTARISK_j = \frac{\sigma_{j2008}}{\sigma_{j2006}} \quad (55)$$

Where

$\Delta TOTARISK_j$  is the change in the total risk of bank j.

$\sigma_{j2008}$  is the total risk of bank j at the end of year 2008.

$\sigma_{j2006}$  is the total risk of bank j at the end of year 2006.

- Change in idiosyncratic risk ( $\Delta IDIORISK$ ) during the crisis period 2006-2008 (based on the evolution of idiosyncratic risk illustrated in Figure 12).

$$\Delta IDIORISK_j = \frac{\sigma_{uj2008}}{\sigma_{uj2006}} \quad (56)$$

Where

$\Delta IDIORISK_j$  is the change in the idiosyncratic risk of bank j.

$\sigma_{uj2008}$  is the idiosyncratic risk of bank j at the end of year 2008.

$\sigma_{uj2006}$  is the idiosyncratic risk of bank j at the end of year 2006.

- Change in CDS ( $\Delta CDS$ ) during the crisis period 2007-2009. Information on CDS started to be available on the market at the end of 2007 for most of the banks in our list. Since then, this index of banks has continuously increased until recently. However we choose the time frame 2007-2009 for our research to examine effects of CEO compensation existed before the crisis period since we suppose that after 2009, change in CDS might be impacted by other reasons, not only by the crisis.

$$\Delta CDS_j = \frac{CDS_{j\max}}{CDS_{j2007}} \quad (57)$$

Where

$\Delta CDS_j$  is the change in the credit default swap of bank j.

$CDS_{j\max}$  is the max credit default swap of bank j during the period 2007-2009.

$CDS_{j2007}$  is the credit default swap of bank j at the end of year 2007.

Based on the set of hypotheses in Section 5.3, we summarize expectation of relationships between CEO compensation and bank risks in Table 14 and between CEO compensation and changes in bank risk during the crisis period in Table 15.

**Table 14 Summarize expectation of relationships between CEO compensation and bank risks**

|           | H.1<br>TOTARISK | H.2<br>SYSTRISK | H.3<br>IDIORISK | H.4<br>LLP | H.5<br>NPL | H.6<br>z-score | Hypothesis<br>H |
|-----------|-----------------|-----------------|-----------------|------------|------------|----------------|-----------------|
| BONUS     | +               | +               | +               | +          | +          | -              | 1               |
| BONUSPER  | +               | +               | +               | +          | +          | -              | 2               |
| SALARY    | -               | -               | -               | -          | -          | +              | 3               |
| SALARYPER | -               | -               | -               | -          | -          | +              | 4               |
| OTHERS    | +               | +               | +               | +          | +          | -              | 5               |
| OTHERPER  | +               | +               | +               | +          | +          | -              | 6               |

**Table 15 Summarize expectation of relationships between CEO compensation and changes in bank risk during the crisis period**

|               | H.1<br>$\Delta$ TOTARISK | H.2<br>$\Delta$ IDIORISK | H.3<br>$\Delta$ LLP | H.4<br>$\Delta$ NPL | H.5<br>drop_Zscore | H.6<br>$\Delta$ Ratings | H.7<br>$\Delta$ CDS | H.8<br>SHARDROP | Hypothesis<br>H |
|---------------|--------------------------|--------------------------|---------------------|---------------------|--------------------|-------------------------|---------------------|-----------------|-----------------|
| BONUS         | +                        | +                        | +                   | +                   | +                  | -                       | +                   | +               | 7               |
| BONUSPER      | +                        | +                        | +                   | +                   | +                  | -                       | +                   | +               | 8               |
| SALARY        | -                        | -                        | -                   | -                   | -                  | +                       | -                   | -               | 9               |
| SALARYPER     | -                        | -                        | -                   | -                   | -                  | +                       | -                   | -               | 10              |
| OTHERS        | +                        | +                        | +                   | +                   | +                  | -                       | +                   | +               | 11              |
| OTHERPER      | +                        | +                        | +                   | +                   | +                  | -                       | +                   | +               | 12              |
| STOCK usage   | +                        | +                        | +                   | +                   | +                  | -                       | +                   | +               | 13              |
| OPTIONS usage | +                        | +                        | +                   | +                   | +                  | -                       | +                   | +               | 14              |

*Compensation:* We consider both annual compensation and equity-based compensation.

- *Annual compensation of the year 2006:* considered under two following groups: 1/ *Log value of each annual component* includes: Total annual compensation (*TOTALCOMP*), salary (*SALARY*), annual bonus (*BONUS*) and other annual compensation (*OTHERS*); 2/ *Proportional value of each annual component* includes percentage of salary (*SALARYPER*), percentage of annual bonus (*BONUSPER*) and percentage of the other annual compensation (*OTHERPER*). The proportional value is measured by value of each component over total annual compensation which is a sum of salary, annual bonus and the other annual compensation.

- *Equity-based compensation:* including stock and stock options awarded to CEO. We consider in this dissertation dummy of equity-based compensation usage (*OPTUSE*; *STOUSE*) during the period 2005-2007. As equity-based compensation has a long vesting time and may have capacity to induce managers to take risk in long-term, we consider using equity-based compensation in the period of three years before the year 2008 meaning 2005-2007. In this period, if a bank used at least one time stock option to compensate CEO, then dummy *OPTUSE* is 1, if not it is 0. Likewise, if stock was used at least one time to pay to CEO, then *STOUSE* is 1, if not it is 0.

*Control variables:* To control multicollinearity problem and the validation of model, we re-define set of control variables each time starting regression on new type of dependent variable (*ΔRisk*). We rely on the following principles to select the appropriate set of control variables for each regression:

- The maximum variance inflation factor (VIF) value is not greater than 2.50<sup>27</sup>
- The F test for regression illustrates that the model is valid

As a result, set of control variables may include one or more following indicators:

*BC:* is bank capital at the end of the year 2006, measured by a bank's core capital expressed as a percentage of its risk-weighted assets.

*CV:* is charter value at the end of the year 2006, measured by market to book value of bank assets which is a sum of market value of equity and book value of liabilities then divided by book value of total assets.

*LOAN:* is bank loan at the end of the year 2006, measured by ratio of net loans of a bank to total assets.

*GDP:* is the GDP growth rate of each country in the year 2008.

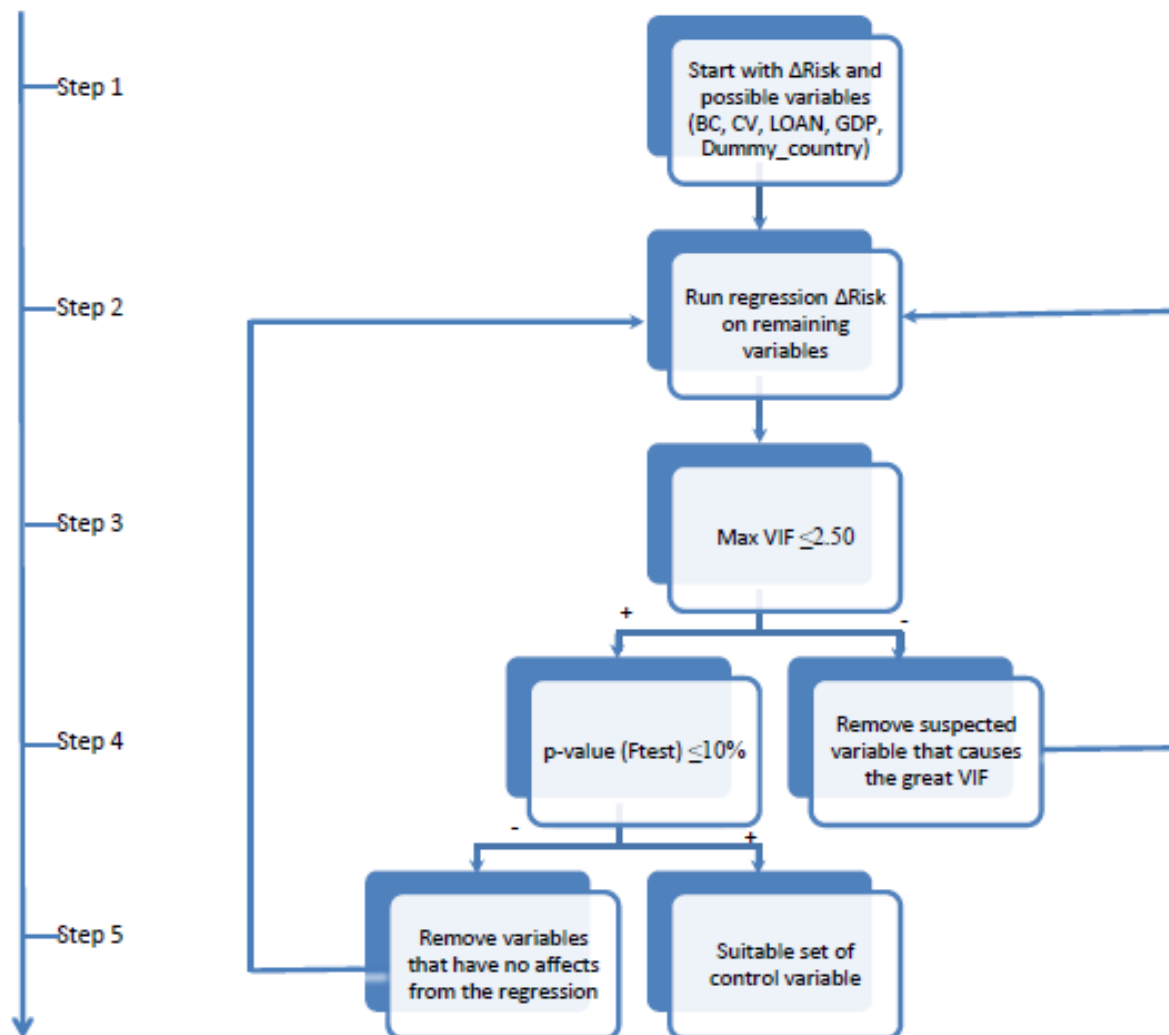
*Dummy\_region:* is dummy of U.S., Canada, U.K., and Europe.

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<sup>27</sup> Suggestion of Paul Allison available at <http://statisticalhorizons.com/multicollinearity>

The process of defining a suitable set of control variables to model that related to a certain type of  $\Delta Risk$  is as follows (Figure 11):

**Figure 11 Process of defining a suitable set of control variables to each research model related to certain type of  $\Delta Risk$**



To define an appropriate set of control variable for each model, we firstly run regression  $\Delta Risk$  on all the variables listed above, including BC, CV, LOAN, GDP and Dummy\_country. If the maximum VIF pull out from the regression is greater than 2.50, we remove the variable that is suspected to create the great VIF. We come back to run regression  $\Delta Risk$  on the rest variables at Step 2. However if the maximum VIF at Step 3 is not greater than 2.50, we take into account F-test of the regression to see if the model is valid or not. If the p-value of F-test is not greater than 10%, it means the model is valid, therefore we consider all the dependent variables in the regression into the suitable set of control variable. Conversely, if the p-value of F-test is greater than 10%, we remove variables that are



illustrated to have no effect on  $\Delta Risk$ . We come back to Step 2 to run regression with the rest variables. Repeating this process and our results are shown below:

Models which suitable to each  $\Delta Risk$  are as follows:

- *SHADROP*:

$$SHARDROP_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases} \quad (58)$$

- *ΔRATING*:

$$\Delta RATINGLT_{i,j} = \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 GDP_j + \beta_3 LOAN_{i,j} + \varepsilon_{i,j} \quad (59)$$

$$\Delta RATINGST_{i,j} = \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 GDP_j + \beta_3 LOAN_{i,j} + \varepsilon_{i,j} \quad (60)$$

- *Drop\_Zscore*

$$Drop\_Zscore_{i,j} = \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 CV_{i,j} + \beta_3 dummy\_region + \varepsilon_{i,j} \quad (61)$$

- *ΔLLP*:

$$\Delta LLP_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases} \quad (62)$$

- *ΔNPL*:

$$\Delta NPL_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases} \quad (63)$$

- *ΔTOTARISK*:

$$\Delta TOTARISK_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases} \quad (64)$$

- *ΔIDIORISK*:

$$\Delta IDIORISK_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases} \quad (65)$$

-  $\Delta CDS$ :

$$\Delta CDS5Y_{i,j} = \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 GDP_j + \beta_3 LOAN_{i,j} + \varepsilon_{i,j} \quad (66)$$

$$\Delta CDS1Y_{i,j} = \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 GDP_j + \beta_3 LOAN_{i,j} + \varepsilon_{i,j} \quad (67)$$

#### 5.4.5 Presentation of data and building of the database

We firstly collect financial data from FactSet database. A list of all banks from America, Canada, United Kingdom and Western Europe which have total assets larger than USD 20 billion in 2001 is considered. Following the above condition, a list of 88 banks is comprised. Since the compensation policy is normally unique in each group, we exclude 14 banks that are not the GUO (Global Ultimate Owner) from the list for the main purpose of looking for a relationship between CEO compensation and bank risk-taking. We then gather all financial data which is the source of computing the dependent variable (Risks) as well as the control variables from January 2003 to December 2011<sup>28</sup>. Information on bank rating is compiled from BankScope<sup>29</sup>. We begin our investigation period at the start of 2003 because information on executive compensation of many European banks was not disclosed before 2003 (Table 16).

Information on CEO compensation is partly compiled from the Thomson One Banker. Following this database, CEO compensation mostly is classified into six categories: salary; bonus; annual other compensation; restricted stock awards; LTIPs (Long term incentive plans) and other compensation. However data reported in these categories is not consistent among banks. For example for one bank both options awards and executive pension are included in the other compensation, but for another bank, only executive pension is reported in the other compensation while option awards is in the category of LTIPs. Another example of the inconsistency is that bonus reported for this bank includes annual bonus in cash while deferred annual bonus which is paid in shares appeared in restricted stock awards category; however for another bank we can find these two amounts all in the bonus category. To be sure about the consistency in each category among banks, we download the official documents (such as annual report, management proxy circular or registration document...) that disclose compensation policy of all banks to double-check all obtained data.

<sup>28</sup>The market indexes used to compute all the market-based measures of risk are listed in the Appendix.

<sup>29</sup>Numeric equivalent of notes on bank rating is listed in the Appendix (following the introduction of FactSet).

**Table 16 Number of banks that disclosed CEO compensation from 2003 to 2010**

| Year | Zone    | Banks in sample | Number of banks disclosing information on |           |            |                    |
|------|---------|-----------------|---|-----------|------------|--------------------|
|      |         |                 | Annual compensation                       | CEO bonus | CEO salary | Other compensation |
| 2003 | America | 21              | 19  | 19        | 19         | 19                 |
|      | Canada  | 6               | 6   | 6         | 6          | 6                  |
|      | England | 6               | 1   | 1         | 1          | 1                  |
|      | Europe  | 30              | 5   | 5         | 5          | 5                  |
| 2004 | America | 21              | 19  | 19        | 19         | 19                 |
|      | Canada  | 6               | 6   | 6         | 6          | 6                  |
|      | England | 6               | 6   | 6         | 6          | 6                  |
|      | Europe  | 30              | 11  | 11        | 11         | 11                 |
| 2005 | America | 21              | 20  | 20        | 20         | 20                 |
|      | Canada  | 6               | 6   | 6         | 6          | 6                  |
|      | England | 6               | 6   | 6         | 6          | 6                  |
|      | Europe  | 30              | 18  | 18        | 18         | 18                 |
| 2006 | America | 21              | 20  | 20        | 20         | 20                 |
|      | Canada  | 6               | 6   | 6         | 6          | 6                  |
|      | England | 6               | 6   | 6         | 6          | 6                  |
|      | Europe  | 30              | 22  | 22        | 22         | 22                 |
| 2007 | America | 21              | 21  | 21        | 21         | 21                 |
|      | Canada  | 6               | 6   | 5         | 6          | 6                  |
|      | England | 6               | 6   | 6         | 6          | 6                  |
|      | Europe  | 30              | 24  | 24        | 24         | 24                 |
| 2008 | America | 21              | 21  | 21        | 21         | 21                 |
|      | Canada  | 6               | 6   | 5         | 6          | 6                  |
|      | England | 6               | 6   | 6         | 6          | 6                  |
|      | Europe  | 30              | 24  | 24        | 24         | 24                 |
| 2009 | America | 21              | 21  | 21        | 21         | 21                 |
|      | Canada  | 6               | 6   | 5         | 6          | 6                  |
|      | England | 6               | 6   | 6         | 6          | 6                  |
|      | Europe  | 30              | 24  | 24        | 24         | 24                 |
| 2010 | America | 21              | 21  | 21        | 21         | 21                 |
|      | Canada  | 6               | 6   | 5         | 6          | 6                  |
|      | England | 6               | 6   | 6         | 6          | 6                  |
|      | Europe  | 30              | 30  | 30        | 30         | 30                 |

Then we re-categorized CEO compensation into 4 groups:

- a. Salary which reports a fixed amount paid in cash periodically.
- b. Bonus includes annual bonus paid in cash, deferred bonus and voluntary deferral bonus paid in shares.

c. Equity incentive compensation paid in shares/options with a vesting period lasts from three years to ten years.

d. Other Compensation includes all other amounts CEOs receive: benefit in kinds such as cars, insurances; pension funds; dividends of shares granted under share payment plans or interest accrued for amount of bonus deferred.

Related to the equity-based compensation, to fit well our method of research we manually collected from public documentation of all banks in our list because information got from Thomson One Banker firstly is limited for European banks and secondly is reported under the different form from what we need (e.g number of stock option holding).

Although it took us a lot of efforts to collect information on CEO compensation, we can only have database for 63 out of 74 banks in the initial list.

### **Statistical description**

The evolution of measures of bank risk: the systematic risk, the idiosyncratic risk, the total risk, Z-score and two kinds of credit risk are depicted in Figure 12.

With the exception of the last measure of risk, it is clear from all other figures, bank risks started to rise abnormally in 2007 and reached to their peak in about 2009 then decreased in 2010 to the same level of the year 2008 before being up again in 2011. Referring to the Z-score, as we said above, the higher Z-score reflects the better financial situation and lower risk. The figure of evolution of Z-score showed that through all the years studied, European banks are always at the highest level of risk (lowest Z-score). Banks in England and American remain the same level of Z-score at 20 whereas Canadian banks keep it at 30.

The evolution of non-performing loan also illustrates the lowest position of European banks in the period 2004-2011. The ratio of non-performing loan to total assets of banks in Europe fluctuates at the same trend with their colleague in America and England till 2009. Since then, while this type of risk in American and English banks has reduced gradually, European banks' one still keeps growing. For special case of Canada, the rate of non-performing loan fluctuated not much in period 2003-2009. In 2010 – 2011 we can see a slight increase of this risk in Canada; however it was at much lower level compared with other zones studied.

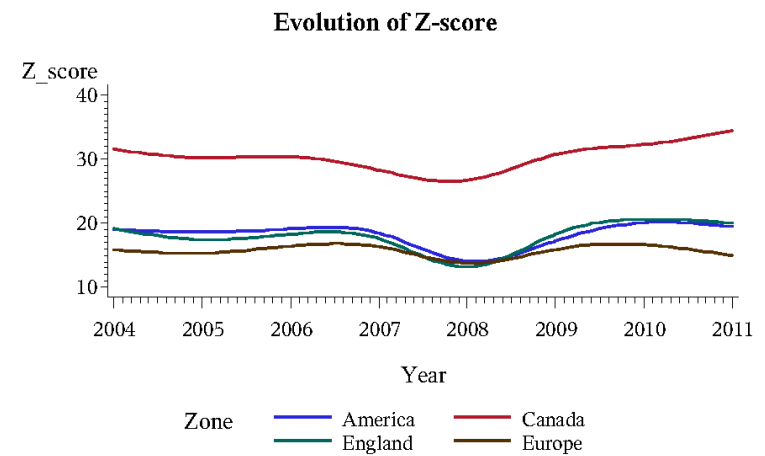
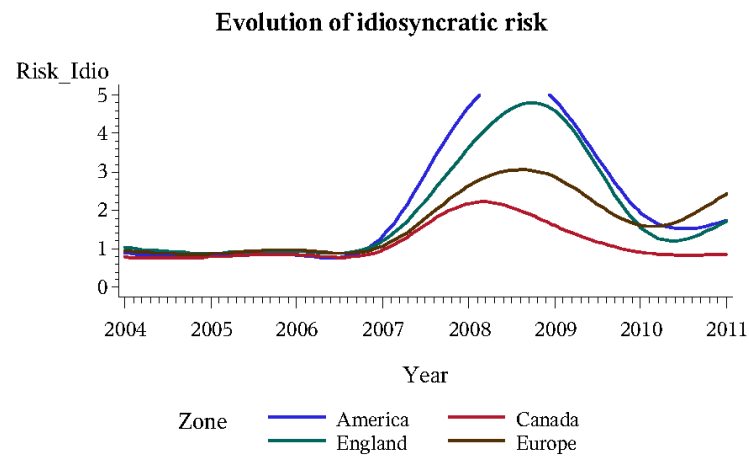
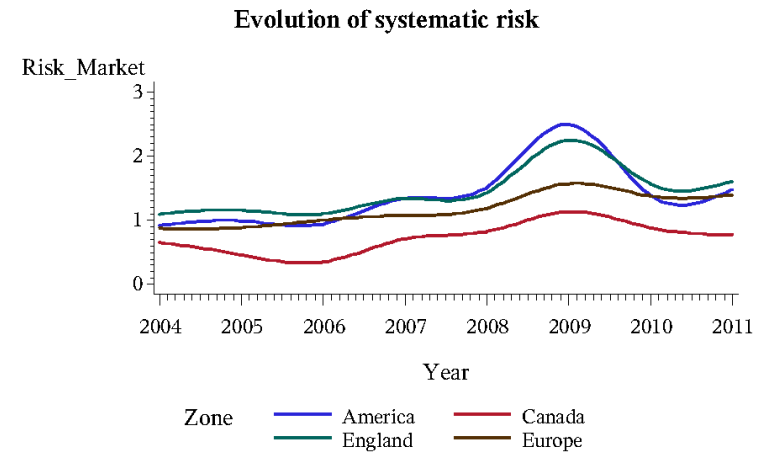
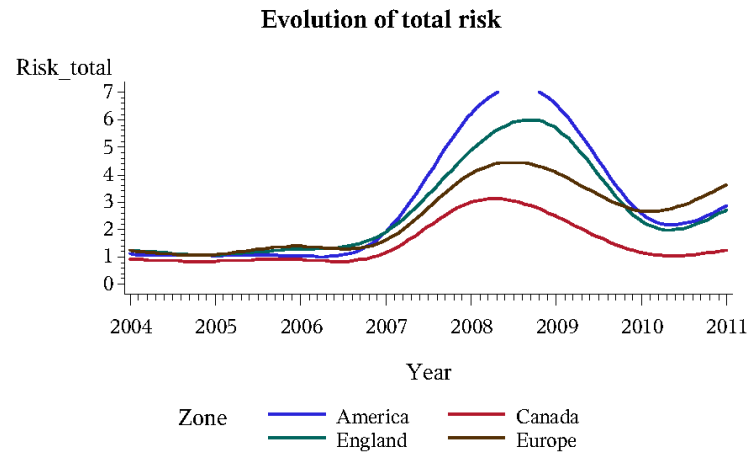
For the rest type of risk considered, in general, the order is always the same from 2007 to 2010: 1. America, 2. England, 3. Europe and 4. Canada (1: highest level of risk, 4: lowest level of risk).

The evolutions of total annual compensation; bonus; salary and other annual compensation then are depicted in Figure 13. The figure showed that in America and England, total annual compensation and annual bonus of banks' CEOs increased rapidly from 2003 to

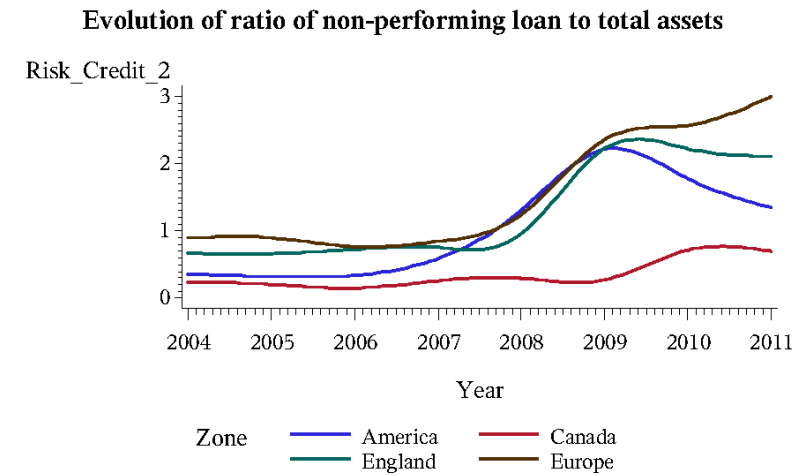
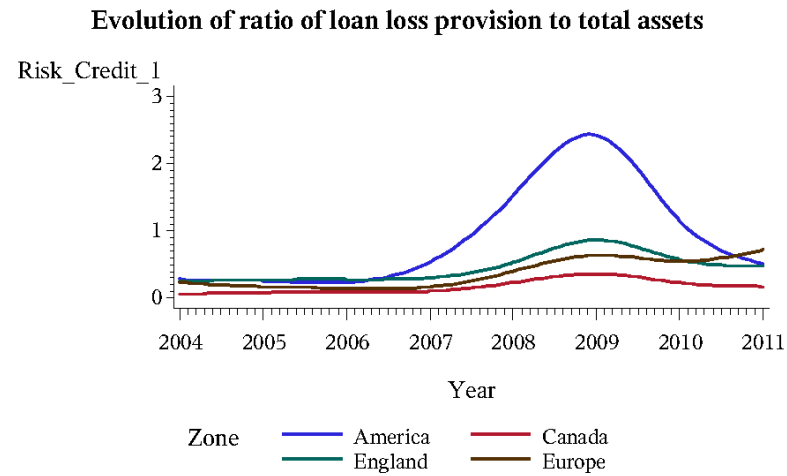
2006 then reached their pick in 2007 before dropping sharply in 2008 – 2009. Since the end of 2009, these two components have grown up again at the same speed of the normal period. We can see the same trend of total annual compensation and annual bonus of CEOs in European and Canadian banks, however level of fluctuation through all period was much smaller compared with the one of American and English banks.

Figure 13 also illustrates that banks in England and Europe prefer remaining at a certain level (between \$1 million and \$2 million) of salary and a small amount (under \$0.5 million) of other annual compensation (mostly under the form of benefit in kinds). In contrast, American and Canadian executives receive lower level of salaries (less than \$1 million) but higher amount of other annual compensation compared with colleagues in England and Europe. Accounted for the most proportion in the other annual compensation of American and Canadian banks' CEOs are pension funds and interests as well as dividends from all share plans awarded to executives in previous years.

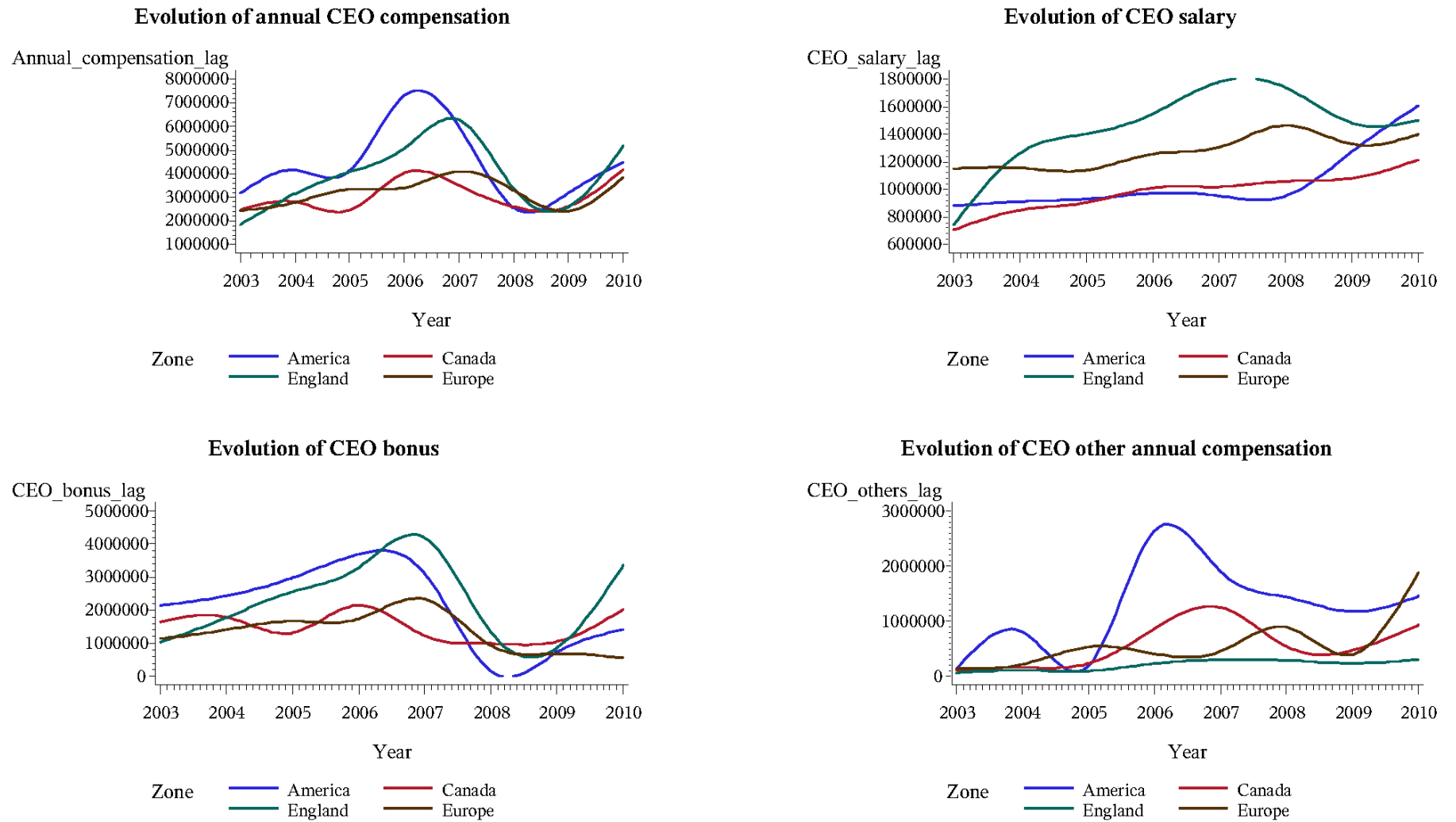
**Figure 12.a Evolution of the bank risk**



**Figure 12.b Evolution of bank risk (continued)**

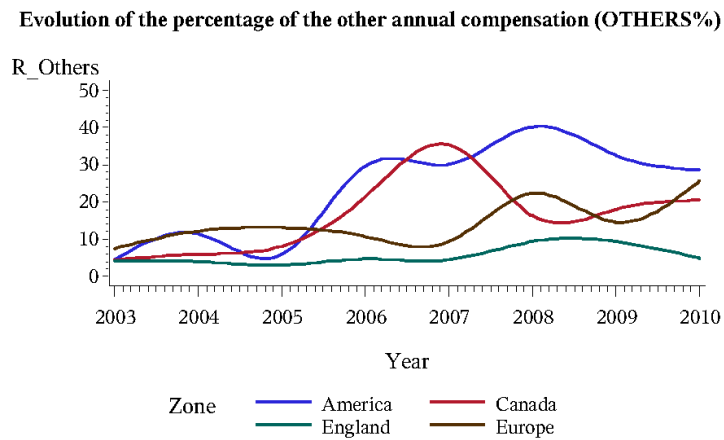
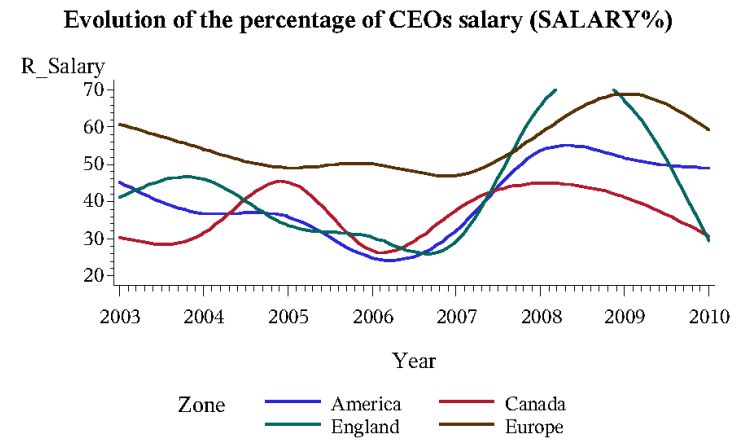
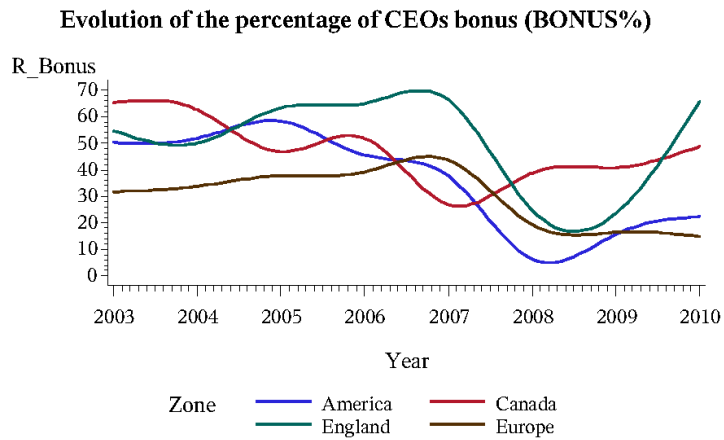


**Figure 13.a Evolution of CEOs' compensation**





**Figure 13.b Evolution of CEOs' compensation**



The descriptive statistics of database used for the general equation (48) is illustrated in Table 17, Table 18 and Table 19. Then Table 20, Table 21 and Table 22 describe the descriptive statistics of cross sectional database used for the general equation (49).

***a. Descriptive statistics of panel data which is used for the investigation of CEO compensation's impact on bank risks during the period 2004-2008***

Since our objective is to examine the impact of each CEO compensation component on bank risks, we run regression the general equation (48) independently for each compensation component including salary, bonus, and other annual compensation. We also consider the effect of compensation structure on bank risk-taking. As a result, the equation (48) is run separately for percentage of each component.

Table 17 presents the correlation matrix of each set of independent variables. The largest correlation coefficient in all panels of the table is for size and loan (maximum = -42%). To consider a strong level of a relationship, we follow Dancey and Reidy's (2004) which is shown in Table 18.

The descriptive statistics for bank risk measures and independent variables are presented in Table 19 and Table 20 respectively. During the period 2004-2008, the mean of market-based measure of risks including total risk, idiosyncratic risk and systematic risk are 1.95, 1.42 and 1.03 respectively. With regard to credit risks, the mean value is 0.54% for loan loss provision to total loan ratio and 1.32% for non-performing loan to total loan ratio. The mean value of Z-score is 44.13 with the minimum and maximum value ranges between 1.79 and 153.05. In our sample, the mean CEO salary is 1,143,808 U.S. dollars, with a minimum value of 124,030 U.S. dollars and a maximum value of 4,564,098 U.S. dollars. The mean value of CEO bonus is 2,321,313 U.S. dollars. The minimum and maximum value ranges between 0 and 14,500,000 U.S. dollars. This range of CEO's other annual compensation is much larger, between 0 and 23,204,508 U.S. dollars, with the mean value of 665,153 U.S. dollars. Related to compensation structure, the mean value is 41% for percentage of CEO salary, 47% for percentage of CEO bonus, and 12% for percentage of the other annual compensation.

**Table 17.a Correlation matrix of variables used in the equation (48)**

|            | CEO Salary | Size  | BC    | CV   | LOAN | GDP |
|------------|------------|-------|-------|------|------|-----|
| CEO Salary | 1          |       |       |      |      |     |
| Size       | 0,41       | 1     |       |      |      |     |
| BC         | -0,06      | -0,29 | 1     |      |      |     |
| CV         | -0,10      | -0,35 | 0,41  | 1    |      |     |
| LOAN       | -0,06      | -0,41 | -0,23 | 0,01 | 1    |     |
| GDP        | -0,05      | -0,11 | 0,12  | 0,40 | 0,00 | 1   |

|       | BONUS | Size  | BC    | CV   | LOAN | GDP |
|-------|-------|-------|-------|------|------|-----|
| BONUS | 1     |       |       |      |      |     |
| Size  | 0,49  | 1     |       |      |      |     |
| BC    | 0,25  | -0,35 | 1     |      |      |     |
| CV    | 0,14  | -0,42 | 0,40  | 1    |      |     |
| LOAN  | -0,37 | -0,42 | -0,16 | 0,09 | 1    |     |
| GDP   | -0,07 | -0,16 | 0,10  | 0,38 | 0,06 | 1   |

|        | OTHERS | Size  | BC    | CV    | LOAN | GDP |
|--------|--------|-------|-------|-------|------|-----|
| OTHERS | 1      |       |       |       |      |     |
| Size   | 0,12   | 1     |       |       |      |     |
| BC     | -0,18  | -0,32 | 1     |       |      |     |
| CV     | -0,03  | -0,39 | 0,40  | 1     |      |     |
| LOAN   | -0,09  | -0,40 | -0,25 | -0,02 | 1    |     |
| GDP    | -0,13  | -0,13 | 0,09  | 0,37  | 0,00 | 1   |

This table present correlation matrix of each dependent variable set used in the equation (48). CEO Salary is natural logarithm of salary that CEO received. BONUS is natural logarithm of annual bonus that CEO received. OTHERS is natural logarithm of CEO's other annual compensation. Size is natural logarithm of bank's total assets. BC is the capital adequacy ratio which is a measure of a bank's ability to absorb a reasonable amount of loss. CV is bank's charter value. LOAN is percentage of bank loan to total assets. GDP is GDP growth rate.

**Table 17.b Correlation matrix of variables used in the equation (48) (continue)**

|           | SALARYPER | Size  | BC    | CV   | LOAN | GDP |
|-----------|-----------|-------|-------|------|------|-----|
| SALARYPER | 1         |       |       |      |      |     |
| Size      | -0,32     | 1     |       |      |      |     |
| BC        | -0,29     | -0,29 | 1     |      |      |     |
| CV        | -0,19     | -0,35 | 0,41  | 1    |      |     |
| LOAN      | 0,41      | -0,41 | -0,23 | 0,01 | 1    |     |
| GDP       | -0,01     | -0,11 | 0,12  | 0,40 | 0,00 | 1   |

|          | BONUSPER | Size  | BC    | CV   | LOAN | GDP |
|----------|----------|-------|-------|------|------|-----|
| BONUSPER | 1        |       |       |      |      |     |
| Size     | 0,34     | 1     |       |      |      |     |
| BC       | 0,36     | -0,29 | 1     |      |      |     |
| CV       | 0,18     | -0,35 | 0,41  | 1    |      |     |
| LOAN     | -0,39    | -0,41 | -0,23 | 0,01 | 1    |     |
| GDP      | 0,10     | -0,11 | 0,12  | 0,40 | 0,00 | 1   |

|          | OTHERPER | Size  | BC    | CV   | LOAN | GDP |
|----------|----------|-------|-------|------|------|-----|
| OTHERPER | 1        |       |       |      |      |     |
| Size     | -0,06    | 1     |       |      |      |     |
| BC       | -0,13    | -0,29 | 1     |      |      |     |
| CV       | 0,00     | -0,35 | 0,41  | 1    |      |     |
| LOAN     | -0,01    | -0,41 | -0,23 | 0,01 | 1    |     |
| GDP      | -0,13    | -0,11 | 0,12  | 0,40 | 0,00 | 1   |

This table present correlation matrix of each dependent variable set used in the equation (48). SALARYPER is percentage of CEO's Salary to total annual compensation. BONUSPER is percentage of CEO's bonus to total annual compensation. OTHERPER is percentage of CEO's other annual compensation to total annual compensation. Size is natural logarithm of bank's total assets. BC is the capital adequacy ratio which is a measure of a bank's ability to absorb a reasonable amount of loss. CV is bank's charter value. LOAN is percentage of bank loan to total assets. GDP is GDP growth rate.

**Table 18 Rule of thumb to define strong level of relationship between two variables**

| Value of the Correlation Coefficient | Strength of Correlation |
|--------------------------------------|-------------------------|
| 1                                    | Perfect                 |
| 0.7 - 0.9                            | Strong                  |
| 0.4 - 0.6                            | Moderate                |
| 0.1 - 0.3                            | Weak                    |
| 0                                    | Zero                    |

Source: Dancey and Reidy's (2004) cited by the University of Strathclyde, available at the following website:  
<http://www.strath.ac.uk/aer/materials/4dataanalysisineducationalresearch/unit4/correlationsdirectionandstrength>

**Table 19 Descriptive statistics of bank risk measures that are used in the equation (48)**

| Variable                           | N   | MEAN  | STD   | MIN   | MAX    |
|------------------------------------|-----|-------|-------|-------|--------|
| Total risk (TOTARISK)              | 265 | 1,95  | 1,60  | 0,39  | 8,18   |
| Idiosyncratic risk (IDIORISK)      | 265 | 1,42  | 1,19  | 0,38  | 7,09   |
| Systematic risk (SYSTRISK)         | 265 | 1,03  | 0,36  | -0,11 | 1,96   |
| Loan loss provision ratio (LLP), % | 264 | 0,54  | 0,75  | -0,33 | 5,83   |
| Non-performing loan ratio (NPL), % | 265 | 1,32  | 1,20  | 0,02  | 5,69   |
| Distance-to-default (Z_score)      | 265 | 44,13 | 32,86 | 1,79  | 153,05 |

This table presents summary statistics for various risk measures

Bank capital ratio in our sample ranges from 8.32% to 24.7% with an average of 12.11%. The average of charter value is 1.06 with a range between a minimum value of 0.98 and a maximum value of 1.06. Finally, the mean value of bank loan to total asset ratio is 56.37%. The minimum and maximum value ranges between 4.92% and 82.95%.

**Table 20** Descriptive statistics of the explanatory variable that are used in the equation (48)

| Variable  | N   | MEAN      | STD       | MIN     | MAX        |
|---|-----|-----------|-----------|---------|------------|
| CEO Salary , dollars                                      | 263 | 1 143 808 | 595 412   | 124 030 | 4 564 098  |
| CEO Salary (SALARY), natural logarithm                    | 263 | 13,85     | 0,45      | 11,73   | 15,33      |
| CEO Bonus, dollars  | 263 | 2 321 313 | 2 576 726 | -       | 14 500 000 |
| CEO Bonus (BONUS), natural logarithm                      | 237 | 14,23     | 1,18      | 10,65   | 16,49      |
| CEO other annual compensation, dollars                    | 263 | 665 153   | 1 872 262 | -       | 23 204 508 |
| CEO other annual compensation (OTHERS), natural logarithm | 230 | 12,20     | 1,72      | 6,07    | 16,96      |
| Percentage of CEO salary (SALARYPER), %                   | 263 | 0,41      | 0,24      | 0,04    | 1,00       |
| Percentage of CEO bonus (BONUSPER), %                     | 263 | 0,47      | 0,25      | 0,00    | 0,92       |
| Percentage of other annual compensation (OTHERPER), %     | 263 | 0,12      | 0,17      | 0,00    | 0,96       |
| Bank total assets, mil dollars                            | 265 | 477 139   | 588 371   | 23 514  | 3 783 173  |
| Bank total assets (Size), natural logarithm               | 265 | 12,36     | 1,24      | 10,07   | 15,15      |
| Bank capital (BC), %                                      | 251 | 12,11     | 2,01      | 8,32    | 24,70      |
| Square of Bank capital (BC_square)                        | 251 | 150,71    | 56,96     | 69,22   | 610,09     |
| Bank charte value (CV)                                    | 265 | 1,06      | 0,05      | 0,98    | 1,27       |
| Percentage of bank loan (LOAN), %                         | 265 | 56,73     | 15,56     | 4,92    | 82,95      |
| GDP growth rate   | 265 | 4,78      | 1,94      | -5,24   | 9,08       |

This table presents summary statistics for bank characteristic variables (dependent variables).

*b. Descriptive statistics of cross sectional data which is used for the investigation of CEO compensation's impact on significant changes in bank risks during the recent financial crisis period*

The descriptive statistics for variables used in the equation (49) are presented in Table 21, Table 22 and Table 23. Table 21 shows that the maximum correlation coefficient in all panels is -47%.

**Table 21.a Correlation matrix of variables used in the model (49)**

|        | SALARY | Size  | BC    | CV    | LOAN  | GDP |
|--------|--------|-------|-------|-------|-------|-----|
| SALARY | 1      |       |       |       |       |     |
| Size   | 0.30   | 1     |       |       |       |     |
| BC     | -0.05  | -0.30 | 1     |       |       |     |
| CV     | -0.09  | -0.40 | 0.50  | 1     |       |     |
| LOAN   | -0.07  | -0.47 | -0.27 | 0.08  | 1     |     |
| GDP    | -0.07  | 0.12  | 0.10  | -0.06 | -0.27 | 1   |

|       | BONUS | Size  | BC    | CV    | LOAN  | GDP |
|-------|-------|-------|-------|-------|-------|-----|
| BONUS | 1     |       |       |       |       |     |
| Size  | 0.38  | 1     |       |       |       |     |
| BC    | 0.33  | -0.37 | 1     |       |       |     |
| CV    | 0.24  | -0.44 | 0.52  | 1     |       |     |
| LOAN  | -0.34 | -0.44 | -0.19 | 0.11  | 1     |     |
| GDP   | -0.05 | 0.11  | 0.10  | -0.07 | -0.27 | 1   |

|        | OTHERS | Size  | BC    | CV    | LOAN  | GDP |
|--------|--------|-------|-------|-------|-------|-----|
| OTHERS | 1      |       |       |       |       |     |
| Size   | 0.02   | 1     |       |       |       |     |
| BC     | 0.02   | -0.29 | 1     |       |       |     |
| CV     | 0.22   | -0.40 | 0.48  | 1     |       |     |
| LOAN   | -0.07  | -0.47 | -0.32 | 0.04  | 1     |     |
| GDP    | 0.05   | 0.12  | 0.11  | -0.05 | -0.27 | 1   |

This table present correlation matrix of each dependent variable set used in the equation (49). SALARY is natural logarithm of salary that CEO received. BONUS is natural logarithm of annual bonus that CEO received. OTHERS is natural logarithm of CEO's other annual compensation. Size is natural logarithm of bank's total assets. BC is the capital adequacy ratio which is a measure of a bank's ability to absorb a reasonable amount of loss. CV is bank's charter value. LOAN is percentage of bank loan to total assets. GDP is GDP growth rate.

**Table 21.b Correlation matrix of variables used in the model (49) (continue)**

|           | SALARYPER | Size  | BC    | CV    | LOAN  | GDP |
|-----------|-----------|-------|-------|-------|-------|-----|
| SALARYPER | 1         |       |       |       |       |     |
| Size      | -0.24     | 1     |       |       |       |     |
| BC        | -0.42     | -0.30 | 1     |       |       |     |
| CV        | -0.27     | -0.40 | 0.50  | 1     |       |     |
| LOAN      | 0.36      | -0.47 | -0.27 | 0.08  | 1     |     |
| GDP       | -0.03     | 0.12  | 0.10  | -0.06 | -0.27 | 1   |

|          | BONUSPER | Size  | BC    | CV    | LOAN  | GDP |
|----------|----------|-------|-------|-------|-------|-----|
| BONUSPER | 1        |       |       |       |       |     |
| Size     | 0.43     | 1     |       |       |       |     |
| BC       | 0.44     | -0.30 | 1     |       |       |     |
| CV       | 0.11     | -0.40 | 0.50  | 1     |       |     |
| LOAN     | -0.47    | -0.47 | -0.27 | 0.08  | 1     |     |
| GDP      | 0.00     | 0.12  | 0.10  | -0.06 | -0.27 | 1   |

|          | OTHERPER | Size  | BC    | CV    | LOAN  | GDP |
|----------|----------|-------|-------|-------|-------|-----|
| OTHERPER | 1        |       |       |       |       |     |
| Size     | -0.27    | 1     |       |       |       |     |
| BC       | -0.06    | -0.30 | 1     |       |       |     |
| CV       | 0.18     | -0.40 | 0.50  | 1     |       |     |
| LOAN     | 0.17     | -0.47 | -0.27 | 0.08  | 1     |     |
| GDP      | 0.04     | 0.12  | 0.10  | -0.06 | -0.27 | 1   |

This table present correlation matrix of each dependent variable set used in the equation (49). SALARYPER is percentage of CEO's Salary to total annual compensation. BONUSPER is percentage of CEO's bonus to total annual compensation. OTHERPER is percentage of CEO's other annual compensation to total annual compensation. Size is natural logarithm of bank's total assets. BC is the capital adequacy ratio which is a measure of a bank's ability to absorb a reasonable amount of loss. CV is bank's charter value. LOAN is percentage of bank loan to total assets. GDP is GDP growth rate.



**Table 22 Descriptive statistics of bank risk measures used in the equation (49)**

| Variable   | N  | MEAN  | STD   | MIN    | MAX    |
|--|----|-------|-------|--------|--------|
| Change in total risk (delta_TOTARISK)              | 69 | 4,07  | 1,88  | 1,22   | 8,96   |
| Change in idiosyncratic risk (delta_IDIORISK)      | 69 | 3,86  | 2,01  | 1,15   | 10,32  |
| Change in loan loss provision (delta_LLPL)         | 67 | 1,82  | 2,60  | 0,03   | 18,66  |
| Change in non performing loan (delta_NPL)          | 67 | 2,05  | 1,97  | -2,17  | 7,60   |
| Change in Z score (delta_Zscore), %                | 69 | 27,92 | 46,23 | -36,95 | 345,52 |
| Change in CDS1Y (delta_CDS1Y)                      | 37 | 9,38  | 5,15  | 2,32   | 21,61  |
| Change in CDS5Y (delta_CDS5Y)                      | 37 | 4,74  | 2,12  | 1,13   | 9,33   |
| Sharp drop of stock returns (SHARDROP), %          | 69 | 71,73 | 14,81 | 40,44  | 99,57  |
| Change in bank ratings long-term (delta_RATINGLT)  | 64 | -0,01 | 0,01  | -0,06  | 0,01   |
| Change in bank ratings short-term (delta_RATINGST) | 63 | 0,00  | 0,01  | -0,02  | 0,01   |

This table presents summary statistics for various risk measures. Change in total risk ( $\Delta$ TOTARISK) is measured by total risk in 2008 divided by total risk in 2006. Change in idiosyncratic risk ( $\Delta$ IDIORISK) is measured by idiosyncratic risk in 2008 divided by idiosyncratic risk in 2006. Change in loan loss provision ( $\Delta$ LLP) is the difference between loan loss ratio in 2009 and loan loss ratio in 2006. Change in non-performing loan ( $\Delta$ NPL) is the difference between non-performing loan ratio in 2009 and non-performing loan ratio in 2006. Change in Z-score ( $\Delta$ Zscore) is measured by difference between Z-score in 2008 and Z-score in 2006 then divided by Z-score in 2006, in percentage. Change in CDS1Y (5Y) ( $\Delta$ CDS1Y,  $\Delta$ CDS5Y) is measured by CDS1Y (5Y) in 2009 divided by CDS1Y (5Y) in 2007. Sharp drop of stock price (SHARPDROP) is measured by using difference between stock price in 2008 and stock price in 2006 then divided by stock price in 2006, in percentage. Finally change in bank ratings long-term (short-term) ( $\Delta$ RATINGLT,  $\Delta$ RATINGST) is measured by difference between bank ratings long-term (short-term) in 2011 and bank ratings long-term (short-term) in 2007.

Table 22 illustrates the summary statistics for changes in risk measures during the financial crisis period. The mean value of  $\Delta$ TOTARISK is 4.07 meaning the average increase in total risk during the period 2006-2008 is 4.07 times. A minimum increase is 1.22 times and a maximum increase is 8.96 times. The average increase in idiosyncratic risk is 3.86 with a range between a minimum increase of 1.15 and a maximum increase of 10.32.  $\Delta$ LLP ranges from 0.03 to 18.66 with the average value of 1.82.  $\Delta$ NPL ranges from -2.17 (non-performing loan ratio in 2009 is smaller than non-performing loan ratio in 2006) to 7.60 with the mean value of 2.05. On average, Z-score value in 2008 decreases 27.92% compared with 2006. Average increase in CDS index is 4.74 for CDS5Y and 9.38 for CDS1Y. Finally change in bank rating short-term ranges from -0.02 to 0.01 while change in bank rating long-term ranges between -0.06 and 0.01.

**Table 23 Descriptive statistics of the explanatory variable used in the equation (49)**

| Variable  | N  | MEAN      | STD       | MIN     | MAX        |
|---|----|-----------|-----------|---------|------------|
| CEO salary, dollars                                   | 54 | 1,190,583 | 581,339   | 124,030 | 3,586,531  |
| CEO salary (SALARY), natural logarithm                | 54 | 13.89     | 0.47      | 11.73   | 15.09      |
| CEO bonus, dollars                                    | 54 | 2,795,261 | 2,973,147 | -       | 13,200,000 |
| CEO bonus (BONUS), natural logarithm                  | 49 | 14.47     | 1.13      | 10.80   | 16.40      |
| Other annual compensation, dollars                    | 54 | 1,293,825 | 3,235,979 | -       | 23,204,508 |
| Other annual compensation (OTHERS), natural logarithm | 52 | 12.82     | 1.82      | 7.88    | 16.96      |
| Percentage of CEO salary (SALARYPER), %               | 54 | 35.22     | 22.95     | 3.59    | 97.54      |
| Percentage of CEO bonus (BONUSPER), %                 | 54 | 46.60     | 24.27     | 0.00    | 90.44      |
| Percentage of other compensation (OTHERPER), %        | 54 | 18.18     | 18.96     | 0.00    | 87.50      |
| CEO option holdings (OPTHOLD)                         | 49 | 1,929,952 | 4,373,177 | -       | 28,905,502 |
| CEO stock holdings (STOHOLD)                          | 56 | 1,708,023 | 2,464,891 | 100     | 13,961,414 |
| Bank total assets, mil dollars                        | 69 | 495,156   | 586,271   | 29,931  | 1,963,227  |
| Bank total assets (Size), natural logarithm           | 69 | 12.40     | 1.24      | 10.31   | 14.49      |
| Bank capital (BC), %                                  | 67 | 12.21     | 2.07      | 8.80    | 18.50      |
| Bank charter value (CV)                               | 69 | 1.06      | 0.05      | 1.00    | 1.19       |
| Bank loan (LOAN), %                                   | 68 | 57.07     | 17.46     | 8.33    | 82.08      |
| GDP growth rate (GDP), %                              | 69 | 2.22      | 2.19      | -5.24   | 10.99      |

This table presents summary statistics for bank characteristic variables (dependent variables).

The summary statistics for independent variables are presented in Table 23. The average CEO salary in 2006 is 1,190,583 U.S. dollars with a minimum value of 124,030 U.S. dollars and maximum value of 3,586,531 U.S. dollars. The average CEO bonus in 2006 is 2,795,261 U.S. dollars. A minimum and maximum bonus is zero and 13,200,000 U.S. dollars respectively. CEO other annual compensation ranges from zero to 23,204,508 U.S. dollars with the average amount of 1,293,825 U.S. dollars. The average annual compensation structure is 35% for salary, 47% for bonus and 18% for other annual compensation. The mean value of CEO stock option holdings at the end of 2006 is 1,929,952, with a range between a minimum number of zero and a maximum number of 28,905,502. The mean value of CEO share holdings at the same time is 1,708,023, with a range of number from 100 to 13,961,414. The average value of bank capital ratio is 12.21% and the mean charter value is 1.06. Finally bank loan ratio ranges between 8.33% and 82.08% with the average ratio of 57.07%.

## 6 Analysis and presentation of findings

### 6.1 Examine effect of CEO compensation on bank risk measures during the period 2004-2008 by using panel data

This study is conducted based on a panel data in which the independent variables are all the same across panels. Reference to the correlation matrix illustrated in Table 17, some of correlations surpass 0.4. In this situation, we therefore demand for a multicollinearity test among independent variables in PROC PANEL which is a statement used in SAS to run regression a panel data. Following an instruction from SAS Support Communities, it is possible to use PROC REG instead of PROC PANEL to calculate the VIF's which let us know the multicollinearity level of database.<sup>30</sup> Our results confirm that we have no problem running regression. Detail of these results is illustrated in Appendix 6 of this dissertation.

With regards to control variables in our research model (equation 48), bank capital, bank size, bank loan, and charter value may be endogenous. To define which control variable in our panel data is endogenous, we conduct the Hausman Test for endogeneity.<sup>31</sup> Table 24 illustrates the results of Hausman test for endogeneity. The first column refers to measures of risk which are in turn the dependent variable. For each measure of risk, each control variable in turn is tested for its endogeneity. For example, for the case of considering impacts of BC, CV, LOAN, Size on TOTARISK, Hausman test shows that CV is endogenous whereas BC, LOAN and Size are exogenous (the second line of Table 24). Detail of this procedure as well as results under SAS 9.3 are presented in Appendix 7.

<sup>30</sup> Introduction of multicollinearity test in Proc Panel available at <https://communities.sas.com/thread/47675>

<sup>31</sup> Introduction of Hausman Test for endogeneity available at <https://espin086.wordpress.com/2010/08/02/hausman-test-for-endogeneity-parents-education-as-iv-for-offspring-education-transmission-of-inate-ability/>

**Table 24 Results of Hausman test for endogeneity**

| Dependent variable | BC         | CV         | LOAN      | Size       |
|--------------------|------------|------------|-----------|------------|
| TOTARISK           | exogenous  | endogenous | exogenous | exogenous  |
| SYSTRISK           | exogenous  | exogenous  | exogenous | exogenous  |
| IDIORISK           | exogenous  | endogenous | exogenous | exogenous  |
| LLP                | exogenous  | endogenous | exogenous | endogenous |
| NPL                | endogenous | exogenous  | exogenous | exogenous  |
| Z-score            | exogenous  | exogenous  | exogenous | exogenous  |

As it was mentioned in Section 5.4.4.1, we considered to use two-step system generalized method of moments (GMM) to run regression the equation (48). Since some bank specific variables such as bank capital, charter value, and bank size may be endogenous and our sample is small, two-step system GMM seems to be the most suitable estimation. However in order to run regression based on GMM estimation, endogenous variables must exist. After running Hausman test for endogeneity, we realized that regressions related to TOTARISK, IDIORISK, LLP and NPL can be applied GMM estimation. Regressions related to SYSTRISK and Z-score however cannot be based on GMM as all variables are exogenous. Since we have no problem with multicollinearity and all variables are exogenous, these two regressions (the ones related to SYSTRISK and Z-score) are conducted based on OLS estimation with the same control variables mentioned and added dummy of region (U.S., Canada, U.K., and Europe) to consider the possible effect of differences among countries.

We now analyze effect of CEO annual compensation on bank risk measures during the period 2004-2008. The analysis is divided under two sections: effect of compensation level including influence of CEO salary, CEO bonus and CEO other annual compensation; and effect of compensation structure including impact of percentage of CEO salary, percentage of CEO bonus and percentage of CEO other annual compensation.

Table 25 to Table 30 report the two steps system GMM results in the first four columns and the OLS results in the last two columns of annual compensation's effect on bank risks. The diagnostics tests in all tables show that under the two steps system GMM estimation, the models are well fitted since tests statistics for both second-order autocorrelation in second differences (AR(2)) and Sargan test of over-identifying restrictions in all columns are statistically insignificant which mean that our instruments are valid. To validate the models running OLS regression, we check the residual plots. Our models are confirmed to be well fitted. We then only analyze effect of each dependent variable in the following sections.

### 6.1.1 Compensation level

#### 6.1.1.1 Salary

Following Table 25, we firstly analyze influences of control variables on bank risks. Bank size is illustrated to significantly decrease total risk and idiosyncratic risk but increase credit risks which are measured by ratio of loan loss provision to total loan and ratio of non-performing loan to total loan. These results are all at the 0.1% significant level. Bank size however has no relation to systematic risk and Z-score. Our results in one hand support for research of Konishi and Yasuda (2004) at the point that larger banks have more chance to be internally diversified than smaller banks, therefore total risk as well as idiosyncratic risk of larger banks are smaller than the one of smaller banks. On the other hand, our study is consistent with the one of Saunders et al., (1990) that large banks, under regulatory protection, are “too big to fail”. As a result they may prefer to undertake riskier loan activities which are an explanation for significantly positive relationship between bank size and credit risks.

With regard to bank capital, we follow Haq and Heaney (2011) when testing for a non-linear relation between capital and bank risks. Bank capital in our research is Total capital adequacy ratio, which is sum of Tier 1 capital and Tier 2 capital then divided by Credit risk-adjusted assets. Reference to Basel III norms<sup>32</sup>, banks are required to strengthen their bank capital adequacy ratios. We therefore, in this research, take into account the total capital adequacy ratio in replace of KOA (equity on total assets of bank) that inherently is an indicator commonly used to describe the capital capacity of an organization. Table 25 illustrates a concave association at the 0.1% significant level between bank capital and total risk, between bank capital and idiosyncratic risk as well as between bank capital and credit risks. This issue will be presented more detail in Section 6.1.3. Under the OLS estimation, bank capital is shown to have no impact on systematic risk and on Z-score. Stemming from the calculation formula, Z-score should be positively correlated with KOA. However the correlation between KOA and Total capital adequacy ratio (BC) is not necessary to be positive due to the difference in calculating both the numerator and denominator of the ratios. In our sample, correlation between KOA and BC is about 0.21 and between Z-score and BC is 0.05.

Considering the concave association between bank capital and total risk/idiosyncratic risk as well as between bank capital and credit risks, we take the derivative the equation (48) with respect to bank capital variable (BC) yields:

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<sup>32</sup> Basel III: A global regulatory framework for more resilient banks and banking systems, Dec. 2010, available at <http://www.bis.org/publ/bcbs189.pdf>

$$\frac{\delta Risk}{\delta BC} = \beta_3 + 2\beta_4 BC \quad (68)$$

Solving for BC gives you

$$\begin{aligned} \frac{\delta Risk}{\delta BC} &= 0 \\ \Leftrightarrow \beta_3 + 2\beta_4 BC &= 0 \\ \Leftrightarrow BC &= \frac{-\beta_3}{2\beta_4} \end{aligned} \quad (69)$$

As a result,

$$\frac{\delta LLP}{\delta BC} = 0 \Leftrightarrow BC = \frac{-0.42}{2 * (-0.01)} = 21\% \quad (70)$$

and

$$\frac{\delta NPL}{\delta BC} = 0 \Leftrightarrow BC = \frac{-2.41}{2 * (-0.07)} = 17\% \quad (71)$$

and

$$\frac{\delta IDIORISK}{\delta BC} = 0 \Leftrightarrow BC = \frac{-0.12}{2 * (-0.008)} = 7.5\% \quad (72)$$

and

$$\frac{\delta TOTARISK}{\delta BC} = 0 \Leftrightarrow BC = \frac{-0.055}{2 * (-0.0025)} = 11\% \quad (73)$$

This finding suggests that, at low levels of bank capital, as bank capital increased, total risk, idiosyncratic risk as well as credit risks (ratio of loan loss provision to total loan and ratio of non-performing loan to total loan) of bank increase, but as the capital buffer gets larger these measures of risk increase at decreasing rate. At the point of BC equals 7.5%, idiosyncratic risk doesn't grow and after this point of BC, bank's idiosyncratic risk starts to fall. In our sample, the minimum BC is 8.32% (Table 20), consequently, the relationship

between bank capital and idiosyncratic risk in the estimation period of 2004-2008 is negative. This means that in our sample, bank which has smaller capital buffer takes more idiosyncratic risk. Likewise, the point of BC at which loan loss provision ratio and non-performing loan ratio start to fall are 21% and 17% respectively. Our findings are inconsistent with prior studies (e.g. Calem and Rob 1999, Haq and Heaney, 2011) since the relationships between bank capital and bank risks in their works are illustrated to be convex. An explanation for our results may lie in bank size of our sample. As mentioned in Section 5.4.5, since all of banks in our sample are “too big to fail”, bank which has larger capital may prefer to take riskier loan activities. This behavior works until a large enough point of BC. After that point, the larger capital buffer decreases credit risks. This result may suggest some caution in evaluating the effectiveness of the regulatory policy. It is possible to rely on bank capital requirement to control bank risk-taking; however, the level of optimal capital buffer is not the same for all firms in banking sector.

**Table 25 Impact of CEO salary on bank risks**

| Parameter                          | TOTARISK | IDIORISK | LLP     | NPL     | SYSTRISK | Z-score  |
|------------------------------------|----------|----------|---------|---------|----------|----------|
| 01. Constant                       | 0.01     | 0.02     | 0.02    | -0.01   | 0.90     | -236.84  |
|                                    | ns       | ns       | ns      | ns      | ns       | ***      |
| 02. Log (Salary, dollars)          | -0.03    | -0.03    | -0.05   | -0.13   | 0.02     | 0.86     |
|                                    | ***      | ***      | ***     | ***     | ns       | ns       |
| 03. Log(Total assets, mil dollars) | -0.04    | -0.09    | 0.12    | 0.27    | 0.02     | 3.48     |
|                                    | ***      | ***      | ***     | ***     | ns       | ns       |
| 04. Bank capital, %                | 0.06     | 0.12     | 0.42    | 2.41    | 0.02     | -1.42    |
|                                    | ***      | ***      | ***     | ***     | ns       | ns       |
| 05. Square of Bank capital         | -0.00    | -0.00    | -0.01   | -0.07   |          |          |
|                                    | ***      | ***      | ***     | ***     |          |          |
| 06. Charter value                  | 1.29     | 1.15     | -4.08   | -19.29  | -0.58    | 230.62   |
|                                    | ***      | ***      | ***     | ***     | ns       | ***      |
| 07. Bank loan, %                   | 0.00     | 0.00     | 0.01    | 0.02    | -0.00    | -0.01    |
|                                    | *        | ***      | ***     | ***     | ns       | ns       |
| Dummy Year                         | Yes      | Yes      | Yes     | Yes     | Yes      | Yes      |
| Dummy Region                       |          |          |         |         | Yes      | Yes      |
| Model estimation                   | GMM      | GMM      | GMM     | GMM     | OLS      | OLS      |
| Characteristics of models          |          |          |         |         |          |          |
| Root mean square error             | 1.033    | 0.905    | 0.882   | 1.654   |          |          |
| Sargan test<br>(P-value)           | 75.384   | 72.999   | 67.083  | 66.624  |          |          |
|                                    | (1.000)  | (1.000)  | (1.000) | (1.000) |          |          |
| AR(1)<br>(P-value)                 | 4.117    | 3.751    | 2.559   | -0.632  |          |          |
|                                    | (<.0001) | (<.0001) | (0.005) | (0.736) |          |          |
| AR(2)<br>(P-value)                 | -1.070   | 0.496    | -2.539  | -1.622  |          |          |
|                                    | (0.858)  | (0.310)  | (0.994) | (0.948) |          |          |
| F-test<br>(p-value)                |          |          |         |         | 19.30    | 5.02     |
|                                    |          |          |         |         | (<.0001) | (<.0001) |
| R <sup>2</sup>                     |          |          |         |         | 0.4932   | 0.2019   |

This table presents the result of the two-step system GMM estimates of equation (48). The bank risks include total risk, systematic risk, idiosyncratic risk, credit risks and risk of default which is measured by Z-score. Credit risks are measured using equation (36) and (37). Total risk, systematic risk and idiosyncratic risk are defined in equation (35). Log (Total assets) captures bank's size, measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. Dummy year considers different effect between each of year 2005/2006/2007/2008 and year 2004. AR(1) and AR(2) are the test statistics for first order and second order serial correlation respectively. Sargan test is a test of over identifying restrictions. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.



Charter value is found to have significantly negative effect at the 0.1% significant level on credit risks but significantly positive impact on total risk, idiosyncratic risk and Z-score of banks. This finding is consistent with the study of Haq and Heaney (2012) which found a negative effect of charter value on bank credit risk, but significantly positive relationship between charter value and bank equity risk. An explanation for negative effects of charter value on credit risks and risk of default (positive effect on Z-score) is that banks possibly choose to avoid risk to protect their charter values (Keeley 1990, Park and Peristiani, 2007, Anderson and Fraser, 2000). However since charter value captures growth opportunities which originate from taking on more risky but profitable activities, then both bank risk and charter value may move in the same direction (Saunders and Wilson, 2001). Our positive relationship between charter value and bank equity risk therefore supports for Saunders and Wilson (2001).

With regard to bank loan ratio, it is illustrated to increase total risk, idiosyncratic risk and induce credit risks. This means bank which focuses more on loan activities gets higher risks (both market-based risks and credit risks). Bank loan has no influence on systematic risk, and Z-score.

We then consider the impact of compensation on bank risks. Table 25 presents the effect of CEO salary. Following this finding, CEO salary is illustrated to decrease total risk, idiosyncratic risk and two types of credit risks. Hypotheses 3.1, 3.3, 3.4 and 3.5 therefore are supported. CEO salary has no impact on systematic risk and Z-score. As a result Hypotheses 3.2 and 3.6 are rejected. Coefficients of CEO salary in relationship with total risk, idiosyncratic risk and credit risks are all statistically significant at the 0.1% significant level. This means that in the sample of large banks, banks which compensate their CEO higher salary take lower total risk and lower idiosyncratic risk; they also face with lower risks related to loan activities.

#### **6.1.1.2 Bonus**

This section focuses on the influence of CEO bonus on bank risk measures. Regard to bank size, Table 26 shows that bank's total assets decrease total risk and idiosyncratic risk but increase credit risks. We found no evidence of relationship between bank size and systematic risk or Z-score.

**Table 26 Impact of CEO bonus on bank risks**

| Parameter                          | TOTARISK | IDIORISK | LLP     | NPL     | SYSTRISK | Z_score  |
|------------------------------------|----------|----------|---------|---------|----------|----------|
| 01. Constant                       | -0.01    | 0.00     | 0.01    | -0.03   | 1.23     | -237.29  |
|                                    | ns       | ns       | ns      | ns      | *        | ***      |
| 02. Log(Bonus, dollars)            | -0.00    | -0.01    | -0.01   | -0.05   | 0.01     | -0.19    |
|                                    | ns       | ***      | ***     | ***     | **       | ns       |
| 03. Log(Total assets, mil dollars) | -0.06    | -0.09    | 0.21    | 0.21    | 0.01     | 3.98     |
|                                    | ***      | ***      | ***     | ***     | ns       | ns       |
| 04. Bank capital, %                | -0.00    | 0.04     | 0.49    | 1.72    | 0.01     | -1.40    |
|                                    | ns       | *        | ***     | ***     | ns       | ns       |
| 05. Square of Bank capital         | -0.00    | -0.00    | -0.01   | -0.05   |          |          |
|                                    | ns       | ns       | ***     | ***     |          |          |
| 06. Charter value                  | 1.82     | 1.61     | -6.23   | -14.51  | -0.60    | 238.30   |
|                                    | ***      | ***      | ***     | ***     | ns       | ***      |
| 07. Bank loan, %                   | -0.00    | 0.00     | 0.01    | 0.02    | -0.00    | -0.01    |
|                                    | ns       | ns       | ***     | ***     | ns       | ns       |
| Dummy Year                         | Yes      | Yes      | Yes     | Yes     | Yes      | Yes      |
| Dummy Region                       |          |          |         |         | Yes      | Yes      |
| Model estimation                   | GMM      | GMM      | GMM     | GMM     | OLS      | OLS      |
| Characteristics of models          |          |          |         |         |          |          |
| Root mean square error             | 1.037    | 0.912    | 0.920   | 1.433   |          |          |
| Sargan test<br>(P-value)           | 82.024   | 77.992   | 69.536  | 58.419  |          |          |
|                                    | (1.000)  | (1.000)  | (1.000) | (1.000) |          |          |
| AR(1)<br>(P-value)                 | 4.109    | 3.631    | 2.438   | -1.079  |          |          |
|                                    | (<.0001) | (<.0001) | (0.007) | (0.860) |          |          |
| AR(2)<br>(P-value)                 | -1.119   | 0.327    | -2.260  | -1.548  |          |          |
|                                    | (0.869)  | (0.372)  | (0.988) | (0.939) |          |          |
| F-test<br>(p-value)                |          |          |         |         | 20.56    | 5.00     |
|                                    |          |          |         |         | (<.0001) | (<.0001) |
| R <sup>2</sup>                     |          |          |         |         | 0.5090   | 0.2014   |

This table presents the result of the two-step system GMM estimates of equation (48). The bank risks include total risk, systematic risk, idiosyncratic risk, credit risks and risk of default which is measured by Z-score. Credit risks are measured using equation (36) and (37). Total risk, systematic risk and idiosyncratic risk are defined in equation (35). Log (Total assets) captures bank's size, measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. Dummy year considers different effect between each of year 2005/2006/2007/2008 and year 2004. AR(1) and AR(2) are the test statistics for first order and second order serial correlation respectively. Sargan test is a test of over identifying restrictions. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

The impact of bank capital on bank risk is re-confirmed to be concave shape in column 2, 3, 4. No relationship between bank capital and total risk or systematic risk is found. Z\_score also is illustrated not to be effected by bank capital.

Charter value is found to have significantly negative effect on credit risks; positive impact on total risk, idiosyncratic risk, Z-score; and no relationship with systematic risk. These results are consistent with the findings in the section of salary's effect on bank risks.

The effects of bank loan ratio on credit risks are significantly positive whereas no evidence of relationship between bank loan and other measures of risk is found.

In general, effects of control variables in the regression of bank risks on CEO bonus are consistent with the one in the regression of bank risks on CEO salary. This is also a sign of a good model.

Table 26 illustrates that CEO bonus induces systematic risk. The findings support for our Hypothesis 1.2. This means that the higher CEO bonus compensated is, the higher bank's systematic risk is. Hypothesis 1.1, Hypothesis 1.3, Hypothesis 1.4, Hypothesis 1.5, Hypothesis 1.6 are all rejected as our results illustrated that CEO bonus has negative impact on idiosyncratic risk as well as on credit risks and has no effect on Z-score and total risk.

#### *6.1.1.3 Other annual compensation*

We repeat here that the main components of CEO's other annual compensation are define-benefit pension plans which guarantee that CEO will receive a definite amount of benefit upon retirement; various perquisites such as free use of company car or company aircraft or house rent allowance...; severance payments in case of CEO's departure; dividends of shares which have been granted but have not yet vested. Table 27 presents the effect of CEO's other annual compensation and control variables on bank risks.

Control variables have always important and consistent effects as referred in the two previous sections. We therefore focus on analyzing effect of CEO's other annual compensation in this section. CEO's other annual compensation is illustrated in Table 27 to significantly increase with all measures of market-based risk and ratio of loan loss provision to total loan (LLP). The findings mean that bank which remunerates higher other annual compensation to its CEO takes higher market-based risks and gets higher ratio of loan loss provision to total loan. As a result, our Hypotheses 5.1, 5.2, 5.3, 5.4 are supported. Hypotheses 5.5, 5.6 are rejected since CEO's other annual compensation is proved to have no effect on ratio of non-performing loan to total loan (NPL) and Z-score.

**Table 27 Impact of CEO's other annual compensation on bank risks**

| Parameter                                   | TOTARISK | IDIORISK | LLP     | NPL     | SYSTRISK | Z-score  |
|---|----------|----------|---------|---------|----------|----------|
| 01. Constant                                | -0.02    | 0.01     | 0.02    | -0.04   | 1.05     | -228.53  |
|   | ns       | ns       | ns      | ns      | ns       | ***      |
| 02. Log(Other annual compensation, dollars) | 0.03     | 0.03     | 0.01    | -0.00   | 0.01     | 0.67     |
|   | ***      | ***      | ***     | ns      | **       | ns       |
| 03. Log(Total assets, mil dollars)          | -0.04    | -0.11    | 0.13    | 0.14    | 0.02     | 3.20     |
|   | ***      | ***      | ***     | **      | ns       | ns       |
| 04. Bank capital, %                         | 0.10     | 0.10     | 0.41    | 1.88    | 0.02     | -1.35    |
|   | ***      | ***      | ***     | ***     | *        | ns       |
| 05. Square of Bank capital                  | -0.00    | -0.00    | -0.01   | -0.06   |          |          |
|   | ***      | ***      | ***     | ***     |          |          |
| 06. Charter value                           | 0.51     | 0.93     | -4.86   | -15.26  | -0.57    | 230.95   |
|   | *        | ***      | ***     | ***     | ns       | ***      |
| 07. Bank loan, %                            | 0.00     | 0.00     | 0.01    | 0.02    | -0.00    | -0.02    |
|   | *        | **       | ***     | ***     | ns       | ns       |
| Dummy Year                                  | Yes      | Yes      | Yes     | Yes     | Yes      | Yes      |
| Dummy Region                                |          |          |         |         | Yes      | Yes      |
| Model estimation                            | GMM      | GMM      | GMM     | GMM     | OLS      | OLS      |
| Characteristics of models                   |          |          |         |         |          |          |
| Root mean square error                      | 1.008    | 0.890    | 0.890   | 1.467   |          |          |
| Sargan test<br>(P-value)                    | 80.415   | 80.097   | 67.872  | 54.913  |          |          |
|   | (1.000)  | (1.000)  | (1.000) | (1.000) |          |          |
| AR(1)<br>(P-value)                          | 4.004    | 3.481    | 2.508   | -0.0060 |          |          |
|   | (<.0001) | (0.0003) | (0.006) | (0.502) |          |          |
| AR(2)<br>(P-value)                          | -1.307   | 0.162    | -2.224  | -1.806  |          |          |
|   | (0.904)  | (0.436)  | (0.987) | (0.965) |          |          |
| F-test<br>(P-value)                         |          |          |         |         | 20.34    | 5.17     |
|   |          |          |         |         | (<.0001) | (<.0001) |
| R <sup>2</sup>                              |          |          |         |         | 0.5063   | 0.2068   |

This table presents the result of the two-step system GMM estimates of equation (48). The bank risks include total risk, systematic risk, idiosyncratic risk, credit risks and risk of default which is measured by Z-score. Credit risks are measured using equation (36) and (37). Total risk, systematic risk and idiosyncratic risk are defined in equation (35). Log (Total assets) captures bank's size, measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. Dummy year considers different effect between each of year 2005/2006/2007/2008 and year 2004. AR(1) and AR(2) are the test statistics for first order and second order serial correlation respectively. Sargan test is a test of over identifying restrictions. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

### 6.1.2 Compensation structure

We analyzed the effect of each component's value in annual compensation package on bank measures of risk in the above section. In this part, we consider the effect of compensation structure that is each component's percentage in annual compensation package on bank risks.

Regarding to the control variables, their effects on bank risks mostly are consistent with the above analysis. We therefore reserve the following analysis only for impact of CEO's compensation structure.

#### 6.1.2.1 Percentage of salary

Table 28 illustrates statistically negative effect of percentage of CEO salary on all measures of market-based risk and ratio of loan loss provision to total loan. Moreover CEO salary structure is proved to have no relationship with bank's risk of default which is reflected by Z-score indicator; hypothesis 4.6 therefore is rejected. This finding can be interpreted as banks with CEOs having larger proportion of salary get lower level of market-based risks (total risk, systematic risk, and idiosyncratic risk) and lower ratio of loan loss provision to total loan. Our hypotheses 4.1, 4.2, 4.3 and 4.4 therefore are supported. Hypothesis 4.5 of relationship between CEO salary structure and non-performing loan ratio is rejected by our study as a significantly positive effect at the 0.1% significant level is found. Since fixed payment accounts for a large proportion, managers may prefer conducting traditional activities such as lending activities than market-based ones. Lending activities in an economic growth period seem to be more stable than the market-based ones. Focusing resources on lending activities whereas a large portion of manager's wealth is definitely (not tied to bank performance), this may lead to loosening of policies relating to lending activities. However imprudent in making-decision related to a loan is one of the main reasons leading a bank to face with credit risk. This behavior may be a possible explanation for the negative effects of CEO salary structure on market-based measures of risk but positive effect of salary structure on bank's ratio of non-performing loan to total loan.

#### 6.1.2.2 Percentage of bonus

Our findings show significantly negative relationship between percentage of CEO bonus and idiosyncratic risk as well as between percentage of CEO bonus and non-performing loan to total loan ratio. Moreover percentage of bonus is illustrated to have no effect on total risk, systematic risk and risk of default which is reflected by Z-score. Consequently Hypothesis 2 (including 6 sub hypotheses) is rejected. Actually, not as what people has thought about responsibility of bonus towards bank risk-taking, percentage of this component does not induce any type of bank risk, but conversely, it decreases idiosyncratic risk at 1% significant level and non-performing loan ratio at 0.1% significant level. Banks with CEO having higher percentage of bonus in total annual compensation get lower

idiosyncratic risk and lower ratio of non-performing loan. As CEO bonus is a component which is tied to bank performance, if it accounts for a large proportion of CEO's wealth, evidently he must be more conservative in every decision relating to bank performance. From that perspective, usage of bonus in compensation package is even better than salary in controlling bank's credit risk. Another explanation is that CEO bonus, in nominal terms, is determined by Compensation Committee of a bank which is independent from bank CEO. Based on bank performance of the given year, the Compensation Committee will independently calculate CEO bonus. However is the Compensation Committee really independent from CEO? In case CEO has some certain "impact" on the Compensation Committee in determining his bonus, then CEO bonus is not a pay-for-performance instrument anymore. Conversely, it may be somewhat like salary.

**Table 28 Impact of percentage of CEO salary on bank risks**

| Parameter                          | TOTARISK | IDIORISK | LLP     | NPL      | SYSTRISK | Z-score  |
|------------------------------------|----------|----------|---------|----------|----------|----------|
| 01. Constant                       | -0.02    | 0.00     | 0.03    | -0.02    | 1.92     | -260.33  |
|                                    | ns       | ns       | *       | ns       | ***      | ***      |
| 02. Percentage of Salary,%         | -0.00    | -0.00    | -0.00   | 0.01     | -0.00    | 0.15     |
|                                    | ***      | ***      | ***     | ***      | ***      | ns       |
| 03. Log(Total assets, mil dollars) | -0.05    | -0.08    | 0.15    | 0.16     | -0.01    | 5.00     |
|                                    | ***      | ***      | ***     | ***      | ns       | *        |
| 04. Bank capital, %                | 0.01     | -0.02    | 0.40    | 1.60     | 0.01     | -0.77    |
|                                    | ns       | ns       | ***     | ***      | ns       | ns       |
| 05. Square of Bank capital         | -0.00    | 0.00     | -0.01   | -0.05    |          |          |
|                                    | ns       | ns       | ***     | ***      |          |          |
| 06. Charter value                  | 1.73     | 1.84     | -4.79   | -13.77   | -0.67    | 233.26   |
|                                    | ***      | ***      | ***     | ***      | ns       | ***      |
| 07. Bank loan, %                   | 0.00     | 0.00     | 0.01    | 0.01     | -0.00    | -0.03    |
|                                    | ns       | ***      | ***     | ***      | ns       | ns       |
| Dummy Year                         | Yes      | Yes      | Yes     | Yes      | Yes      | Yes      |
| Dummy Region                       |          |          |         |          | Yes      | Yes      |
| Model estimation                   | GMM      | GMM      | GMM     | GMM      | OLS      | OLS      |
| Characteristics of models          |          |          |         |          |          |          |
| Root mean square error             | 1.036    | 0.923    | 0.905   | 1.394    |          |          |
| Sargan test<br>(P-values)          | 76.675   | 78.212   | 68.839  | 64.094   |          |          |
|                                    | (1.000)  | (1.000)  | (1.000) | (1.000)  |          |          |
| AR(1)<br>(P-values)                | 4.122    | 3.701    | 2.540   | -0.4.500 |          |          |
|                                    | (<.0001) | (0.0001) | (0.006) | (0.674)  |          |          |
| AR(2)<br>(P-values)                | -1.190   | 0.574    | -2.610  | -1.817   |          |          |
|                                    | (0.883)  | (0.283)  | (0.995) | (0.965)  |          |          |
| F-test<br>(P-value)                |          |          |         |          | 21.54    | 4.90     |
|                                    |          |          |         |          | (<.0001) | (<.0001) |
| R <sup>2</sup>                     |          |          |         |          | 0.5227   | 0.1996   |

This table presents the result of the two-step system GMM estimates of equation (48). The bank risks include total risk, systematic risk, idiosyncratic risk, credit risks and risk of default which is measured by Z-score. Credit risks are measured using equation (36) and (37). Total risk, systematic risk and idiosyncratic risk are defined in equation (35). Log (Total assets) captures bank's size, measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. Dummy year considers different effect between each of year 2005/2006/2007/2008 and year 2004. AR(1) and AR(2) are the test statistics for first order and second order serial correlation respectively. Sargan test is a test of over identifying restrictions. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 29 Impact of percentage of CEO bonus on bank risks**

| Parameter                          | TOTARISK | IDIORISK | LLP     | NPL      | SYSTRISK | Z-score  |
|------------------------------------|----------|----------|---------|----------|----------|----------|
| 01. Constant                       | -0.02    | -0.00    | 0.04    | -0.00    | 1.33     | -258.34  |
|                                    | ns       | ns       | *       | ns       | *        | ***      |
| 02. Percentage of Bonus, %         | -0.00    | -0.00    | -0.00   | -0.01    | 0.00     | -0.18    |
|                                    | ns       | ***      | ns      | ***      | ns       | ns       |
| 03. Log(Total assets, mil dollars) | -0.04    | -0.07    | 0.16    | 0.27     | 0.01     | 5.58     |
|                                    | ***      | ***      | ***     | ***      | ns       | *        |
| 04. Bank capital, %                | 0.01     | 0.05     | 0.46    | 1.39     | 0.01     | -0.38    |
|                                    | ns       | **       | ***     | ***      | ns       | ns       |
| 05. Square of Bank capital         | -0.00    | -0.00    | -0.01   | -0.04    |          |          |
|                                    | ns       | ns       | ***     | ***      |          |          |
| 06. Charter value                  | 1.58     | 1.27     | -5.39   | -12.54   | -0.62    | 234.03   |
|                                    | ***      | ***      | ***     | ***      | ns       | ***      |
| 07. Bank loan, %                   | -0.00    | 0.00     | 0.01    | 0.01     | -0.00    | -0.02    |
|                                    | ns       | ns       | ***     | ***      | ns       | ns       |
| Dummy Year                         | Yes      | Yes      | Yes     | Yes      | Yes      | Yes      |
| Dummy Region                       |          |          |         |          | Yes      | Yes      |
| Model estimation                   | GMM      | GMM      | GMM     | GMM      | OLS      | OLS      |
| Characteristics of models          |          |          |         |          |          |          |
| Root mean square error             | 1.045    | 0.917    | 0.910   | 1.342    |          |          |
| Sargan test<br>(P-value)           | 80.228   | 77.149   | 77.591  | 58.074   |          |          |
|                                    | (1.000)  | (1.000)  | (1.000) | (1.000)  |          |          |
| AR(1)<br>(P-values)                | 4.122    | 3.482    | 2.527   | -0.6.578 |          |          |
|                                    | (<.0001) | (0.0002) | (0.006) | (0.745)  |          |          |
| AR(2)<br>(P-value)                 | -1.138   | 0.349    | -2.579  | -1.583   |          |          |
|                                    | (0.872)  | (0.363)  | (0.995) | (0.943)  |          |          |
| F-test<br>(P-value)                |          |          |         |          | 19.27    | 5.03     |
|                                    |          |          |         |          | (<.0001) | (<.0001) |
| R <sup>2</sup>                     |          |          |         |          | 0.4949   | 0.2036   |

This table presents the result of the two-step system GMM estimates of equation (48). The bank risks include total risk, systematic risk, idiosyncratic risk, credit risks and risk of default which is measured by Z-score. Credit risks are measured using equation (36) and (37). Total risk, systematic risk and idiosyncratic risk are defined in equation (35). Log (Total assets) captures bank's size, measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. Dummy year considers different effect between each of year 2005/2006/2007/2008 and year 2004. AR(1) and AR(2) are the test statistics for first order and second order serial correlation respectively. Sargan test is a test of over identifying restrictions. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.



**Table 30 Impact of percentage of CEO other annual compensation on bank risks**

| Parameter                                      | TOTARISK | IDIORISK | LLP     | NPL      | SYSTRISK | Z-score  |
|--|----------|----------|---------|----------|----------|----------|
| 01. Constant                                   | -0.01    | -0.00    | 0.03    | 0.00     | 0.97     | -229.62  |
|  | ns       | ns       | ns      | ns       | ns       | ***      |
| 02. Percentage of other annual compensation, % | 0.01     | 0.00     | 0.00    | 0.01     | 0.00     | 0.07     |
|  | ***      | ***      | ***     | ***      | *        | ns       |
| 03. Log(Total assets, mil dollars)             | -0.04    | -0.10    | 0.17    | 0.14     | 0.03     | 3.71     |
|  | **       | ***      | ***     | **       | ns       | ns       |
| 04. Bank capital, %                            | 0.05     | 0.05     | 0.37    | 1.64     | 0.02     | -1.28    |
|  | *        | ***      | ***     | ***      | *        | ns       |
| 05. Square of Bank capital                     | -0.00    | -0.00    | -0.01   | -0.05    |          |          |
|  | *        | **       | ***     | ***      |          |          |
| 06. Charter value                              | 1.02     | 1.31     | -5.02   | -13.44   | -0.59    | 230.11   |
|  | ***      | ***      | ***     | ***      | ns       | ***      |
| 07. Bank loan, %                               | 0.00     | 0.00     | 0.01    | 0.02     | -0.00    | 0.00     |
|  | ns       | ***      | ***     | ***      | ns       | ns       |
| Dummy Year                                     | Yes      | Yes      | Yes     | Yes      | Yes      | Yes      |
| Dummy Region                                   |          |          |         |          | Yes      | Yes      |
| Model estimation                               | GMM      | GMM      | GMM     | GMM      | OLS      | OLS      |
| Characteristics of models                      |          |          |         |          |          |          |
| Root mean square error                         | 1.031    | 0.910    | 0.911   | 1.433    |          |          |
| Sargan test<br>(P-value)                       | 80.808   | 81.262   | 56.461  | 63.765   |          |          |
|  | (1.000)  | (1.000)  | (1.000) | (1.000)  |          |          |
| AR(1)<br>(P-value)                             | 4.136    | 3.254    | 2.311   | -0.2.839 |          |          |
|  | (<.0001) | (0.0001) | (0.010) | (0.612)  |          |          |
| AR(2)<br>(P-value)                             | -1.229   | 0.232    | -2.480  | -1.714   |          |          |
|  | (0.890)  | (0.408)  | (0.993) | (0.957)  |          |          |
| F-test<br>(P-value)                            |          |          |         |          | 19.94    | 4.75     |
|  |          |          |         |          | (<.0001) | (<.0001) |
| R <sup>2</sup>                                 |          |          |         |          | 0.5035   | 0.1945   |

This table presents the result of the two-step system GMM estimates of equation (48). The bank risks include total risk, systematic risk, idiosyncratic risk, credit risks and risk of default which is measured by Z-score. Credit risks are measured using equation (36) and (37). Total risk, systematic risk and idiosyncratic risk are defined in equation (35). Log (Total assets) captures bank's size, measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. Dummy year considers different effect between each of year 2005/2006/2007/2008 and year 2004. AR(1) and AR(2) are the test statistics for first order and second order serial correlation respectively. Sargan test is a test of over identifying restrictions. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

### *6.1.2.3 Percentage of other annual compensation*

Besides showing the influences of control variable which were mentioned in previous sections, Table 30 also presents the effect of percentage of CEO's other annual compensation. The findings illustrate that percentage of CEO's other annual compensation significantly increases with all measures of market-based risk (total risk, idiosyncratic risk and systematic risk) and credit risks (LLP and NPL) but has no relation with Z-score. Coefficients, if any, are all statistically significant. This finding is consistent with our Hypotheses 6.1, 6.2, 6.3, 6.4, 6.5. The interpretation is that banks which compensate to their CEOs higher percentage of other annual compensation are found to have higher total risk, higher idiosyncratic risk, higher systematic risk, higher ratio of loan loss provision to total loan as well as higher ratio of non-performing loan to total loan.

### **6.1.3 Conclusion**

In the first empirical research, we investigate the effect of CEO compensation including: CEO salary, CEO bonus, CEO other annual compensation, Percentage of CEO salary, percentage of CEO bonus and percentage of CEO other annual compensation. We develop and test a model of bank risk using the above compensation variables (alternatively) and other control variables which are bank size, bank capital, charter value and bank loan. The research model allows for non-linearity on the effect of bank capital which is measured by risk adjusted total capital ratio. We use a sample of 63 large banks drawn from Europe, Canada and United States spanning a 5 year period from 2004 to 2008 for bank risk variables and a 5 year period from 2003 to 2007 for independent variables. We use six bank risk measures in this empirical analysis which are total risk, systematic risk, idiosyncratic risk, loan loss provision to total loan ratio, non-performing loan to total loan ratio, and risk of default measured through Z-score.

Considering the effects of control variables, Table 31 synthesizes our results. The findings show that bank size which is measured through total assets has significantly negative effect on total risk and idiosyncratic risk but significantly positive impact on credit risks which are loan loss provision to total loan ratio and non-performing loan to total loan ratio. Relationships between bank size and systematic risk and between bank size and Z-score are not clear through all our regressions; however they may be positive, if any. This finding can be interpreted that larger banks have more chance to diversify market-based activities; consequently they may decrease total risk and idiosyncratic risk. However as all of them are "too big to fail" banks, the larger ones may prefer riskier loans which are expected to bring back more profits. This leads to higher ratio of loan loss provision to total loan and higher ratio of non-performing loan to total loan at greater banks. All of the effects are at the 0.1% significant level and are consistent through all of our regressions.

**Table 31 Synthesize effects of control variables on measures of bank risks**

| Control variables              | TOTARISK |     |     |     |     |     |             | SYSTRISK |     |     |     |     |     |             | IDIORISK |     |     |     |     |     |             |
|--------------------------------|----------|-----|-----|-----|-----|-----|-------------|----------|-----|-----|-----|-----|-----|-------------|----------|-----|-----|-----|-----|-----|-------------|
|                                | M1       | M2  | M3  | M4  | M5  | M6  | Synthesize  | M1       | M2  | M3  | M4  | M5  | M6  | Synthesize  | M1       | M2  | M3  | M4  | M5  | M6  | Synthesize  |
| Log(Total assets, mil dollars) | -        | -   | -   | -   | -   | -   | -           | ns       | ns  | ns  | ns  | ns  | ns  | ns          | -        | -   | -   | -   | -   | -   | -           |
| Bank capital, %                | ***      | *** | *** | *** | *** | **  | ***         | ns       | ns  | ns  | ns  | ns  | ns  | ns          | ***      | *** | *** | *** | *** | *** | ***         |
| Square of Bank capital         | +        |     | +   |     |     | +   | +           | ns       | ns  | +   |     |     | +   | +           | +        | +   |     | +   | +   | +   | +           |
| Charter value                  | *        | ns  | *** | ns  | ns  | *   | (direction) | ns       | ns  | *   | ns  | ns  | *   | (direction) | **       | *   | *** | ns  | *   | *** | **          |
| Bank loan, %                   | -        |     | -   |     |     | -   | -           |          |     |     |     |     |     |             | -        |     | -   |     |     | -   | -           |
|                                | ***      | ns  | *** | ns  | ns  | *   | (direction) |          |     |     |     |     |     |             | ***      | ns  | *** | ns  | ns  | **  | (direction) |
|                                | +        | +   | +   | +   | +   | +   | +           | ns       | ns  | ns  | ns  | ns  | ns  | ns          | +        | +   | +   | +   | +   | +   | +           |
|                                | ***      | *** | *   | *** | *** | *** | ***         | ns       | ns  | ns  | ns  | ns  | ns  | ns          | ***      | *** | *** | *** | *** | *** | ***         |
|                                | +        |     | +   |     |     | +   | +           | ns       | ns  | ns  | ns  | ns  | ns  | ns          | +        |     | +   | +   | +   | +   | +           |
|                                | *        | ns  | *   | ns  | ns  | ns  | (direction) | ns       | ns  | ns  | ns  | ns  | ns  | ns          | ***      | ns  | **  | *** | ns  | *** | ***         |
| Control variables              | LLP      |     |     |     |     |     |             | NPL      |     |     |     |     |     |             | Z_score  |     |     |     |     |     |             |
|                                | M1       | M2  | M3  | M4  | M5  | M6  | Synthesize  | M1       | M2  | M3  | M4  | M5  | M6  | Synthesize  | M1       | M2  | M3  | M4  | M5  | M6  | Synthesize  |
| Log(Total assets, mil dollars) | +        | +   | +   | +   | +   | +   | +           | +        | +   | +   | +   | +   | +   | +           | ns       | ns  | ns  | +   | +   | ns  | +           |
| Bank capital, %                | ***      | *** | **  | *** | *** | *** | ***         | ***      | *** | *** | **  | *** | *** | ***         | ns       | ns  | ns  | *   | *   | ns  | (direction) |
| Square of Bank capital         | +        | +   | +   | +   | +   | +   | +           | +        | +   | +   | +   | +   | +   | +           | ns       | ns  | ns  | ns  | ns  | ns  | ns          |
| Charter value                  | ***      | *** | *** | *** | *** | *** | ***         | ***      | *** | *** | *** | *** | *** | ***         | ns       | ns  | ns  | ns  | ns  | ns  | ns          |
| Bank loan, %                   | -        | -   | -   | -   | -   | -   | -           | -        | -   | -   | -   | -   | -   | -           |          |     |     |     |     |     |             |
|                                | ***      | *** | *** | *** | *** | *** | ***         | ***      | *** | *** | *** | *** | *** | ***         | +        | +   | +   | +   | +   | +   | +           |
|                                | +        | +   | +   | +   | +   | +   | +           | +        | +   | +   | +   | +   | +   | +           | ***      | *** | *** | *** | *** | *** | ***         |
|                                | ***      | *** | *** | *** | *** | *** | ***         | ***      | *** | *** | *** | *** | *** | ***         | ns       | ns  | ns  | ns  | ns  | ns  | ns          |

This table synthesizes effects of control variables on different measures of bank risks. M1: the obtained results (related to the control variables only) in running regression bank risk on CEO salary and the other control variables. M2: the obtained results in running regression bank risk on CEO bonus and the other control variables. M3: the obtained results in running bank risk on CEO's other annual compensation and the control variables. M4: the obtained results in running regression bank risk on CEO salary structure. M5: the obtained results in running regression bank risk on CEO bonus structure. M6: the obtained results in running regression bank risk on other annual compensation structure.

Table 31 illustrates an evidence of non-linear (convex-shaped) relation between bank capital and credit risks at the 0.1% level of significance. The findings are consistent through all of regressions and can be explained that at low levels of bank capital, as bank capital increases, credit risks increase, but as the capital buffer gets larger bank risks increase at decreasing rate. At “certain point” of bank capital, bank risks do not grow and after this point, they start to fall. In relations with market-based measures of risk, we can see a direction of non-linear association (convex-shaped) between bank capital and idiosyncratic risk. Association between bank capital and systematic risk or between bank capital and total risk are not clear as the results are not consistent through different regressions. However the relationship between bank capital and total risk may be under the convex-shaped, if any. Bank capital is illustrated to have no effect on Z-score. The findings are not supported for the previous studies on relationship between bank capital and bank risk as most of them illustrated negative effects or concave-shaped associations (Furlong and Keeley, 1989; Besanko and Kanatas, 1996; Haq and Heaney, 2012). We propose that an explanation for our results may lie in bank size of our sample. As mentioned in Section 5.4.5, since all of banks in our sample are “too big to fail”, bank which has larger capital may prefer to take riskier activities in exchange of big profits. As a result, under the role of authorities, bank capital can be based on to control bank risk; however it is necessary to choose a suitable threshold (the “certain point” of bank capital mentioned above). Choosing a wrong threshold may have the opposite effect (e.g. in case a threshold which is smaller than the “certain point” of bank capital, bank capital then continues to augment bank risks).

**Table 32 Synthesize CEO compensation effect on measures of bank risk**

| Parameter                          | TOTARISK | IDIORISK | LLP | NPL | SYSTRISK | Z_score |
|------------------------------------|----------|----------|-----|-----|----------|---------|
| Log(Salary, dollars)               | -        | -        | -   | -   |          |         |
|                                    | ***      | ***      | *** | *** | ns       | ns      |
| Log(Bonus, dollars)                |          | -        | -   | -   | +        |         |
|                                    | ns       | ***      | *** | *** | **       | ns      |
| Log(Other compensation, dollars)   | +        | +        | +   |     | +        |         |
|                                    | ***      | ***      | *** | ns  | **       | ns      |
| Percentage of salary, %            | -        | -        | -   | +   | -        |         |
|                                    | ***      | ***      | *** | *** | ***      | ns      |
| Percentage of bonus, %             |          | -        | -   | -   |          |         |
|                                    | ns       | **       | *** | *** | ns       | ns      |
| Percentage of other compensation,% | +        | +        | +   | +   | +        |         |
|                                    | ***      | ***      | *** | *** | *        | ns      |

Results about effect of charter value on bank risk are very consistent: significantly positive relations between charter value and total risk, idiosyncratic risk and Z-score; significantly negative relations between charter value and loan loss provision to total loan

ratio and non-performing loan to total loan ratio; no association between charter value and systematic risk. This finding is consistent with the study of Haq and Heaney (2012) which found a negative effect of charter value on bank credit risk, but significantly positive relationship between charter value and bank equity risk.

Bank loan is another important factor of bank risk as it is illustrated to significantly increase loan loss provision to total loan ratio and non-performing loan to total loan ratio at the 0.1% significant level. Banks that focus on loan activities are also to be illustrated to have higher idiosyncratic risk and higher total risk. However bank loan has not any effect on systematic risk and Z-score.

We then synthesize results about effect of CEO compensation on bank risks in Table 32. Our results reveal very interesting information that CEO salary and CEO bonus actually has the nearly same effect on most of bank risk measures. Both CEO salary and CEO bonus decrease idiosyncratic risk, loan loss provision to total loan ratio and non-performing loan to total loan ratio; and have no relationship to bank's Z-score. The differences are in the association with total risk and systematic risk. CEO salary is illustrated to have no impact on systematic risk and to decrease total risk; however CEO bonus is proved to induce systematic risk but to have no effect on total risk. Coefficients of CEO salary or CEO bonus, if any, are all statistically significant. Most of our hypotheses related to CEO salary level (3.1, 3.3, 3.4, and 3.5) are supported by this study. Hypothesis 3.2 and 3.6 are rejected. Referring to CEO bonus, not as expected, our results showed that mostly CEO bonus does not increase bank risk but conversely, it statistically reduces idiosyncratic risk, loan loss provision to total loan ratio and non-performing loan to total loan ratio. As a result, only Hypotheses 1.2 is supported, the rest 1.1, 1.3, 1.4, 1.5, 1.6 are all rejected. Since CEO bonus is linked to bank performance, apparently shareholders use it for the purpose of incentivizing managers to look for profitable activities. Since the crisis happened, CEO bonus has been claimed to be the component that places executives in a pressure to chase the best results. Consequently, it has been thought to make executives focus on near-term performance at the expense of long-term sustainability. In this dissertation, we investigate effects of CEO bonus on bank risks which are collected after one year since CEO bonus was rewarded. Our results then does not support for the above point of view which blames executive bonus for inducing bank risk-taking. We agree that bonus encourages CEO to look for more profitable activities that may be riskier; however it also enhances manager's prudence in making each decision. That may be possible explanation for our results. Another explanation is that CEO bonus, in nominal terms, is determined by Compensation Committee of a bank which is independent from bank CEO. Based on bank performance of the given year, the Compensation Committee will independently calculate CEO bonus. However is the Compensation Committee really independent from CEO? In case CEO has some certain "impact" on the Compensation Committee in determining his bonus, then CEO bonus is not a pay-for-performance instrument anymore. Conversely, it may be somewhat like salary.

Most of relations between CEO's other annual compensation and bank risks are found to be positive. This component is illustrated to increase total risk, idiosyncratic risk, systematic risk and ratio of loan loss provision to total loan at 0.1% level of significance. Positive effect of CEO's other annual compensation on systematic risk is found at 1% significant level. However we have no evidence of relationship between this component and ratio of non-performing loan to total loan or Z-score. Subsequently, Hypotheses 5.1, 5.2, 5.3, 5.4 are supported whereas Hypotheses 5.5, 5.6 are rejected.

Following this finding which was resulted based on a sample of very large banks, in CEO's annual compensation package, it is the other annual compensation that most induces bank risk-taking but not CEO bonus. Consequently, setting limits on value of executive bonus suggested by authorities may not be effective for risk control objective in the banking sector. Up to the estimated period in this dissertation, obtaining comprehensive information on these forms of pay however has been difficult. Because of insufficient disclosure, some previous studies labeled perquisites, pensions and severance pay as "stealth" compensation that may allow executives to surreptitiously extract rents (Jensen & Meckling, 1976; Jensen, 1986; Bebchuk & Fried, 2004). We therefore suppose that effect of other annual compensation in CEO's compensation package must be more studied in the future.

Considering impact of compensation structure, our results show that percentage of other annual compensation increases most kinds of bank risk (except risk of default measured through Z-score). Hypotheses 6.1, 6.2, 6.3, 6.4, 6.5 therefore are supported; Hypothesis 6.6 is rejected. Percentage of CEO bonus is illustrated to have negative association with idiosyncratic risk, loan loss provision to total loan ratio and non-performing loan to total loan ratio. Consequently Hypotheses 2 (2.1, 2.2, 2.3, 2.4, 2.5, and 2.6) are all rejected. Whereas percentage of salary is found to have negative effect on total risk, systematic risk, idiosyncratic risk and loan loss provision to total loan ratio, but significantly positive impact on non-performing loan to total loan ratio. Referring to our hypotheses, Hypothesis 4.5 and Hypothesis 4.6 are therefore rejected; the rest hypotheses related to CEO salary structure are supported. This finding reveals that authority, for the purpose of controlling bank risk, should better focus on other annual compensation both under level and under structure perspective. Table 33 below summarizes our results in comparing with the expected effects of CEO compensation on bank risks.

**Table 33 Comparing obtained results with expected effects of CEO compensation on bank risks**

|           | H.1<br>TOTARISK |        | H.2<br>SYSTRISK |        | H.3<br>IDIORISK |        | H.4<br>LLP |        | H.5<br>NPL |        | H.6<br>z-score |        | Hypothesis<br>H |
|-----------|-----------------|--------|-----------------|--------|-----------------|--------|------------|--------|------------|--------|----------------|--------|-----------------|
|           | expected        | result | expected        | result | expected        | result | expected   | result | expected   | result | expected       | result |                 |
| BONUS     | +               | ns     | +               | +      | +               | -      | +          | -      | +          | -      | -              | ns     | 1               |
| BONUSPER  | +               | ns     | +               | ns     | +               | -      | +          | -      | +          | -      | -              | ns     | 2               |
| SALARY    | -               | -      | -               | ns     | -               | -      | -          | -      | -          | -      | +              | ns     | 3               |
| SALARYPER | -               | -      | -               | -      | -               | -      | -          | -      | -          | +      | +              | ns     | 4               |
| OTHERS    | +               | +      | +               | +      | +               | +      | +          | +      | +          | ns     | -              | ns     | 5               |
| OTHERPER  | +               | +      | +               | +      | +               | +      | +          | +      | +          | +      | -              | ns     | 6               |

## 6.2 Examine effect of CEO compensation on bank risk at the time of financial crisis by using cross-sectional data

Sharp changes in measures of bank risks have been witnessed throughout the period 2006-2008 as 2008 is considered the peak of the financial crisis. This dissertation aims to investigate responsibility of CEO compensation in the crisis. To quantify this responsibility, we take into account effects of CEO compensation rewarded in the normal period (2006) on changes in bank risks during the crisis period. Detail of research models that are appropriately defined to each type of change in bank risk ( $\Delta Risk$ ) was presented in Section 5.4.4.2. In this section, we focus on results and analysis to better understand about the relationship between CEO compensation and bank risk-taking. However in order to facilitate referencing between results and research models, we shortly repeat here the most important characteristics of models:

- For investigation of CEO compensation's effects on change in total risk, on change in idiosyncratic risk, on sharp drop in stock price, on change in ratio of loan loss provision to total loan and on change in ratio of non-performing loan to total loan, the model is:

$$\Delta Risk_{i,j} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 BC_{i,j} + \beta_3 CV_{i,j} \\ + \beta_4 LOAN_{i,j} + \beta_5 GDP_j + \beta_6 dummy\_region + \varepsilon_{i,j} \end{cases} \quad (73)$$

- For investigation of CEO compensation's effects on change in bank ratings for short-term, on change in bank ratings for long term, on change in CDS1Y and on change in CDS5Y, the model is:

$$\Delta RISK_{i,j} = \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 GDP_j + \beta_3 LOAN_{i,j} + \varepsilon_{i,j} \quad (74)$$

- For investigation of CEO compensation's effects on the change in Z-score, we use the following model:

$$\Delta RISK_{i,j} = \alpha_o + \beta_1 Compensation_{i,j} + \beta_2 CV + \beta_3 dummy\_region + \varepsilon_{i,j} \quad (76)$$

Where  $\Delta Risk$  is a change in bank risk during the crisis period. Detail of the calculation for  $\Delta Risk$  was presented in Section 5.4.4.2. With regards to dependent variables in our models, except GDP is collected at the end of 2008, the rest is collected at the end of 2006.

Table 34 to Table 41 report the OLS results of CEO compensation's effect on changes in bank risks during the crisis period. We use the variance inflation factor (VIF) to control the multicollinearity issue in all of OLS regressions. VIF illustrates how much the variance of an estimated regression coefficient is increased due to collinearity problem. We follow a suggestion of Paul Allison which proposes that: if any of the VIF values exceeds 2.50, it implies that the regression coefficients may be poorly estimated because of multicollinearity<sup>33</sup>. As the maximum VIF reported by Table 34 to Table 41 is 2.33, we have no problem running OLS regression. The analysis is divided under two sections: Influence of annual compensation; and influence of equity-based compensation.

## 6.2.1 Influence of annual compensation on change in bank risks during the crisis period

### 6.2.1.1 Compensation level

#### Salary

Table 34 presents the effect of CEO salary and other control variables on abnormal changes in bank risks. Considering effects of control variables, after a quick look through Table 34 we can see that charter value and GDP are variables that have the most effect on changes in bank risk, if any. Charter value at the end of 2006 is illustrated to have negative effect on change in total risk, on change in idiosyncratic risk, and on sharp drop in stock price and on change in loan loss provision ratio. This means that banks with higher charter value in 2006 seem to be less affected by the financial crisis as they got smaller drop in stock price, smaller increase in total risk and smaller increase in idiosyncratic risk and smaller change in ratio of loan loss provision to total loan. Some previous studies explained for a negative relationship between charter value and bank risk that banks possibly choose to avoid risk to protect their charter values (Keeley 1990, Park and Peristiani, 2007, Anderson and Fraser, 2000).

GDP growth rate is found to have negative effect on sharp drop in stock price, on change in total risk, on change in idiosyncratic risk, on change in loan loss provision to total loan ratio, and on change in CDS5Y, and positive effect on change in bank ratings (both for long term and short term). This finding is logical as GDP growth rate reflects changes in the economic environment; banks therefore face greater risk in countries with lower one.

<sup>33</sup> Suggestion of Paul Allison available at <http://statisticalhorizons.com/multicollinearity>



Bank capital and bank loan in 2006 are illustrated to have no effect on changes in bank risk during the crisis except a positive relationship between bank loan and change in non-performing loan ratio. That is logical when banks that more focused on loan activities before the crisis then suffered higher changes in ratio of non-performing loan to total loan during the crisis period.

CEO salary is confirmed to have no relation to most of changes in bank risk during the crisis period. However, CEO salary (in 2006) is illustrated to increase with change in non-performing loan ratio during the crisis. This result seems to be consistent with our results in the previous empirical research. Since CEO is assured by a large amount of fixed payment, he may prefer conducting traditional activities such as lending activities than market-based ones. Lending activities in an economic growth period seem to be more stable than the market-based ones. Focusing resources on lending activities whereas a large portion of manager's wealth is definitely (not tied to bank performance), this may lead to loosening of policies relating to lending activities. Consequently during the crisis period, the bank had to face with high increase in non-performing loan stemmed from bad quality loans. As a result, our hypotheses 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8 are all rejected.

**Table 34.a Impact of CEO salary on changes in bank risks**

| Parameter                     | SHARDROP | delta_IDIORISK | delta_LL | delta_NPL | delta_TOTARISK |
|-------------------------------|----------|----------------|----------|-----------|----------------|
| 01. SALARY, natural logarithm | -0.00    | 0.22           | 0.14     | 1.26      | 0.38           |
|                               | ns       | ns             | ns       | **        | ns             |
| 02. Bank capital, %           | 0.00     | 0.02           | 0.07     | -0.16     | -0.06          |
|                               | ns       | ns             | ns       | ns        | ns             |
| 03. Bank charter value        | -1.76    | -17.10         | -13.58   | -7.03     | -10.82         |
|                               | **       | **             | **       | ns        | *              |
| 04. Bank loan, %              | 0.00     | 0.00           | 0.01     | 0.04      | 0.01           |
|                               | ns       | ns             | ns       | **        | ns             |
| 05. GDP growth rate, %        | -0.03    | -0.29          | -0.38    | -0.43     | -0.23          |
|                               | *        | *              | **       | *         | *              |
| Dummy country                 | Yes      | Yes            | Yes      | Yes       | Yes            |
| Characteristics of models     |          |                |          |           |                |
| 1. F test                     | 4.769    | 8.586          | 13.703   | 6.915     | 13.478         |
| 2. p-value                    | 0.0003   | <.0001         | <.0001   | 0.00001   | <.0001         |
| 3. R <sup>2</sup>             | 0.464    | 0.610          | 0.718    | 0.563     | 0.710          |
| 4. Max VIF of the model       | 1.938    | 1.938          | 1.999    | 1.999     | 1.938          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). SALARY is measured by natural logarithm of CEO salary. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 34.b Impact of CEO salary on changes in bank risks**

| Parameter                     | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|-------------------------------|-------------|-------------|----------------|----------------|--------------|
| 01. SALARY, natural logarithm | 0.15        | 0.31        | -0.00          | -0.00          | -0.42        |
|                               | ns          | ns          | ns             | ns             | ns           |
| 02. Bank charter value        |             |             |                |                | -428.02      |
|                               |             |             |                |                | *            |
| 03. Bank loan, %              | -0.03       | -0.01       | -0.00          | -0.00          |              |
|                               | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %        | -0.85       | -0.50       | 0.00           | 0.00           |              |
|                               | ns          | *           | ***            | **             |              |
| Dummy Country                 | No          | No          | No             | No             | Yes          |
| Characteristics of models     |             |             |                |                |              |
| 1. F test                     | 0.835       | 1.914       | 5.337          | 6.681          | 2.293        |
| 2. p-value                    | 0.489       | 0.157       | 0.003          | 0.0008         | 0.060        |
| 3. R <sup>2</sup>             | 0.102       | 0.207       | 0.258          | 0.308          | 0.193        |
| 4. Max VIF of the model       | 1.105       | 1.105       | 1.089          | 1.089          | 1.645        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52). SALARY is measured by natural logarithm of CEO salary. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 35.a Impact of CEO bonus on changes in bank risks**

| Parameter                    | SHARDROP | delta_IDIORISK | delta_LLPL | delta_NPL | delta_TOTARISK |
|------------------------------|----------|----------------|------------|-----------|----------------|
| 01. BONUS, natural logarithm | 0.01     | 0.47           | 0.09       | 0.19      | 0.48           |
|                              | ns       | *              | ns         | ns        | **             |
| 02. Bank capital, %          | 0.01     | -0.02          | 0.08       | -0.21     | -0.11          |
|                              | ns       | ns             | ns         | ns        | ns             |
| 03. Bank charter value       | -2.03    | -18.54         | -14.62     | -5.87     | -11.59         |
|                              | ***      | **             | **         | ns        | *              |
| 04. Bank loan, %             | 0.00     | 0.02           | 0.01       | 0.04      | 0.03           |
|                              | ns       | ns             | ns         | *         | *              |
| 05. GDP growth rate, %       | -0.03    | -0.22          | -0.39      | -0.40     | -0.16          |
|                              | *        | ns             | **         | ns        | ns             |
| Dummy Country                | Yes      | Yes            | Yes        | Yes       | Yes            |
| Characteristics of models    |          |                |            |           |                |
| 1. F test                    | 6.012    | 8.650          | 11.854     | 5.226     | 13.857         |
| 2. p-value (F test)          | <.0001   | <.0001         | <.0001     | 0.0002    | <.0001         |
| 3. R <sup>2</sup>            | 0.552    | 0.640          | 0.714      | 0.524     | 0.740          |
| 4. Max VIF of the model      | 1.989    | 1.989          | 2.081      | 2.081     | 1.989          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). BONUS is measured by natural logarithm of CEO bonus. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 35.b Impact of CEO bonus on changes in bank risks**

| Parameter                    | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|------------------------------|-------------|-------------|----------------|----------------|--------------|
| 01. BONUS, natural logarithm | -0.15       | 0.18        | 0.00           | 0.00           | 3.44         |
|                              | ns          | ns          | ns             | ns             | ns           |
| 02. Bank charter value       |             |             |                |                | -467.89      |
|                              |             |             |                |                | *            |
| 03. Bank loan, %             | -0.03       | 0.01        | -0.00          | -0.00          |              |
|                              | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %       | -0.87       | -0.44       | 0.00           | 0.00           |              |
|                              | ns          | ns          | ***            | **             |              |
| Dummy Country                | No          | No          | No             | No             | Yes          |
| Characteristics of models    |             |             |                |                |              |
| 1. F test                    | 0.739       | 1.625       | 4.948          | 6.359          | 2.322        |
| 2. p-value                   | 0.541       | 0.215       | 0.005          | 0.001          | 0.059        |
| 3. R <sup>2</sup>            | 0.0100      | 0.196       | 0.266          | 0.323          | 0.213        |
| 4. Max VIF of the model      | 1.489       | 1.489       | 1.240          | 1.244          | 1.694        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52). BONUS is measured by natural logarithm of CEO bonus. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 36.a Impact of CEO other annual compensation on changes in bank risks**

**Table 36.a Impact of CEO's other annual compensation on changes in bank risks**

| Parameter                     | SHARDROP | delta_IDIORISK | delta_LL | delta_NPL | delta_TOTARISK |
|-------------------------------|----------|----------------|----------|-----------|----------------|
| 01. OTHERS, natural logarithm | -0.01    | -0.02          | -0.06    | 0.10      | 0.09           |
|                               | ns       | ns             | ns       | ns        | ns             |
| 02. Bank capital, %           | 0.00     | 0.00           | 0.09     | -0.20     | -0.06          |
|                               | ns       | ns             | ns       | ns        | ns             |
| 03. Bank charter value        | -1.86    | -17.57         | -14.17   | -6.96     | -11.01         |
|                               | ***      | **             | **       | ns        | *              |
| 04. Bank loan, %              | -0.00    | -0.00          | 0.01     | 0.04      | 0.01           |
|                               | ns       | ns             | ns       | *         | ns             |
| 05. GDP growth rate, %        | -0.03    | -0.29          | -0.39    | -0.42     | -0.22          |
|                               | *        | *              | **       | *         | *              |
| Dummy Country                 | Yes      | Yes            | Yes      | Yes       | Yes            |
| Characteristics of models     |          |                |          |           |                |
| 1. F test                     | 5.057    | 8.314          | 13.703   | 4.889     | 12.594         |
| 2. p-value                    | 0.0002   | <.0001         | <.0001   | 0.0003    | <.0001         |
| 3. R <sup>2</sup>             | 0.491    | 0.613          | 0.728    | 0.488     | 0.706          |
| 4. Max VIF of the model       | 2.332    | 2.332          | 2.320    | 2.320     | 2.332          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). OTHERS is measured by natural logarithm of CEO other annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, ns denotes non-significant.

**Table 36.b Impact of CEO other annual compensation on changes in bank risks**

| Parameter                     | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|-------------------------------|-------------|-------------|----------------|----------------|--------------|
| 01. OTHERS, natural logarithm | 0.00        | 0.29        | -0.00          | -0.00          | -1.09        |
|                               | ns          | ns          | ns             | ns             | ns           |
| 02. Bank charter value        |             |             |                |                | -427.44      |
|                               |             |             |                |                | *            |
| 03. Bank loan, %              | -0.03       | -0.01       | -0.00          | -0.00          |              |
|                               | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %        | -0.85       | -0.48       | 0.00           | 0.00           |              |
|                               | ns          | *           | ***            | **             |              |
| Dummy Country                 | No          | No          | No             | No             | Yes          |
| Characteristics of models     |             |             |                |                |              |
| 1. F test                     | 0.832       | 2.575       | 4.927          | 6.101          | 2.299        |
| 2. p-value                    | 0.490       | 0.080       | 0.005          | 0.001          | 0.060        |
| 3. R <sup>2</sup>             | 0.102       | 0.260       | 0.251          | 0.299          | 0.200        |
| 4. Max VIF of the model       | 1.121       | 1.121       | 1.082          | 1.082          | 2.143        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52). OTHERS is measured by natural logarithm of CEO other annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

### Bonus

Table 35 re-confirms effect of charter value and GDP growth rate on bank risk changes. CEO bonus in 2006 is illustrated to have positive impact on increase in total risk, idiosyncratic risk. Banks having CEO with higher bonus face with higher increase in total risk and idiosyncratic risk during the crisis. However no evidence of relation between CEO bonus and other measures (sharp drop in stock price, change in loan loss provision to total asset ratio, change in non-performing loan to total asset ratio, change in CDS, change in bank ratings and change in Z-score) is found. This finding supports for Hypothesis 7.1 and Hypothesis 7.2, but reject Hypotheses 7.3, 7.4, 7.5, 7.6, 7.7, 7.8.

### Other annual compensation

Have a look at Table 36; results on effect of control variables are very consistent with the previous analysis. Referring to the interest variable, the finding reveals that CEO other

annual compensation in 2006 is not related to changes in bank risk during the crisis period. Our Hypotheses in group 11 are all rejected.

#### 6.2.1.2 Compensation structure

##### Percentage of salary

Table 37 presents results pull out from equation (49) with percentage of CEO salary as the compensation variable. The effect of GDP and effect of charter value on bank risk changes are consistent with the above regressions. Our findings also reveal no relation between percentages of CEO salary and changes in bank risk during the crisis. All Hypotheses in group 10 then are rejected.

**Table 37.a Impact of percentage of CEO salary on changes in bank risks**

| Parameter                        | SHARDROP | delta_IDIORISK | delta_LL | delta_NPL | delta_TOTARISK |
|----------------------------------|----------|----------------|----------|-----------|----------------|
| 01. Percentage of SALARY         | 0.01     | -1.51          | 0.48     | -0.34     | -1.62          |
|                                  | ns       | ns             | ns       | ns        | ns             |
| 02. Bank capital, %              | 0.00     | -0.03          | 0.08     | -0.22     | -0.12          |
|                                  | ns       | ns             | ns       | ns        | ns             |
| 03. Bank charter value           | -1.77    | -16.37         | -13.66   | -6.05     | -9.95          |
|                                  | **       | **             | **       | ns        | *              |
| 04. Bank loan, %                 | 0.00     | 0.01           | 0.01     | 0.04      | 0.02           |
|                                  | ns       | ns             | ns       | *         | ns             |
| 05. GDP growth rate, %           | -0.03    | -0.25          | -0.40    | -0.43     | -0.19          |
|                                  | *        | ns             | **       | ns        | ns             |
| Dummy country                    | Yes      | Yes            | Yes      | Yes       | Yes            |
| <b>Characteristics of models</b> |          |                |          |           |                |
| 1. F test                        | 4.771    | 9.221          | 13.775   | 5.079     | 14.520         |
| 2. p-value                       | 0.0003   | <.0001         | <.0001   | 0.0002    | <.0001         |
| 3. R <sup>2</sup>                | 0.465    | 0.626          | 0.719    | 0.486     | 0.725          |
| 4. Max VIF of the model          | 2.175    | 2.175          | 2.210    | 2.210     | 2.175          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). SALARYPER is a percentage of CEO salary to total CEO annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, ns denotes non-significant.



**Table 37.b Impact of percentage of CEO salary on changes in bank risks**

| Parameter                 | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|---------------------------|-------------|-------------|----------------|----------------|--------------|
| 01. Percentage of SALARY  | 2.06        | -1.60       | -0.00          | -0.00          | -22.28       |
|                           | ns          | ns          | ns             | ns             | ns           |
| 02. Bank charter value    |             |             |                |                | -430.73      |
|                           |             |             |                |                | *            |
| 03. Bank loan, %          | -0.05       | 0.00        | -0.00          | -0.00          |              |
|                           | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %    | -0.92       | -0.45       | 0.00           | 0.00           |              |
|                           | ns          | ns          | ***            | **             |              |
| Dummy Country             | No          | No          | No             | No             | Yes          |
| Characteristics of models |             |             |                |                |              |
| 1. F test                 | 0.883       | 2.049       | 5.098          | 6.729          | 2.412        |
| 2. p-value                | 0.465       | 0.136       | 0.004          | 0.0008         | 0.050        |
| 3. R <sup>2</sup>         | 0.107       | 0.218       | 0.250          | 0.310          | 0.201        |
| 4. Max VIF of the model   | 1.705       | 1.705       | 1.238          | 1.238          | 1.923        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52).  $\text{SALARYPER}$  is a percentage of CEO salary to total CEO annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Tableau 38.a Impact of percentage of CEO bonus on changes in bank risks**

| Parameter                 | SHARDROP | delta_IDIORISK | delta_LL | delta_NPL | delta_TOTARISK |
|---------------------------|----------|----------------|----------|-----------|----------------|
| 01. Percentage of BONUS   | -0.01    | 1.58           | 0.06     | -1.17     | 1.34           |
|                           | ns       | ns             | ns       | ns        | ns             |
| 02. Bank capital, %       | 0.00     | -0.05          | 0.06     | -0.17     | -0.12          |
|                           | ns       | ns             | ns       | ns        | ns             |
| 03. Bank charter value    | -1.77    | -16.91         | -13.48   | -6.20     | -10.53         |
|                           | **       | **             | **       | ns        | *              |
| 04. Bank loan, %          | 0.00     | 0.01           | 0.01     | 0.03      | 0.02           |
|                           | ns       | ns             | ns       | ns        | ns             |
| 05. GDP growth rate, %    | -0.03    | -0.25          | -0.38    | -0.48     | -0.20          |
|                           | *        | ns             | **       | *         | ns             |
| Dummy Country             | Yes      | Yes            | Yes      | Yes       | Yes            |
| Characteristics of models |          |                |          |           |                |
| 1. F test                 | 4.771    | 9.444          | 13.601   | 5.303     | 14.175         |
| 2. p-value                | 0.0003   | <.0001         | <.0001   | 0.0001    | <.0001         |
| 3. R <sup>2</sup>         | 0.465    | 0.632          | 0.717    | 0.497     | 0.720          |
| 4. Max VIF of the model   | 1.933    | 1.933          | 2.024    | 2.024     | 1.933          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). BONUSPER is a percentage of CEO bonus to total CEO annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 38.b Impact of percentage of CEO bonus on changes in bank risks**

| Parameter                 | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|---------------------------|-------------|-------------|----------------|----------------|--------------|
| 01. Percentage of BONUS   | -1.79       | 0.95        | 0.01           | 0.01           | 26.83        |
|                           | ns          | ns          | ns             | *              | ns           |
| 02. Bank charter value    |             |             |                |                | -440.75      |
|                           |             |             |                |                | *            |
| 03. Bank loan, %          | -0.05       | -0.00       | 0.00           | -0.00          |              |
|                           | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %    | -0.91       | -0.47       | 0.00           | 0.00           |              |
|                           | ns          | ns          | ***            | ***            |              |
| Dummy Country             | No          | No          | No             | No             | Yes          |
| Characteristics of models |             |             |                |                |              |
| 1. F test                 | 0.865       | 1.896       | 6.765          | 9.095          | 2.521        |
| 2. p-value                | 0.474       | 0.160       | 0.0007         | 0.00008        | 0.042        |
| 3. R <sup>2</sup>         | 0.106       | 0.205       | 0.306          | 0.377          | 0.208        |
| 4. Max VIF of the model   | 2.217       | 2.217       | 1.424          | 1.437          | 1.621        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52).  $\text{BONUSPER}$  is a percentage of CEO bonus to total CEO annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 39.a Impact of percentage of CEO other annual compensation on changes in bank risks**

| Parameter                                   | SHARDROP | delta_IDIORISK | delta_LL | delta_NPL | delta_TOTARISK |
|---|----------|----------------|----------|-----------|----------------|
| 01. Percentage of other annual compensation | 0.00     | -0.41          | -0.67    | 2.09      | 0.08           |
|   | ns       | ns             | ns       | ns        | ns             |
| 02. Bank capital, %                         | 0.00     | 0.01           | 0.06     | -0.19     | -0.07          |
|   | ns       | ns             | ns       | ns        | ns             |
| 03. Bank charter value                      | -1.77    | -17.09         | -13.72   | -5.45     | -10.53         |
|   | **       | **             | **       | ns        | *              |
| 04. Bank loan, %                            | 0.00     | 0.00           | 0.01     | 0.04      | 0.01           |
|   | ns       | ns             | ns       | *         | ns             |
| 05. GDP growth rate, %                      | -0.03    | -0.30          | -0.39    | -0.43     | -0.24          |
|   | *        | *              | **       | *         | *              |
| Dummy Country                               | Yes      | Yes            | Yes      | Yes       | Yes            |
| Characteristics of models                   |          |                |          |           |                |
| 1. F test                                   | 4.769    | 8.523          | 13.891   | 5.622     | 12.933         |
| 2. p-value                                  | 0.0003   | <.0001         | <.0001   | 0.00007   | <.0001         |
| 3. R <sup>2</sup>                           | 0.464    | 0.608          | 0.721    | 0.511     | 0.702          |
| 4. Max VIF of the model                     | 2.242    | 2.242          | 2.225    | 2.225     | 2.242          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). OTHERPER is a percentage of CEO other annual compensation to total annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 39.b Impact of percentage of CEO other annual compensation on changes in bank risks**

| Parameter                                   | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|---|-------------|-------------|----------------|----------------|--------------|
| 01. Percentage of other annual compensation | -1.17       | 1.75        | -0.01          | -0.00          | -20.07       |
|   | ns          | ns          | ns             | ns             | ns           |
| 02. Bank charter value                      |             |             |                |                | -435.09      |
|   |             |             |                |                | *            |
| 03. Bank loan, %                            | -0.02       | -0.02       | -0.00          | -0.00          |              |
|   | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %                      | -0.85       | -0.51       | 0.00           | 0.00           |              |
|   | ns          | *           | ***            | ***            |              |
| Dummy Country                               | No          | No          | No             | No             | Yes          |
| Characteristics of models                   |             |             |                |                |              |
| 1. F test                                   | 0.840       | 1.946       | 6.583          | 7.981          | 2.355        |
| 2. p-value                                  | 0.487       | 0.152       | 0.0009         | 0.0002         | 0.054        |
| 3. R <sup>2</sup>                           | 0.103       | 0.210       | 0.300          | 0.347          | 0.197        |
| 4. Max VIF of the model                     | 1.195       | 1.195       | 1.118          | 1.121          | 2.020        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52). OTHERPER is a percentage of CEO other annual compensation to total annual compensation. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

### Percentage of bonus

Influence of percentage of CEO bonus on bank risk changes is shown in Table 38. The result reveals that except a positive relation (5% significant level) between percentage of bonus and change in bank ratings for short term, CEO bonus has no effect on any other changes in bank risk during the crisis. Following this result, banks with policy of higher percentage bonus in the compensation package to CEO seem to get better ratings for short-term evaluated by Fitch. As percentage of CEO bonus is mostly found to have no impact on changes in bank risk, and if any, its influence is in the opposite direction of what it was expected. Consequently, all Hypotheses in the group Hypothesis 8 are rejected.

### **Percentage of other annual compensation**

Table 39 illustrates an evidence of no relation between percentage of CEO's other annual compensation and changes in bank risk during the crisis period. Hypotheses in the group Hypothesis 12 are all rejected.

We investigate possible responsibility of CEO's annual compensation used in the normal period (2006) into the recent financial crisis through relation between each component in the annual compensation package and abnormal changes in bank risk during the crisis period. Our findings show that CEO's other annual compensation (both under level and structure perspective) have no association to changes in bank risk during this period. Effect of CEO bonus on some changes in bank risk, however, is presented. Under the level perspective, CEO bonus is illustrated to augment change in total risk and change in idiosyncratic risk; whereas under the structure perspective, percentage of CEO bonus is shown to get better ratings for short term re-evaluated by Fitch Ratings. CEO bonus however is proved to have no relation with the abnormal changes in stock price, in CDS, in Z-score, in non-performing loan to total loan ratio or in loan loss provision to total loan ratio.

#### **6.2.2 Influence of equity-based compensation on change in bank risks during the crisis period**

Effect of CEO equity-based compensation on bank risk changes during the crisis period is presented in Table 40 and Table 41.

As influences of the control variables on bank risk changes are consistent with the previous sections, we only focus on analysis of the results related to equity-based compensation in this section.

Table 40 illustrates the effect of usage of stock option (OPTUSE) as an instrument to compensate CEO in the period 2005-2007 on the changes in bank risk during the crisis. We find in Table 40.a, positive effects at 1% of significant level of OPTUSE on sharp drop in stock price and on the abnormal changes in idiosyncratic risk and total risk. This finding means that banks with a compensation policy of using stock option to compensate CEOs in the pre-crisis period suffer more decrease in stock price during the crisis period and get higher increase in total risk and idiosyncratic risk at the peak of crisis period. No evidence of the relationship between OPTUSE and the changes in credit risks, in CDS, in bank ratings or in Z-score is found. Hypotheses 14.1, 14.2, 14.8 are supported but Hypotheses 14.3, 14.4, 14.5, 14.6, 14.7 are rejected. Usage of bank stocks to compensate CEO in the pre-crisis period is revealed (in Table 41) to have no impact on bank risk changes in the crisis period. Hypotheses in group H.13 are all rejected.

**Table 40.a Impact of using stock options as an instrument to compensate CEO on the changes in bank risks**

| Parameter                 | SHARDROP | delta_IDIORISK | delta_LL | delta_NPL | delta_TOTARISK |
|---------------------------|----------|----------------|----------|-----------|----------------|
| 01. OPTUSE                | 0.11     | 1.07           | 0.00     | -0.89     | 0.90           |
|                           | **       | **             | ns       | ns        | **             |
| 02. Bank capital, %       | 0.01     | 0.12           | 0.09     | -0.20     | 0.08           |
|                           | ns       | ns             | ns       | ns        | ns             |
| 03. Bank charter value    | -1.74    | -21.00         | -13.64   | -6.52     | -14.34         |
|                           | ***      | ***            | ***      | ns        | ***            |
| 04. Bank loan, %          | 0.00     | 0.00           | 0.01     | 0.03      | 0.01           |
|                           | ns       | ns             | ns       | ns        | ns             |
| 05. GDP growth rate, %    | -0.02    | -0.23          | -0.32    | -0.19     | -0.15          |
|                           | *        | *              | **       | ns        | ns             |
| Dummy Country             | Yes      | Yes            | Yes      | Yes       | Yes            |
| Characteristics of models |          |                |          |           |                |
| 1. F test                 | 6.859    | 10.753         | 12.648   | 5.051     | 14.711         |
| 2. p-value                | <.0001   | <.0001         | <.0001   | 0.0002    | <.0001         |
| 3. R <sup>2</sup>         | 0.539    | 0.647          | 0.687    | 0.468     | 0.715          |
| 4. Max VIF of the model   | 1.752    | 1.752          | 1.797    | 1.797     | 1.752          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). OPTUSE is dummy of using stock option to compensate CEO in the period 2005-2007. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 40.b Impact of using stock options as an instrument to compensate CEO on the changes in bank risks**

| Parameter                 | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|---------------------------|-------------|-------------|----------------|----------------|--------------|
| 01. OPTUSE                | -0.37       | 0.39        | -0.00          | 0.00           | 10.23        |
|                           | ns          | ns          | ns             | ns             | ns           |
| 02. Bank charter value    |             |             |                |                | -405.61      |
|                           |             |             |                |                | *            |
| 03. Bank loan, %          | -0.06       | -0.02       | -0.00          | -0.00          |              |
|                           | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %    | -0.80       | -0.48       | 0.00           | 0.00           |              |
|                           | ns          | *           | **             | *              |              |
| Dummy Country             | No          | No          | No             | No             | Yes          |
| Characteristics of models |             |             |                |                |              |
| 1. F test                 | 0.804       | 1.956       | 3.799          | 3.697          | 2.465        |
| 2. p-value                | 0.503       | 0.145       | 0.016          | 0.018          | 0.045        |
| 3. R <sup>2</sup>         | 0.085       | 0.184       | 0.189          | 0.188          | 0.192        |
| 4. Max VIF of the model   | 1.292       | 1.292       | 1.169          | 1.170          | 1.691        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52). OPTUSE is dummy of using stock option to compensate CEO in the period 2005-2007. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.



**Table 41.a Impact of using bank shares as an instrument to compensate CEO on the changes in bank risks**

| Parameter                 | SHARDROP | delta_IDIORISK | delta_LLPL | delta_NPL | delta_TOTARISK |
|---------------------------|----------|----------------|------------|-----------|----------------|
| 01. STOUSE                | 0.04     | 0.03           | 0.71       | -0.25     | 0.42           |
|                           | ns       | ns             | ns         | ns        | ns             |
| 02. Bank capital, %       | -0.00    | 0.06           | 0.09       | -0.11     | 0.03           |
|                           | ns       | ns             | ns         | ns        | ns             |
| 03. Bank charter value    | -1.61    | -20.05         | -14.36     | -9.34     | -13.79         |
|                           | **       | ***            | ***        | ns        | **             |
| 04. Bank loan, %          | -0.00    | -0.00          | 0.01       | 0.03      | 0.01           |
|                           | ns       | ns             | ns         | *         | ns             |
| 05. GDP growth rate, %    | -0.03    | -0.29          | -0.35      | -0.34     | -0.17          |
|                           | *        | *              | **         | ns        | ns             |
| Dummy country             | Yes      | Yes            | Yes        | Yes       | Yes            |
| Characteristics of models |          |                |            |           |                |
| 1. F test                 | 4.309    | 8.981          | 14.093     | 4.098     | 12.258         |
| 2. p-value                | 0.0007   | <.0001         | <.0001     | 0.001     | <.0001         |
| 3. R <sup>2</sup>         | 0.439    | 0.620          | 0.724      | 0.433     | 0.690          |
| 4. Max VIF of the model   | 1.978    | 1.978          | 2.002      | 2.002     | 1.978          |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include sharp drop in stock price (SHARDROP), change in total risk ( $\Delta$ TOTARISK), change in idiosyncratic risk ( $\Delta$ IDIORISK), change in credit risks ( $\Delta$ LLP and  $\Delta$ NPL). SHARDROP is measured using equation (50).  $\Delta$ TOTARISK is measured using equation (55).  $\Delta$ IDIORISK is measured using equation (56) and credit risks are defined in equation (53) and (54). STOUSE is dummy of using bank's stock to compensate CEO during the period 2005-2007. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

**Table 41.b Impact of using bank shares as an instrument to compensate CEO on changes in bank risks**

| Parameter                 | delta_CDS1Y | delta_CDS5Y | delta_RATINGLT | delta_RATINGST | delta_Zscore |
|---------------------------|-------------|-------------|----------------|----------------|--------------|
| 01. STOUSE                | -1.70       | 0.04        | -0.00          | -0.00          | 7.00         |
|                           | ns          | ns          | ns             | ns             | ns           |
| 02. Bank charter value    |             |             |                |                | -429.00      |
|                           |             |             |                |                | **           |
| 03. Bank loan, %          | -0.06       | -0.02       | -0.00          | -0.00          |              |
|                           | ns          | ns          | ns             | ns             |              |
| 04. GDP growth rate, %    | -0.94       | -0.50       | 0.00           | 0.00           |              |
|                           | ns          | *           | **             | **             |              |
| Dummy Country             | No          | No          | No             | No             | Yes          |
| Characteristics of models |             |             |                |                |              |
| 1. F test                 | 1.047       | 1.939       | 4.251          | 6.892          | 2.417        |
| 2. p-value                | 0.390       | 0.150       | 0.0010         | 0.0006         | 0.049        |
| 3. R <sup>2</sup>         | 0.116       | 0.195       | 0.217          | 0.315          | 0.198        |
| 4. Max VIF of the model   | 1.209       | 1.209       | 1.124          | 1.125          | 1.809        |

This table presents the result of the OLS estimates of equation (49). The changes in bank risks during the crisis period include change in 1 year credit default swap ( $\Delta\text{CDS1Y}$ ), change in 5 year credit default swap ( $\Delta\text{CDS5Y}$ ), change in long term bank ratings ( $\Delta\text{RATINGLT}$ ), change in short term bank ratings ( $\Delta\text{RATINGST}$ ), and change in distance-to-default ( $\Delta\text{Zscore}$ ).  $\Delta\text{CDS1Y}$  is measured using equation (57).  $\Delta\text{CDS5Y}$  is measured using equation (57).  $\Delta\text{RATINGLT}$  is measured using equation (51).  $\Delta\text{RATINGST}$  is measured using equation (51) and  $\Delta\text{Zscore}$  is defined in equation (52). STOUSE is dummy of using bank's stock to compensate CEO during the period 2005-2007. Bank's size is measured by natural logarithm of total assets. Bank capital is the capital adequacy ratio measured by bank's core capital divided by risk-weighted assets. Charter value is the market to book value of bank's assets. Bank loan is the ratio of total loan to total assets. GDP is the GDP growth rate of each country. \* denotes significant at 5%, \*\* denotes significant at 1% and \*\*\* denotes significant at 0.1% level, *ns* denotes non-significant.

### 6.2.3 Conclusion

We examine in the second empirical research the impact of CEO compensation used in 2006 on the abnormal changes in bank risks during the crisis period including the change in total risk, idiosyncratic risk, credit risks, Z-score, CDS and bank ratings and sharp drop in stock price. Compensation components considered in our research include: CEO salary, CEO bonus, CEO other annual compensation, percentage of CEO salary, percentage of CEO bonus, percentage of CEO other annual compensation, usage of stock option, and usage of bank stock to compensate CEO. We develop and test a model of bank risk using the above compensation variables (alternatively) and other control variables which may be bank capital, charter value, bank loan and GDP growth rate and dummy of country. We use a sample of 63 large banks drawn from Europe, United Kingdom, Canada and United States with unbalanced

data. Ten measures of change in bank risks are used in this empirical analysis (sharp drop in bank stock price, change in total risk, change in idiosyncratic risk, change in loan loss provision ratio, change in non-performing loan ratio, change in CDS1Y index, change in CDS5Y index, change in short-term bank ratings, change in long-term bank ratings, and change in Z-score). If compensation is one of the main reasons of the recent financial crisis, it must play an important role in our model.

Before referring to the effect of CEO compensation, we have a look at the roles of the control variables in explaining the bank risk changes. Through all of regressions, we find no evidence of the influence of bank capital or bank loan (collected at the end of 2006) on the bank risk changes during the crisis period. Charter value is illustrated to have negative relation with the sharp drop in bank stock price, total risk and idiosyncratic risk. This means that bank that with higher charter value in 2006 suffered less in the sharp drop in bank stock price during the period 2006-2008 as well as less increase in total risk or in idiosyncratic risk. GDP growth rate plays an important role in explaining these changes in bank risk. Our results show that banks in country whose GDP (in 2008) is higher get less decrease in stock price, less increase in total risk/ idiosyncratic risk, less increase in loan loss provision ratio, less increase in CDS5Y index and got better change in bank ratings both in short term and long term.

**Table 42 Synthesize effects of CEO compensation on changes in bank risk during the crisis period compared with the expected effects**

|               | H.1<br>$\Delta$ TOTARISK |        | H.2<br>$\Delta$ IDIORISK |        | H.3<br>$\Delta$ LLP |        | H.4<br>$\Delta$ NPL |        | H.5<br>drop_Zscore |        | Hypothesis<br>H |
|---------------|--------------------------|--------|--------------------------|--------|---------------------|--------|---------------------|--------|--------------------|--------|-----------------|
|               | estimated                | result | estimated                | result | estimated           | result | estimated           | result | estimated          | result |                 |
| BONUS         | +                        | +      | +                        | +      | +                   | ns     | +                   | ns     | +                  | ns     | 7               |
| BONUSPER      | +                        | ns     | +                        | ns     | +                   | ns     | +                   | ns     | +                  | ns     | 8               |
| SALARY        | -                        | ns     | -                        | ns     | -                   | ns     | -                   | +      | -                  | ns     | 9               |
| SALARYPER     | -                        | ns     | -                        | ns     | -                   | ns     | -                   | ns     | -                  | ns     | 10              |
| OTHERS        | +                        | ns     | +                        | ns     | +                   | ns     | +                   | ns     | +                  | ns     | 11              |
| OTHERPER      | +                        | ns     | +                        | ns     | +                   | ns     | +                   | ns     | +                  | ns     | 12              |
| STOCK usage   | +                        | ns     | +                        | ns     | +                   | ns     | +                   | ns     | +                  | ns     | 13              |
| OPTIONS usage | +                        | +      | +                        | +      | +                   | ns     | +                   | ns     | +                  | ns     | 14              |

|               | H.6a<br>$\Delta$ RATINGST |        | H.6b<br>$\Delta$ RATINGLT |        | H.7a<br>$\Delta$ CDS |        | H.7b<br>$\Delta$ CDS |        | H.8<br>SHARDROP |        | Hypothesis<br>H |
|---------------|---------------------------|--------|---------------------------|--------|----------------------|--------|----------------------|--------|-----------------|--------|-----------------|
|               | estimated                 | result | estimated                 | result | estimated            | result | estimated            | result | estimated       | result |                 |
| BONUS         | -                         | ns     | -                         | ns     | +                    | ns     | +                    | ns     | +               | ns     | 7               |
| BONUSPER      | -                         | +      | -                         | ns     | +                    | ns     | +                    | ns     | +               | ns     | 8               |
| SALARY        | +                         | ns     | +                         | ns     | -                    | ns     | -                    | ns     | -               | ns     | 9               |
| SALARYPER     | +                         | ns     | +                         | ns     | -                    | ns     | -                    | ns     | -               | ns     | 10              |
| OTHERS        | -                         | ns     | -                         | ns     | +                    | ns     | +                    | ns     | +               | ns     | 11              |
| OTHERPER      | -                         | ns     | -                         | ns     | +                    | ns     | +                    | ns     | +               | ns     | 12              |
| STOCK usage   | -                         | ns     | -                         | ns     | +                    | ns     | +                    | ns     | +               | ns     | 13              |
| OPTIONS usage | -                         | ns     | -                         | ns     | +                    | ns     | +                    | ns     | +               | +      | 14              |

Table 42 synthesizes effect of CEO compensation on the changes in bank risk during the crisis period. Whereas no relation between CEO's other annual compensation and any measures of bank risk change is found (both in level and structure perspective), CEO bonus is illustrated to have some certain effect on the abnormal changes in bank risk during the crisis period. Under the level form, CEO bonus is revealed to induce increase in total risk and idiosyncratic risk. However we have no evidence of relationship between CEO bonus and any other type of changes in bank risk such as the sharp drop in stock price, increase in credit risks, increase in bank's CDS index, abnormal decrease in Z-score, and changes in bank ratings. Under the structure form, percentage of CEO bonus is proved not to induce any abnormal change in bank risk during the crisis. CEO salary is showed to have positive impact on the increase in ratio of non-performing loan to total loan.

With regard to equity-based compensation, Table 42 shows that usage of stock (STOUSE) to compensate CEO in the pre-crisis period have no effect on the increase in bank risks. Usage of stock option (OPTUSE) to compensate CEO in the pre-crisis period is the only component which may influence on the sharp drop in bank stock price during the crisis period. It is also illustrated to have positive effect on the increase in total risk and idiosyncratic risk. These effects of OPTUSE are all at the 1% significant level. The results mean that banks who used stock option to compensate their CEO in the period 2005-2007 suffered more stock price drop during the period 2006-2008 and more the changes in total risk as well as idiosyncratic risk.

Among the abnormal changes in bank risk considered in this dissertation, the sharp drop in stock price seems to have the most special impact on society in general and on social psychology in particularly. The changes in other indicators such as total risk, idiosyncratic risk, bank ratings, credit risks, CDS index or Z-score require reader to have certain knowledge in finance in order to analyze bank's risk level, whereas an abnormal decline in the banking stock market is much more understandable to everybody. At the peak of the recent financial crisis, as the banking stock market plunged without brakes, people wanted to look for the reasons of this crisis. One of possible reasons soon were given is executive compensation with the support of media and authorities. Consequently, many new regulations related to control of executive compensation in general and of executive bonus and stock options in particularly have been applied (we mentioned it in Section 1.2.2). In the scope of this dissertation, we are only eligible to conduct research on CEO compensation. However our findings illustrated that CEO bonus has no relation to the abnormal decline in stock price during the crisis period. We only found an evidence of existed relationship between usage of stock options in compensation package and the sharp drop in stock price.

## 7 Discussion

We have presented in the previous sections the research methodology and the empirical results, which help answer the research questions mentioned in Section 5.2. In this section, we clarify each question and discuss our results in details.

### *i/ How do CEO bonuses in the banking sector impact on bank risk?*

Our results show that CEO bonus level hardly increases with bank risk but conversely, it statistically decreases with idiosyncratic risk, loan loss provision to total loan ratio, and non-performing loan to total loan ratio. We cannot find any evidence of CEO bonus' impact on total risk or Z-score. The relationship between CEO bonus and systematic risk is the only one that is illustrated to be positive. We also cannot find evidence of positive association between percentage of CEO bonus and bank risk. Conversely, percentage of CEO bonus is showed to decrease with idiosyncratic risk, ratio of loan loss provision to total loan, and ratio of non-performing loan to total loan.

As CEO bonus is linked to bank performance, apparently shareholders use it to incentivize managers to look for profitable activities. Since the 2008 crisis, CEO bonus has been claimed to be one of the reasons that puts executives under pressure to chase the best profitable activities. Consequently, it has been thought to make executives focus on near-term performance at the expense of long-term sustainability. In this dissertation, we investigated the effects of CEO bonus on the next-year bank risks. We also examined the responsibility of CEO bonus for abnormal changes in bank risk during the crisis period, if any. One of the events that attracted the public's attention the most during the crisis period is the sharp decline in bank stock price. However, our results show that both CEO bonus level and structure do not have any impact on this stock price drop. With regards to the relationship between CEO bonus and other measures of change in bank risk during the crisis period, the results hardly support the aforementioned viewpoint, which blames executive bonus for inducing bank risk-taking.

We agree that bonus encourages CEO to look for more profitable activities that may be riskier; however it may also enhance manager's prudence in decision making. That may be a possible explanation for our results. Another possible explanation is that CEO bonus, in nominal terms, is determined by the Compensation Committee of a bank, which is assumed to be independent of bank CEO. That means, based on bank performance of a given year, the Compensation Committee will independently calculate the CEO bonus. But, is the Compensation Committee really independent of CEO? If CEO has some certain "impact" on the Compensation Committee in determining his bonus, CEO bonus is not really a pay-for-performance instrument anymore. Conversely, it may be somewhat like salary. This may be a

possible reason for the unexpected relationship between CEO bonus and bank risk in our research.

***ii/ How do the salaries of CEOs in the banking sector affect bank risk?***

Most of the results about the relationship between CEO salary and the measures of bank risk are the same as our expectation: CEO salary level and structure decrease with most bank risk types including total risk, idiosyncratic risk, systematic risk, and ratio of loan loss provision to total loan. The impact of CEO salary on Z-score is rejected as the coefficient is not significant.

However, we found a remarkable result on the relationship between percentage of CEO salary and the ratio of non-performing loan to total loan. The percentage of CEO salary has a significantly positive effect on non-performing loan ratio. In the empirical research which investigates the possible responsibility of CEO salary for changes in bank risk during the crisis period, CEO salary is also illustrated to have impact on only change in the ratio of non-performing loan to total loan. A possible explanation is that: since CEO is assured by a large amount of fixed payment, he may prefer conducting traditional activities such as lending activities to market-based ones. Lending activities in an economic growth period seem to be more stable than the market-based ones. However, focusing resources on lending activities while a large portion of manager's wealth is definitely fixed (not tied to bank performance) may lead to loosening of policies relating to lending activities. Consequently, the bank had to face with a high increase in non-performing loan stemmed from bad quality loans, especially during the crisis period.

***iii/ What are the effects of the other annual compensation of CEO on risk-taking in the banking sector?***

In this research, other CEO annual compensation is illustrated to increase with most of bank risk measures (total risk, idiosyncratic risk, systematic risk, ratio of loan loss provision to total loan, and ratio of non-performing loan to total loan). The impact of other CEO annual compensation on Z-score, however, is rejected since the coefficient is not significant. Nevertheless, this component has no effect on any abnormal changes in bank risk during the crisis period.

Following this finding, which is based on a sample of very large banks, in CEO's annual compensation package, it is the other annual compensation that most induces bank risk-taking but not CEO bonus. Consequently, setting limits on executive bonus as suggested by authorities (mentioned in Section 1.2.2) may not be effective for risk control objective in the banking sector. Up to the estimated period in this dissertation, obtaining comprehensive information on these forms of pay however has been difficult. Because of insufficient disclosure, some previous studies labeled perquisites, pensions, and severance pay as "stealth compensation" that may allow executives to surreptitiously extract rents (Jensen & Meckling,

1976; Jensen, 1986; Bebchuk & Fried, 2004). We therefore suggest that the effect of other annual compensation in CEO's compensation package needs to be studied in the future.

***iv/ How do stock options awarded to CEO in the banking sector influence bank risk in the crisis period?***

Our results showed that usage of stock option to compensate CEO (OPTUSE) in the pre-crisis period has a positive link with the increase in total risk, the increase in idiosyncratic risk, and the drop in bank stock price during the crisis. The effects of OPTUSE on them are all at the 1% significant level. This means that banks with a compensation policy of using stock option to compensate CEOs in the pre-crisis period may suffer more decrease in stock price during the crisis period and get higher increase in total risk and idiosyncratic risk at the peak of crisis period. No evidence of relationship between OPTUSE and changes in credit risks, in CDS, in bank ratings or in Z-score is found.

With this finding, OPTUSE is the only component which may influence the sharp drop in bank stock price during the crisis period. Among abnormal changes in bank risk considered in this dissertation, sharp drop in stock price seems to have the most special impact on society in general and on social psychology in particularly. Changes in other indicators such as total risk, idiosyncratic risk, bank ratings, credit risks, CDS index or Z-score require reader to have certain knowledge in finance in order to analyze bank's risk level, whereas an abnormal decline in the banking stock market is much more understandable to everybody. At the peak of the recent financial crisis, as the banking stock market plunged without brakes, people wanted to look for the reasons of this crisis. One of possible reasons soon given with the support of media and authorities is executive compensation. Consequently, many new regulations to control executive compensation in general and executive bonus and stock options in particularly have been applied (we mentioned it in Section 1.2.2). In the scope of this dissertation, we only conduct research on CEO compensation. Our findings indicate that CEO bonus has no link with the abnormal decline in stock price during the crisis period. We only found evidence of an existing relationship between the usage of stock options in compensation package and the sharp drop in stock price.

***v/ How do the restricted stocks awarded to CEO affect bank risk in the crisis period?***

Results from this research show that usage of stock to compensate CEO (STOUSE) in the pre-crisis period has no link with any abnormal changes in bank risks during the crisis period.

***vi/ Which components in the CEO compensation package should be regulated to control bank risk?***

In this part, we take the role of authority to discuss on the components in the CEO compensation package that should be regulated to control bank risk-taking. From our results, CEO salary level and structure are good instruments to control risk-taking behavior of bank



managers. Except for the positive relationship between CEO salary and the ratio of non-performing loan to total loan, we cannot find any positive effect of CEO salary on any other bank risk measures. Our finding also indicates that the impact of CEO bonus on bank risk is quite similar to that of CEO salary. So if the policy to determine CEO bonus in banking sector is still the same, meaning that CEO bonus is not really pay-for-performance, the effort to control CEO bonus by authorities may have no impact on bank risk-taking.

Stock option is illustrated to have the most effect on the abnormal changes in bank risk during the crisis period (notably the drop in bank stock price, the increase in total risk, and the increase in idiosyncratic risk). While CEO bonus and usage of restricted stock to compensate CEO are showed to have no link with these changes of bank risks, CEO salary hardly has effect on them. As a result, usage of stock options to compensate executive should be put under control if authorities want to control bank risk-taking.

In this dissertation, we consider the effect CEO compensation level and structure on bank risk-taking as well as on the abnormal changes in bank risk during the crisis period. The results indicate that there have not many differences between the effects of CEO compensation level and structure on bank risk-taking (Table 32 and Table 42). However in terms of management, we are inclined to consider compensation level to control risk-taking behavior of managers. The reason is that the level of compensation in general and of CEO compensation in specific may be related to bank size effect, country effect or other factors. As a result, we suppose compensation structure seems to be more applicable than compensation level to be placed under regulation to control bank-risk.

## 8 Conclusion

Our research is inspired by the debate on corporate governance in general and by the controversy around executive compensation in particular. Therefore, the aim of this dissertation is to analyse whether and how the types of CEO compensation influence bank risk-taking, and to investigate the possible responsibility of CEO compensation towards the abnormal changes in bank risk during the crisis period in order to contribute to the current understanding of executive compensation. In the following, we conclude our research in four sections. The summary of work conducted is presented in the first section. The second one is about the contribution of our work to the current academic research. The next section refers to all limits of this research. Finally, we present in section 4 some suggestions for future study.

### 8.1 Summary of work conducted

In order to study executive compensation and to have a depth understanding about the relationship between executive compensation and bank risk-taking, this dissertation was divided into two main parts:

- Part I: Theory
- Part II: Empirical research

In the first part, we presented the general theoretical framework of our study. We start with the basic concepts of banking activity and the roles of bank in the economy in order to understand the link between banking system and the crisis. We then discussed the economic context in the period 2008-2009 when many bank simultaneously felt into distress. One of the reasons for bank distress in this period is supposed to be the excessive executive compensation which incentivized bank managers to pursue profitable but risky activities while forgetting bank stability. As a result, a lot of changes in the regulation on remuneration policy were enacted. These changes are referred in the legal context section.

We continue the first part by presenting the main components in executive compensation package as well as factors which are used to measure bank risk-taking. The next section is about the agency theory in corporate governance which helps us to understand the reason for the appearance of equity-based payment in the current compensation package. Finally, a literature review is presented with the state-of-the-art knowledge in executive compensation so as to pose research questions for the dissertation.

Since the objective of this dissertation is to *investigate the effects of each component in the CEO compensation package on the bank risk-taking*, the research questions therefore are as follows:

- i/ How do CEO bonuses in the banking sector impact on bank risk?
- ii/ How do salaries of CEOs in the banking sector affect bank risk?
- iii/ What are the effects of the other annual compensation of CEO on risk-taking in the banking sector?
- iv/ How do stock options awarded to CEOs in the banking sector influence bank risk in the crisis period?
- v/ How do restricted stocks awarded to CEOs affect bank risk in the crisis period?
- vi/ Which components in the CEO compensation package should be regulated to control bank risk?

We used two independent empirical researches to answer the above research questions. The first investigates the effects of CEO annual compensation on bank risk during the period 2004-2008 by using panel data. The second examines the possible responsibility of CEO compensation for the financial crisis, which is quantified by the relationship between CEO compensation and the abnormal changes of bank risk during the crisis period. Our findings illustrated that:

- i/ CEO bonus level does not increase bank risk but, conversely, it statistically reduces idiosyncratic risk, loan loss provision to total loan ratio, and non-performing loan to total loan ratio. For CEO bonus structure, no evidence of positive association between the percentage of

CEO bonus and bank risk is found. On the contrary, the percentage of CEO bonus is showed to decrease with idiosyncratic risk, ratio of loan loss provision to total loan, and ratio of non-performing loan to total loan. The obtained results confirmed that CEO bonus is not a reason of the abnormal changes in bank risk during the crisis period.

ii/ CEO salary level and structure are found to decrease most types of bank risk including total risk, idiosyncratic risk, systematic risk, and ratio of loan loss provision to total loan. CEO salary has no relation to bank Z-score. However, CEO salary structure is showed to induce ratio of non-performing loan to total loan of bank. We also found an evidence for the positive relation between CEO salary and the abnormal change in ratio of non-performing loan to total loan during the crisis period. Except for this relation, no association between CEO salary and any other abnormal change in bank risk during the crisis is found.

iii/ CEO's other annual compensation, in our research, was illustrated to increase most measures of bank risk including total risk, idiosyncratic risk, systematic risk, ratio of loan loss provision to total loan, and ratio of non-performing loan to total loan. However, we cannot find any evidence for the relationship between this component and the abnormal changes in bank risk during the crisis.

iv/ Usage of stock options to compensate CEO in the pre-crisis period (2005-2007) has a positive link with the increase in total risk, with the increase in idiosyncratic risk, and especially with the drop in bank stock price during the crisis.

v/ Usage of restricted stock to compensate CEO in the pre-crisis period (2005-2007) has no effect on any abnormal changes in bank risks during the crisis period.

vi/ In order to control bank risk-taking, we propose that authorities should consider compensation structure. Salary structure is a good instrument to govern bank risk-taking behavior of managers whereas structure of other annual compensation may induce managers to take more risk. In our research, bonus is illustrated to have nearly the same effect on measures of risk as salary. As a result, the regulations to control bonus may probably not reduce bank risk-taking as expected, unless the policy to determine executive bonus is improved to assure that it is really a pay-for-performance component. Regarding the equity-based compensation, our findings showed that usage of stock options to compensate CEO is significantly related to the abnormal changes in bank risk, especially the sharp decline in bank stock price during the crisis period; whereas no association between usage of restricted stock to compensate CEO and changes in bank risk is revealed. Consequently, we propose that usage of only restricted stock to compensate managers may help bank to control risk level.

## **8.2 Contribution**

This thesis contributes to the current understanding of executive compensation in several aspects. Firstly, our research sample is more diversified than previous studies that focus on executive compensation in the banking sector. As mentioned in the theoretical part

of this dissertation, most research on executive compensation is based on data collected from U.S. firms. The reason is that data on compensation of U.S. firms can be collected quite easily from the professional database such as Thomson One Banker, Execucomp, BoardEx,... On the contrary, data on executive pay of European firms had been considered to be sensitive until 2008 when the banking crisis happened. We thus had to manually collect data on executive compensation directly from public documents of banks in order to conduct this research. Our sample covers 63 large banks including 30 European banks, 6 U.K. banks, 6 Canadian banks, and 21 U.S. banks. As a result the findings from this dissertation are comprehensive.

Secondly, the agency theory is considered to play an important role in corporate finance and, under this theory, performance-contingent forms of payment are the primary means of converging the interests of principals (shareholders) and agents (managers) (Jensen & Meckling, 1976). Consequently, research on executive compensation mostly focuses on equity-based compensation, which is believed to incentivize managers to take risk. Since the crisis happened in 2008, studies specialized on the effect of executive bonus on bank risk have been published. However, the impact of executive salary and other annual compensation on taking-risk are hardly considered. We conduct in this dissertation a comprehensive research on the effect of all important components in the CEO compensation package, including CEO salary, CEO bonus, CEO's other annual compensation and equity-based compensation on bank risk, and investigate their possible responsibility to the abnormal changes in bank risk during the recent financial crisis. The obtained results concerning the effect of CEO salary or CEO's other annual compensation on bank risk-taking are similar to what we expect a priori. However, the impact of CEO bonus on bank risk is not similar to the expected one since this effect is illustrated to be near the same of the CEO salary's impact. This finding poses a question for future research: whether we can rely on agency theory to explain the bonus policy in banking institutions? If it is not the agency theory, which theory should be used in order to have a deep understanding of the executive compensation policy in these particular firms? We suppose that, with the actual policy to determine executive bonus, the CEO bonus is not really a pay-for-performance component. Consequently, the agency theory should not be applied to explain the relation between CEO bonus and bank risk.

Thirdly, to investigate whether CEO compensation is one of the causes of the recent financial crisis, we propose a new way to quantify the responsibility of each compensation component. We supposed that if a compensation component has the responsibility for the crisis, that component must play an important role in explaining the sharp increase in bank risks during the crisis period. By means of this new quantification, our results can illustrate clearly which component in the CEO compensation package is related to the crisis.

Finally, based on the results of this dissertation, we could show the effect of each component in CEO compensation package on bank risk and propose some solutions to help

control bank risk-taking. This finding, therefore, can be valuable for authorities in considering which compensation components should be regulated to control bank risk-taking.

### **8.3 Limits of this research**

At the beginning, this dissertation aims to investigate the effect of executive compensation on risk-taking in the European banking sector. However, due to the limit of compensation data in the European banking sector, including not-accessible and bank-to-bank or country-to-country inconsistent data, we include banks from North America that have similar size as that of European data-accessible banks. The limitation of data on executive compensation in European banks is the main reason that restricts us to perform this research with a limited size of CEO and small research sample.

The second limit of this research relates to the statistical analysis software. As our research sample is small, in order to run a regression with a panel data in the first empirical research, we based on two-step generalized method moments (GMM) estimation as it is considered to display the best features in terms of small bias and precision (Soto, 2009). However, both STATA and SAS software require a balanced database whereas our sample is relatively small and contains some missing data. We had to exclude from our sample the banks that only have data available for one year (e.g. data on compensation is available for only the year 2006). We then filled up the remaining data based on the assumption that the executive compensation policy of each bank had not changed during the period 2003-2007 and the CEO was the same person. As a result, we used the same compensation level of the nearest observed year to replace the missing data.

### **8.4 Suggestions for future research**

Since the recent financial crisis, many changes in regulation on executive compensation have been enacted. One of them related to the disclosure of information on executive compensation. As data not only for CEO compensation but also for other executive compensation at individual level are more and more accessible, we can investigate in the future the impact of compensation on bank risk with much more data and in a larger context. Future research may consider the effect of compensation to people whose decision relates to bank risk. We suggest that studies on the relation between compensation and bank risk-taking should be divided into three groups: small banks, middle banks and large banks in order to better understand the differences in corporate governance in the banking sectors.

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*APPENDIX 1: DETAILED LIST OF BANKS IN THE SAMPLE*

|    | <b>Name of Bank</b>                  | <b>Country</b> |
|----|--------------------------------------|----------------|
| 1  | Erste Group Bank AG                  | Austria        |
| 2  | Dexia S.A.                           | Belgium        |
| 3  | KBC Group N.V.                       | Belgium        |
| 4  | Bank of Montreal                     | Canada         |
| 5  | Bank of Nova Scotia                  | Canada         |
| 6  | Canadian Imperial Bank of Commerce   | Canada         |
| 7  | National Bank of Canada              | Canada         |
| 8  | Royal Bank of Canada                 | Canada         |
| 9  | Toronto-Dominion Bank                | Canada         |
| 10 | Danske Bank A/S                      | Denmark        |
| 11 | BNP Paribas S.A.                     | France         |
| 12 | Credit Agricole S.A.                 | France         |
| 13 | Credit Industriel et Commercial S.A. | France         |
| 14 | Societe Generale                     | France         |
| 15 | Aareal Bank AG                       | Germany        |
| 16 | Commerzbank AG                       | Germany        |
| 17 | Deutsche Bank AG                     | Germany        |
| 18 | Alpha Bank A.E.                      | Greece         |
| 19 | National Bank of Greece S.A.         | Greece         |
| 20 | Allied Irish Banks PLC               | Ireland        |

|    | <b>Name of Bank</b>                            | <b>Country</b> |
|----|--|----------------|
| 21 | Bank of Ireland Ord Stk EUR0.64                | Ireland        |
| 22 | Permanent TSB Group Holdings PLC               | Ireland        |
| 23 | Banca Monte dei Paschi di Siena S.p.A.         | Italy          |
| 24 | Banca Popolare dell'Emilia Romagna S.C.A.R.L.  | Italy          |
| 25 | Banca Popolare di Milano S.C.A.R.L.            | Italy          |
| 26 | Banco Popolare S.C.                            | Italy          |
| 27 | Intesa Sanpaolo S.p.A.                         | Italy          |
| 28 | Mediobanca Banca di Credito Finanziario S.p.A. | Italy          |
| 29 | UniCredit S.p.A.                               | Italy          |
| 30 | Unione di Banche Italiane SCpA                 | Italy          |
| 31 | DNB ASA  | Norway         |
| 32 | Banco BPI S/A                                  | Portugal       |
| 33 | Banco Comercial Portugues S/A                  | Portugal       |
| 34 | Banco Espirito Santo S/A                       | Portugal       |
| 35 | Popular Inc.                                   | Puerto Rico    |
| 36 | Banco Bilbao Vizcaya Argentaria S.A.           | Spain          |
| 37 | Banco de Sabadell S.A.                         | Spain          |
| 38 | Banco Popular Espanol S.A.                     | Spain          |
| 39 | Banco Santander S.A.                           | Spain          |
| 40 | Caja De Ahorros Y Pensiones                    | Spain          |
| 41 | Nordea Bank AB                                 | Sweden         |

|    | <b>Name of Bank</b>              | <b>Country</b> |
|----|----------------------------------|----------------|
| 42 | Skandinaviska Enskilda Banken AB | Sweden         |
| 43 | Svenska Handelsbanken A          | Sweden         |
| 44 | Swedbank AB                      | Sweden         |
| 45 | Banque Cantonale Vaudoise        | Switzerland    |
| 46 | Credit Suisse Group AG           | Switzerland    |
| 47 | UBS AG                           | Switzerland    |
| 48 | Barclays PLC                     | United Kingdom |
| 49 | HSBC Holdings PLC                | United Kingdom |
| 50 | Investec PLC                     | United Kingdom |
| 51 | Lloyds Banking Group PLC         | United Kingdom |
| 52 | Royal Bank of Scotland Group Plc | United Kingdom |
| 53 | Standard Chartered PLC           | United Kingdom |
| 54 | Bank of America Corp.            | United States  |
| 55 | Bank of New York Mellon Corp.    | United States  |
| 56 | BB&T Corp.                       | United States  |
| 57 | Capital One Financial Corp.      | United States  |
| 58 | Citigroup Inc.                   | United States  |
| 59 | Comerica Inc.                    | United States  |
| 60 | Fannie Mae                       | United States  |
| 61 | Fifth Third Bancorp              | United States  |
| 62 | First Horizon National Corp.     | United States  |

|    | <b>Name of Bank</b>               | <b>Country</b> |
|----|-----------------------------------|----------------|
| 63 | Huntington Bancshares Inc.        | United States  |
| 64 | JPMorgan Chase & Co.              | United States  |
| 65 | KeyCorp                           | United States  |
| 66 | M&T Bank Corp.                    | United States  |
| 67 | Northern Trust Corp.              | United States  |
| 68 | PNC Financial Services Group Inc. | United States  |
| 69 | Regions Financial Corp.           | United States  |
| 70 | State Street Corp.                | United States  |
| 71 | SunTrust Banks Inc.               | United States  |
| 72 | U.S. Bancorp                      | United States  |
| 73 | Wells Fargo & Co.                 | United States  |
| 74 | Zions Bancorporation              | United States  |

*APPENDIX 2: LIST OF MARKET INDEXES USED TO CALCULATE  
THE MARKET-BASED MEASURES OF RISK*

| <b>Country</b> | <b>Index</b>             |
|----------------|--------------------------|
| Austria        | Austria ATX              |
| Belgium        | Belgium BEL - 20         |
| Canada         | Canada S&P/TSX Composite |
| Denmark        | OMX Copenhagen 20        |
| France         | France CAC 40            |
| Germany        | Germany DAX (TR)         |
| Greece         | Greece ATHEX Composite   |
| Ireland        | Ireland ISEQ Overall     |
| Italy          | FTSE MIB                 |
| Norway         | Norway OSE OBX TR        |
| Portugal       | Portugal PSI General     |
| Puerto rico    | S&P 500                  |
| Spain          | Spain IBEX 35            |
| Sweden         | OMX Stockholm 30         |
| Switzerland    | Switzerland SMI          |
| UK             | FTSE All-Share           |
| US             | S&P 500                  |

APPENDIX 3: NUMERIC EQUIVALENT OF BANK RATINGS  
SUGGESTED BY FACTSET

Source :Database FactSet

*APPENDIX 4: NOTES USED BY FITCH RATINGS AND  
THE NUMERIC EQUIVALENT OF NOTES*

| <b>Fitch Ratings</b>           |                           |                                  |
|--------------------------------|---------------------------|----------------------------------|
| <b>Long-term rating scales</b> | <b>Numeric equivalent</b> | <b>Log of numeric equivalent</b> |
| AAA                            | 750                       | 2.875                            |
| AA+                            | 740                       | 2.869                            |
| AA                             | 730                       | 2.863                            |
| AA-                            | 720                       | 2.857                            |
| A+                             | 710                       | 2.851                            |
| A                              | 700                       | 2.845                            |
| A-                             | 690                       | 2.839                            |
| BBB+                           | 680                       | 2.833                            |
| BBB                            | 670                       | 2.826                            |
| BBB-                           | 660                       | 2.820                            |
| BB+                            | 650                       | 2.813                            |
| BB                             | 640                       | 2.806                            |
| BB-                            | 630                       | 2.799                            |
| B+                             | 620                       | 2.792                            |
| B                              | 610                       | 2.785                            |
| B-                             | 600                       | 2.778                            |

| Fitch Ratings            |                    |                           |
|--------------------------|--------------------|---------------------------|
| Long-term rating scales  | Numeric equivalent | Log of numeric equivalent |
| CCC+                     | 590                | 2.771                     |
| CCC                      | 580                | 2.763                     |
| CCC-                     | 570                | 2.756                     |
| CC                       | 560                | 2.748                     |
| C                        | 550                | 2.740                     |
| SD                       | 540                | 2.732                     |
| D                        | 530                | 2.724                     |
| Short-term rating scales | Numeric equivalent | Log of numeric equivalent |
| F1+                      | 750                | 2.875                     |
| F1                       | 740                | 2.869                     |
| F2                       | 730                | 2.863                     |
| F3                       | 720                | 2.857                     |
| B                        | 710                | 2.851                     |
| C                        | 700                | 2.845                     |
| D                        | 690                | 2.839                     |



## APPENDIX 5: VARIABLE DEFINITIONS

| Variable  | Formula   | Definition  |
|-----------|---|---|
| Size      | Log of Total Assets   | Accounts for the bank size  |
| BC        | Bank's core capital<br>/ Risk-weighted Assets   | The Capital adequacy ratio is a measure of a bank's ability to absorb a reasonable amount of loss |
| CV        | (Market value of Equity<br>+ Book value of liabilities)<br>/ Book value of Total Assets | A measure of Market to Book value of Bank assets  |
| GDP       | (GDP of this year<br>/ GDP of the last year) - 1  | The growth rate of GDP  |
| LOAN      | Total loan/ Total Assets  | The percentage of bank assets is hold in loan outstanding   |
| SALARY    |   | The natural logarithm of CEO Salary   |
| BONUS     |   | The natural logarithm of CEO Annual Bonus   |
| OTHERS    |   | The natural logarithm other annual compensation of CEO  |
| TOTALCOMP | SALARY + BONUS<br>+ OTHERS  | Total annual compensation that CEO receives   |
| SALARYPER | SALARY/TOTALCOMP  | The percentage of Salary  |
| BONUSPER  | ANBONUS/TOTALCOMP   | The percentage of Annual Bonus  |
| OTHERPER  | OTHERS/TOTALCOMP  | The percentage of Other annual compensation   |
| LLP       | Loan loss provision<br>/ Total Assets   | The percentage of Bank assets is set aside to cover bad loans                                     |
| NPL       | Non-performing loan<br>/ Total Assets   | The percentage of Bank assets is hold in bad loans that cannot be collected                       |
| SHARDROP  | (Min value of stock price<br>- Max value of stock price)/<br>Max value of stock price   | Sharp drop in stock price during the period 2006-2008   |

| Variable               | Formula                             | Definition |
|------------------------|-------------------------------------|------------|
| Change in Bank ratings | In the period 2006-2008             |            |
|                        | Log (Bank note at the end of 2011)  |            |
|                        | -Log (Bank note at the end of 2007) |            |

## APPENDIX 6: RESULTS OF VIF TEST FOR MULTICOLLINEARITY

### Result of VIF test for multicollinearity when running regression bank risk on control variables

| The REG Procedure                               |                           |                |                    |                |         |         |
|---|---------------------------|----------------|--------------------|----------------|---------|---------|
| Model: MODEL1                                   |                           |                |                    |                |         |         |
| Dependent Variable: IDIORISK Idiosyncratic risk |                           |                |                    |                |         |         |
| Number of Observations Read                     |                           | 265            |                    |                |         |         |
| Number of Observations Used                     |                           | 251            |                    |                |         |         |
| Number of Observations with Missing Values      |                           | 14             |                    |                |         |         |
| Analysis of Variance                            |                           |                |                    |                |         |         |
| Source  | DF                        | Sum of Squares | Mean Square        | F Value        | Pr > F  |         |
| Model   | 8                         | 268.92843      | 33.61605           | 81.40          | <.0001  |         |
| Error   | 242                       | 99.93543       | 0.41296            |                |         |         |
| Corrected Total                                 | 250                       | 368.86386      |                    |                |         |         |
| Root MSE  |                           | 0.64262        | R-Square           | 0.7291         |         |         |
| Dependent Mean                                  |                           | 1.44992        | Adj R-Sq           | 0.7201         |         |         |
| Coeff Var                                       |                           | 44.32093       |                    |                |         |         |
| Parameter Estimates                             |                           |                |                    |                |         |         |
| Variable  | Label                     | DF             | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept                                       | Intercept                 | 1              | 8.06001            | 1.29472        | 6.23    | <.0001  |
| BC  | Bank capital              | 1              | 0.03408            | 0.02423        | 1.41    | 0.1610  |
| CV  | Bank charter value        | 1              | -4.81843           | 0.95431        | -5.05   | <.0001  |
| Size  | Log bank total assets     | 1              | -0.19479           | 0.04071        | -4.78   | <.0001  |
| LOAN  | Bank loan to total assets | 1              | -0.00153           | 0.00313        | -0.49   | 0.6250  |
| YEAR05  |                           | 1              | -0.04299           | 0.13425        | -0.32   | 0.7491  |
| YEAR06  |                           | 1              | -0.00264           | 0.13119        | -0.02   | 0.9839  |
| YEAR07  |                           | 1              | 0.31112            | 0.13140        | 2.37    | 0.0187  |
| YEAR08  |                           | 1              | 2.43837            | 0.13591        | 17.94   | <.0001  |
| Parameter Estimates                             |                           |                |                    |                |         |         |
| Variable  | Label                     | DF             | Variance Inflation |                |         |         |
| Intercept                                       | Intercept                 | 1              | 0                  |                |         |         |
| BC  | Bank capital              | 1              | 1.44216            |                |         |         |
| CV  | Bank charter value        | 1              | 1.35379            |                |         |         |
| Size  | Log bank total assets     | 1              | 1.58542            |                |         |         |
| LOAN  | Bank loan to total assets | 1              | 1.43826            |                |         |         |
| YEAR05  |                           | 1              | 1.66729            |                |         |         |
| YEAR06  |                           | 1              | 1.74241            |                |         |         |
| YEAR07  |                           | 1              | 1.74793            |                |         |         |
| YEAR08  |                           | 1              | 1.87007            |                |         |         |

## APPENDIX 7: RESULTS OF HAUSMAN TEST FOR ENDOGENEITY

### 1. Results of Hausman test for running regression total risk on control variables

#### 1.1. To test if variable BC is endogenous

| The REG Procedure                          |                           |                |                    |                |         |         |
|--|---------------------------|----------------|--------------------|----------------|---------|---------|
| Model: MODEL1                              |                           |                |                    |                |         |         |
| Dependent Variable: TOTARISK Total risk    |                           |                |                    |                |         |         |
| Number of Observations Read                |                           | 265            |                    |                |         |         |
| Number of Observations Used                |                           | 251            |                    |                |         |         |
| Number of Observations with Missing Values |                           | 14             |                    |                |         |         |
| Analysis of Variance                       |                           |                |                    |                |         |         |
| Source                                     | DF                        | Sum of Squares | Mean Square        | F Value        | Pr > F  |         |
| Model                                      | 8                         | 524.66775      | 65.58347           | 116.17         | <.0001  |         |
| Error                                      | 242                       | 136.62286      | 0.56456            |                |         |         |
| Corrected Total                            | 250                       | 661.29061      |                    |                |         |         |
| Root MSE                                   |                           | 0.75137        | R-Square           | 0.7934         |         |         |
| Dependent Mean                             |                           | 2.00327        | Adj R-Sq           | 0.7866         |         |         |
| Coeff Var                                  |                           | 37.50722       |                    |                |         |         |
| Parameter Estimates                        |                           |                |                    |                |         |         |
| Variable                                   | Label                     | DF             | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept                                  | Intercept                 | 1              | 6.79307            | 1.51383        | 4.49    | <.0001  |
| BC   | Bank capital              | 1              | 0.02234            | 0.02834        | 0.79    | 0.4312  |
| CV   | Bank charter value        | 1              | -4.03745           | 1.11581        | -3.62   | 0.0004  |
| Size                                       | Log bank total assets     | 1              | -0.12929           | 0.04760        | -2.72   | 0.0071  |
| LOAN                                       | Bank loan to total assets | 1              | -0.00107           | 0.00366        | -0.29   | 0.7709  |
| YEAR05                                     |                           | 1              | -0.07274           | 0.15698        | -0.46   | 0.6435  |
| YEAR06                                     |                           | 1              | 0.05002            | 0.15339        | 0.33    | 0.7447  |
| YEAR07                                     |                           | 1              | 0.59783            | 0.15363        | 3.89    | 0.0001  |
| YEAR08                                     |                           | 1              | 3.54503            | 0.15891        | 22.31   | <.0001  |
| Parameter Estimates                        |                           |                |                    |                |         |         |
|  |                           | DF             | Variance Inflation |                |         |         |
| Intercept                                  | Intercept                 | 1              | 0                  |                |         |         |
| BC   | Bank capital              | 1              | 1.44216            |                |         |         |
| CV   | Bank charter value        | 1              | 1.35379            |                |         |         |
| Size                                       | Log bank total assets     | 1              | 1.58542            |                |         |         |
| LOAN                                       | Bank loan to total assets | 1              | 1.43826            |                |         |         |
| YEAR05                                     |                           | 1              | 1.66729            |                |         |         |
| YEAR06                                     |                           | 1              | 1.74241            |                |         |         |
| YEAR07                                     |                           | 1              | 1.74793            |                |         |         |
| YEAR08                                     |                           | 1              | 1.87007            |                |         |         |

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The REG Procedure

Model: MODEL1

Dependent Variable: BC Bank capital

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 768.51091      | 85.39010    | 83.82   | <.0001 |
| Error           | 241 | 245.50485      | 1.01869     |         |        |
| Corrected Total | 250 | 1014.01576     |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 1.00930  | R-Square | 0.7579 |
| Dependent Mean | 12.11076 | Adj R-Sq | 0.7488 |
| Coeff Var      | 8.33394  |          |        |

Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 1.84649            | 2.03414        | 0.91    | 0.3649  |
| BC_1      | Lagged BC                 | 1  | 0.66026            | 0.08224        | 8.03    | <.0001  |
| BC_2      |                           | 1  | 0.24936            | 0.08068        | 3.09    | 0.0022  |
| CV        | Bank charter value        | 1  | 0.90093            | 1.51853        | 0.59    | 0.5535  |
| Size      | Log bank total assets     | 1  | -0.08552           | 0.06434        | -1.33   | 0.1851  |
| LOAN      | Bank loan to total assets | 1  | -0.00616           | 0.00498        | -1.24   | 0.2176  |
| YEAR05    |                           | 1  | -0.24531           | 0.21286        | -1.15   | 0.2503  |
| YEAR06    |                           | 1  | -0.65155           | 0.20638        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.19518           | 0.20838        | -0.94   | 0.3499  |
| YEAR08    |                           | 1  | -0.76612           | 0.21612        | -3.54   | 0.0005  |

The REG Procedure

Model: MODEL1

Dependent Variable: TOTARISK Total risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 524.76679      | 58.30742    | 102.93  | <.0001 |
| Error           | 241 | 136.52382      | 0.56649     |         |        |
| Corrected Total | 250 | 661.29061      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.75265  | R-Square | 0.7935 |
| Dependent Mean | 2.00327  | Adj R-Sq | 0.7858 |
| Coeff Var      | 37.57132 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 6.87923            | 1.53036        | 4.50    | <.0001  |
| BC        | Bank capital              | 1  | 0.01365            | 0.03518        | 0.39    | 0.6984  |
| CV        | Bank charter value        | 1  | -3.93887           | 1.14232        | -3.45   | 0.0007  |
| Size      | Log bank total assets     | 1  | -0.13420           | 0.04911        | -2.73   | 0.0067  |
| LOAN      | Bank loan to total assets | 1  | -0.00149           | 0.00381        | -0.39   | 0.6959  |
| YEAR05    |                           | 1  | -0.07157           | 0.15727        | -0.46   | 0.6495  |
| YEAR06    |                           | 1  | 0.04731            | 0.15379        | 0.31    | 0.7586  |
| YEAR07    |                           | 1  | 0.59745            | 0.15390        | 3.88    | 0.0001  |
| YEAR08    |                           | 1  | 3.54417            | 0.15919        | 22.26   | <.0001  |
| resid     | Residual                  | 1  | 0.02490            | 0.05954        | 0.42    | 0.6762  |

## 1.2. To test if variable CV is endogenous

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The REG Procedure

Model: MODEL1

Dependent Variable: CV Bank charter value

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 0.49965        | 0.05552     | 117.14  | <.0001 |
| Error           | 241 | 0.11422        | 0.00047393  |         |        |
| Corrected Total | 250 | 0.61387        |             |         |        |

|                |         |          |        |
|----------------|---------|----------|--------|
| Root MSE       | 0.02177 | R-Square | 0.8139 |
| Dependent Mean | 1.05841 | Adj R-Sq | 0.8070 |
| Coeff Var      | 2.05685 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.14462            | 0.04453        | 3.25    | 0.0013  |
| BC        | Bank capital              | 1  | 0.00106            | 0.00082059     | 1.29    | 0.1968  |
| CV_1      |                           | 1  | 0.80536            | 0.07719        | 10.43   | <.0001  |
| CV_2      |                           | 1  | 0.06190            | 0.07662        | 0.81    | 0.4199  |
| Size      | Log bank total assets     | 1  | 0.00001710         | 0.00139        | 0.01    | 0.9902  |
| LOAN      | Bank loan to total assets | 1  | -0.00013380        | 0.00010619     | -1.26   | 0.2089  |
| YEAR05    |                           | 1  | -0.00962           | 0.00461        | -2.09   | 0.0380  |
| YEAR06    |                           | 1  | -0.01407           | 0.00446        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.00397           | 0.00447        | -0.89   | 0.3753  |
| YEAR08    |                           | 1  | -0.04367           | 0.00456        | -9.58   | <.0001  |

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The REG Procedure  
Model: MODEL1  
Dependent Variable: TOTARISK Total risk

Number of Observations Read 265  
Number of Observations Used 251  
Number of Observations with Missing Values 14

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 527.47080      | 58.60787    | 105.55  | <.0001 |
| Error           | 241 | 133.81981      | 0.55527     |         |        |
| Corrected Total | 250 | 661.29061      |             |         |        |

Root MSE 0.74516 R-Square 0.7976  
Dependent Mean 2.00327 Adj R-Sq 0.7901  
Coeff Var 37.19739

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 5.22605            | 1.65542        | 3.16    | 0.0018  |
| BC        | Bank capital              | 1  | 0.01179            | 0.02849        | 0.41    | 0.6794  |
| CV        | Bank charter value        | 1  | -2.59475           | 1.27940        | -2.03   | 0.0437  |
| Size      | Log bank total assets     | 1  | -0.11703           | 0.04753        | -2.46   | 0.0145  |
| LOAN      | Bank loan to total assets | 1  | -0.00096586        | 0.00363        | -0.27   | 0.7906  |
| YEAR05    |                           | 1  | -0.07187           | 0.15568        | -0.46   | 0.6447  |
| YEAR06    |                           | 1  | 0.05742            | 0.15216        | 0.38    | 0.7062  |
| YEAR07    |                           | 1  | 0.59677            | 0.15236        | 3.92    | 0.0001  |
| YEAR08    |                           | 1  | 3.58703            | 0.15870        | 22.60   | <.0001  |
| resid     | Residual                  | 1  | -5.72752           | 2.54919        | -2.25   | 0.0256  |

### 1.3. To test if variable Size is endogenous

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The REG Procedure  
Model: MODEL1  
Dependent Variable: Size Log bank total assets

Number of Observations Read 265  
Number of Observations Used 251  
Number of Observations with Missing Values 14

# Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 389.69314      | 43.29924    | 1983.45 | <.0001 |
| Error           | 241 | 5.26110        | 0.02183     |         |        |
| Corrected Total | 250 | 394.95424      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.14775  | R-Square | 0.9867 |
| Dependent Mean | 12.35984 | Adj R-Sq | 0.9862 |
| Coeff Var      | 1.19541  |          |        |

# Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -0.12680           | 0.30027        | -0.42   | 0.6732  |
| BC        | Bank capital              | 1  | -0.00478           | 0.00556        | -0.86   | 0.3909  |
| CV        | Bank charter value        | 1  | -0.11538           | 0.21930        | -0.53   | 0.5993  |
| Size_1    |                           | 1  | 0.87512            | 0.07352        | 11.90   | <.0001  |
| Size_2    |                           | 1  | 0.12954            | 0.07391        | 1.75    | 0.0809  |
| LOAN      | Bank loan to total assets | 1  | -0.00112           | 0.00071720     | -1.55   | 0.1213  |
| YEAR05    |                           | 1  | 0.44840            | 0.03870        | 11.59   | <.0001  |
| YEAR06    |                           | 1  | 0.44502            | 0.03302        | 13.48   | <.0001  |
| YEAR07    |                           | 1  | 0.49268            | 0.03115        | 15.82   | <.0001  |
| YEAR08    |                           | 1  | 0.54421            | 0.03350        | 16.24   | <.0001  |

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# The REG Procedure

Model: MODEL1

Dependent Variable: TOTARISK Total risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

# Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 525.58453      | 58.39828    | 103.71  | <.0001 |
| Error           | 241 | 135.70608      | 0.56310     |         |        |
| Corrected Total | 250 | 661.29061      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.75040  | R-Square | 0.7948 |
| Dependent Mean | 2.00327  | Adj R-Sq | 0.7871 |
| Coeff Var      | 37.45863 |          |        |



| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | 6.59930            | 1.51948        | 4.34    | <.0001  |
| BC                  | Bank capital              | 1  | 0.02412            | 0.02833        | 0.85    | 0.3954  |
| CV                  | Bank charter value        | 1  | -3.99582           | 1.11485        | -3.58   | 0.0004  |
| Size                | Log bank total assets     | 1  | -0.12038           | 0.04805        | -2.51   | 0.0129  |
| LOAN                | Bank loan to total assets | 1  | -0.00072178        | 0.00367        | -0.20   | 0.8442  |
| YEAR05              |                           | 1  | -0.07439           | 0.15678        | -0.47   | 0.6356  |
| YEAR06              |                           | 1  | 0.04916            | 0.15319        | 0.32    | 0.7486  |
| YEAR07              |                           | 1  | 0.59460            | 0.15345        | 3.87    | 0.0001  |
| YEAR08              |                           | 1  | 3.54247            | 0.15872        | 22.32   | <.0001  |
| resid               | Residual                  | 1  | -0.42192           | 0.33066        | -1.28   | 0.2032  |

#### 1.4. To test if variable LOAN is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: LOAN Bank loan to total assets

Number of Observations Read 265  
Number of Observations Used 251  
Number of Observations with Missing Values 14

| Analysis of Variance |     |                |             |         |        |
|----------------------|-----|----------------|-------------|---------|--------|
| Source               | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model                | 9   | 56249          | 6249.91462  | 355.92  | <.0001 |
| Error                | 241 | 4231.91603     | 17.55982    |         |        |
| Corrected Total      | 250 | 60481          |             |         |        |
| Root MSE             |     |                |             |         |        |
|                      |     | 4.19044        | R-Square    | 0.9300  |        |
| Dependent Mean       |     |                |             |         |        |
|                      |     | 56.87372       | Adj R-Sq    | 0.9274  |        |
| Coeff Var            |     |                |             |         |        |
|                      |     | 7.36798        |             |         |        |

| Parameter Estimates |                       |    |                    |                |         |         |
|---------------------|-----------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                 | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept             | 1  | 9.03037            | 8.47530        | 1.07    | 0.2877  |
| BC                  | Bank capital          | 1  | -0.25965           | 0.15717        | -1.65   | 0.0998  |
| CV                  | Bank charter value    | 1  | 4.32865            | 6.24217        | 0.69    | 0.4887  |
| Size                | Log bank total assets | 1  | -0.64419           | 0.26227        | -2.46   | 0.0147  |
| LOAN_1              |                       | 1  | 0.93467            | 0.07028        | 13.30   | <.0001  |
| LOAN_2              |                       | 1  | 0.01642            | 0.07071        | 0.23    | 0.8165  |
| YEAR05              |                       | 1  | 0.76457            | 0.87516        | 0.87    | 0.3832  |
| YEAR06              |                       | 1  | -1.60715           | 0.85532        | -1.88   | 0.0615  |
| YEAR07              |                       | 1  | 1.11286            | 0.86549        | 1.29    | 0.1997  |
| YEAR08              |                       | 1  | 0.26911            | 0.88980        | 0.30    | 0.7626  |

The REG Procedure

Model: MODEL1

Dependent Variable: TOTARISK Total risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 525.22006      | 58.35778    | 103.36  | <.0001 |
| Error           | 241 | 136.07055      | 0.56461     |         |        |
| Corrected Total | 250 | 661.29061      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.75140  | R-Square | 0.7942 |
| Dependent Mean | 2.00327  | Adj R-Sq | 0.7866 |
| Coeff Var      | 37.50890 |          |        |

Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 6.57498            | 1.52987        | 4.30    | <.0001  |
| BC        | Bank capital              | 1  | 0.02585            | 0.02856        | 0.91    | 0.3662  |
| CV        | Bank charter value        | 1  | -4.02948           | 1.11589        | -3.61   | 0.0004  |
| Size      | Log bank total assets     | 1  | -0.12134           | 0.04828        | -2.51   | 0.0126  |
| LOAN      | Bank loan to total assets | 1  | 0.00014411         | 0.00386        | 0.04    | 0.9703  |
| YEAR05    |                           | 1  | -0.07422           | 0.15699        | -0.47   | 0.6368  |
| YEAR06    |                           | 1  | 0.05194            | 0.15341        | 0.34    | 0.7352  |
| YEAR07    |                           | 1  | 0.59665            | 0.15364        | 3.88    | 0.0001  |
| YEAR08    |                           | 1  | 3.54471            | 0.15892        | 22.31   | <.0001  |
| resid     | Residual                  | 1  | -0.01205           | 0.01218        | -0.99   | 0.3236  |

## 2. Results of Hausman test for running regression systematic risk on control variables

### 2.1. To test if variable BC is endogenous

The REG Procedure

Model: MODEL1

Dependent Variable: SYSTRISK Systematic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

| Analysis of Variance |     |                |             |         |        |
|----------------------|-----|----------------|-------------|---------|--------|
| Source               | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model                | 8   | 6.99093        | 0.87387     | 8.96    | <.0001 |
| Error                | 242 | 23.59621       | 0.09751     |         |        |
| Corrected Total      | 250 | 30.58714       |             |         |        |
| Root MSE             |     | 0.31226        | R-Square    | 0.2286  |        |
| Dependent Mean       |     | 1.04629        | Adj R-Sq    | 0.2031  |        |
| Coeff Var            |     | 29.84443       |             |         |        |

| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | 0.03495            | 0.62913        | 0.06    | 0.9557  |
| BC                  | Bank capital              | 1  | 0.01092            | 0.01178        | 0.93    | 0.3546  |
| CV                  | Bank charter value        | 1  | 0.36476            | 0.46372        | 0.79    | 0.4323  |
| Size                | Log bank total assets     | 1  | 0.03130            | 0.01978        | 1.58    | 0.1150  |
| LOAN                | Bank loan to total assets | 1  | -0.00065094        | 0.00152        | -0.43   | 0.6694  |
| YEAR05              |                           | 1  | 0.02203            | 0.06524        | 0.34    | 0.7359  |
| YEAR06              |                           | 1  | 0.01523            | 0.06375        | 0.24    | 0.8114  |
| YEAR07              |                           | 1  | 0.24754            | 0.06385        | 3.88    | 0.0001  |
| YEAR08              |                           | 1  | 0.39575            | 0.06604        | 5.99    | <.0001  |

| Parameter Estimates |                           |    |                    |  |
|---------------------|---------------------------|----|--------------------|--|
| Variable            | Label                     | DF | Variance Inflation |  |
| Intercept           | Intercept                 | 1  | 0                  |  |
| BC                  | Bank capital              | 1  | 1.44216            |  |
| CV                  | Bank charter value        | 1  | 1.35379            |  |
| Size                | Log bank total assets     | 1  | 1.58542            |  |
| LOAN                | Bank loan to total assets | 1  | 1.43826            |  |
| YEAR05              |                           | 1  | 1.66729            |  |
| YEAR06              |                           | 1  | 1.74241            |  |
| YEAR07              |                           | 1  | 1.74793            |  |
| YEAR08              |                           | 1  | 1.87007            |  |

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The REG Procedure

Model: MODEL1

Dependent Variable: BC Bank capital

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

| Analysis of Variance |     |                |             |         |        |
|----------------------|-----|----------------|-------------|---------|--------|
| Source               | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model                | 9   | 768.51091      | 85.39010    | 83.82   | <.0001 |
| Error                | 241 | 245.50485      | 1.01869     |         |        |
| Corrected Total      | 250 | 1014.01576     |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 1.00930  | R-Square | 0.7579 |
| Dependent Mean | 12.11076 | Adj R-Sq | 0.7488 |
| Coeff Var      | 8.33394  |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 1.84649            | 2.03414        | 0.91    | 0.3649  |
| BC_1      | Lagged BC                 | 1  | 0.66026            | 0.08224        | 8.03    | <.0001  |
| BC_2      |                           | 1  | 0.24936            | 0.08068        | 3.09    | 0.0022  |
| CV        | Bank charter value        | 1  | 0.90093            | 1.51853        | 0.59    | 0.5535  |
| Size      | Log bank total assets     | 1  | -0.08552           | 0.06434        | -1.33   | 0.1851  |
| LOAN      | Bank loan to total assets | 1  | -0.00616           | 0.00498        | -1.24   | 0.2176  |
| YEAR05    |                           | 1  | -0.24531           | 0.21286        | -1.15   | 0.2503  |
| YEAR06    |                           | 1  | -0.65155           | 0.20638        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.19518           | 0.20838        | -0.94   | 0.3499  |
| YEAR08    |                           | 1  | -0.76612           | 0.21612        | -3.54   | 0.0005  |

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#### The REG Procedure

Model: MODEL1

Dependent Variable: SYSTRISK Systematic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 7.00430        | 0.77826     | 7.95    | <.0001 |
| Error           | 241 | 23.58284       | 0.09785     |         |        |
| Corrected Total | 250 | 30.58714       |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.31282  | R-Square | 0.2290 |
| Dependent Mean | 1.04629  | Adj R-Sq | 0.2002 |
| Coeff Var      | 29.89781 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.06661            | 0.63604        | 0.10    | 0.9167  |
| BC        | Bank capital              | 1  | 0.00773            | 0.01462        | 0.53    | 0.5976  |
| CV        | Bank charter value        | 1  | 0.40097            | 0.47477        | 0.84    | 0.3992  |
| Size      | Log bank total assets     | 1  | 0.02949            | 0.02041        | 1.45    | 0.1497  |
| LOAN      | Bank loan to total assets | 1  | -0.00080570        | 0.00158        | -0.51   | 0.6110  |
| YEAR05    |                           | 1  | 0.02246            | 0.06536        | 0.34    | 0.7315  |
| YEAR06    |                           | 1  | 0.01424            | 0.06392        | 0.22    | 0.8239  |
| YEAR07    |                           | 1  | 0.24740            | 0.06396        | 3.87    | 0.0001  |
| YEAR08    |                           | 1  | 0.39544            | 0.06616        | 5.98    | <.0001  |
| resid     | Residual                  | 1  | 0.00915            | 0.02475        | 0.37    | 0.7120  |

## 2.2. To test if variable CV is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: CV Bank charter value

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 0.49965        | 0.05552     | 117.14  | <.0001 |
| Error           | 241 | 0.11422        | 0.00047393  |         |        |
| Corrected Total | 250 | 0.61387        |             |         |        |

|                |         |          |        |
|----------------|---------|----------|--------|
| Root MSE       | 0.02177 | R-Square | 0.8139 |
| Dependent Mean | 1.05841 | Adj R-Sq | 0.8070 |
| Coeff Var      | 2.05685 |          |        |

### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.14462            | 0.04453        | 3.25    | 0.0013  |
| BC        | Bank capital              | 1  | 0.00106            | 0.00082059     | 1.29    | 0.1968  |
| CV_1      |                           | 1  | 0.80536            | 0.07719        | 10.43   | <.0001  |
| CV_2      |                           | 1  | 0.06190            | 0.07662        | 0.81    | 0.4199  |
| Size      | Log bank total assets     | 1  | 0.00001710         | 0.00139        | 0.01    | 0.9902  |
| LOAN      | Bank loan to total assets | 1  | -0.00013380        | 0.00010619     | -1.26   | 0.2089  |
| YEAR05    |                           | 1  | -0.00962           | 0.00461        | -2.09   | 0.0380  |
| YEAR06    |                           | 1  | -0.01407           | 0.00446        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.00397           | 0.00447        | -0.89   | 0.3753  |
| YEAR08    |                           | 1  | -0.04367           | 0.00456        | -9.58   | <.0001  |

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The REG Procedure  
Model: MODEL1  
Dependent Variable: SYSTRISK Systematic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 7.16653        | 0.79628     | 8.19    | <.0001 |
| Error           | 241 | 23.42061       | 0.09718     |         |        |
| Corrected Total | 250 | 30.58714       |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.31174  | R-Square | 0.2343 |
| Dependent Mean | 1.04629  | Adj R-Sq | 0.2057 |
| Coeff Var      | 29.79479 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -0.35727           | 0.69254        | -0.52   | 0.6064  |
| BC        | Bank capital              | 1  | 0.00828            | 0.01192        | 0.69    | 0.4878  |
| CV        | Bank charter value        | 1  | 0.72586            | 0.53524        | 1.36    | 0.1763  |
| Size      | Log bank total assets     | 1  | 0.03437            | 0.01988        | 1.73    | 0.0852  |
| LOAN      | Bank loan to total assets | 1  | -0.00062532        | 0.00152        | -0.41   | 0.6812  |
| YEAR05    |                           | 1  | 0.02224            | 0.06513        | 0.34    | 0.7330  |
| YEAR06    |                           | 1  | 0.01708            | 0.06366        | 0.27    | 0.7886  |
| YEAR07    |                           | 1  | 0.24728            | 0.06374        | 3.88    | 0.0001  |
| YEAR08    |                           | 1  | 0.40627            | 0.06639        | 6.12    | <.0001  |
| resid     | Residual                  | 1  | -1.43358           | 1.06645        | -1.34   | 0.1801  |

### 2.3. To test if variable Size is endogenous

#### The REG Procedure

Model: MODEL1

Dependent Variable: Size Log bank total assets

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 389.69314      | 43.29924    | 1983.45 | <.0001 |
| Error           | 241 | 5.26110        | 0.02183     |         |        |
| Corrected Total | 250 | 394.95424      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.14775  | R-Square | 0.9867 |
| Dependent Mean | 12.35984 | Adj R-Sq | 0.9862 |
| Coeff Var      | 1.19541  |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -0.12680           | 0.30027        | -0.42   | 0.6732  |
| BC        | Bank capital              | 1  | -0.00478           | 0.00556        | -0.86   | 0.3909  |
| CV        | Bank charter value        | 1  | -0.11538           | 0.21930        | -0.53   | 0.5993  |
| Size_1    |                           | 1  | 0.87512            | 0.07352        | 11.90   | <.0001  |
| Size_2    |                           | 1  | 0.12954            | 0.07391        | 1.75    | 0.0809  |
| LOAN      | Bank loan to total assets | 1  | -0.00112           | 0.00071720     | -1.55   | 0.1213  |
| YEAR05    |                           | 1  | 0.44840            | 0.03870        | 11.59   | <.0001  |
| YEAR06    |                           | 1  | 0.44502            | 0.03302        | 13.48   | <.0001  |
| YEAR07    |                           | 1  | 0.49268            | 0.03115        | 15.82   | <.0001  |
| YEAR08    |                           | 1  | 0.54421            | 0.03350        | 16.24   | <.0001  |

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The REG Procedure

Model: MODEL1

Dependent Variable: SYSTRISK Systematic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 6.99853        | 0.77761     | 7.94    | <.0001 |
| Error           | 241 | 23.58861       | 0.09788     |         |        |
| Corrected Total | 250 | 30.58714       |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.31285  | R-Square | 0.2288 |
| Dependent Mean | 1.04629  | Adj R-Sq | 0.2000 |
| Coeff Var      | 29.90146 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.01731            | 0.63350        | 0.03    | 0.9782  |
| BC        | Bank capital              | 1  | 0.01109            | 0.01181        | 0.94    | 0.3490  |
| CV        | Bank charter value        | 1  | 0.36855            | 0.46480        | 0.79    | 0.4286  |
| Size      | Log bank total assets     | 1  | 0.03211            | 0.02003        | 1.60    | 0.1103  |
| LOAN      | Bank loan to total assets | 1  | -0.00061940        | 0.00153        | -0.40   | 0.6859  |
| YEAR05    |                           | 1  | 0.02188            | 0.06536        | 0.33    | 0.7382  |
| YEAR06    |                           | 1  | 0.01515            | 0.06387        | 0.24    | 0.8127  |
| YEAR07    |                           | 1  | 0.24725            | 0.06398        | 3.86    | 0.0001  |
| YEAR08    |                           | 1  | 0.39552            | 0.06617        | 5.98    | <.0001  |
| resid     | Residual                  | 1  | -0.03842           | 0.13786        | -0.28   | 0.7807  |

## 2.4. To test if variable Loan is endogenous

The REG Procedure

Model: MODEL1

Dependent Variable: LOAN Bank loan to total assets

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 56249          | 6249.91462  | 355.92  | <.0001 |
| Error           | 241 | 4231.91603     | 17.55982    |         |        |
| Corrected Total | 250 | 60481          |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 4.19044  | R-Square | 0.9300 |
| Dependent Mean | 56.87372 | Adj R-Sq | 0.9274 |
| Coeff Var      | 7.36798  |          |        |

#### Parameter Estimates

| Variable  | Label                 | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|-----------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept             | 1  | 9.03037            | 8.47530        | 1.07    | 0.2877  |
| BC        | Bank capital          | 1  | -0.25965           | 0.15717        | -1.65   | 0.0998  |
| CV        | Bank charter value    | 1  | 4.32865            | 6.24217        | 0.69    | 0.4887  |
| Size      | Log bank total assets | 1  | -0.64419           | 0.26227        | -2.46   | 0.0147  |
| LOAN_1    |                       | 1  | 0.93467            | 0.07028        | 13.30   | <.0001  |
| LOAN_2    |                       | 1  | 0.01642            | 0.07071        | 0.23    | 0.8165  |
| YEAR05    |                       | 1  | 0.76457            | 0.87516        | 0.87    | 0.3832  |
| YEAR06    |                       | 1  | -1.60715           | 0.85532        | -1.88   | 0.0615  |
| YEAR07    |                       | 1  | 1.11286            | 0.86549        | 1.29    | 0.1997  |
| YEAR08    |                       | 1  | 0.26911            | 0.88980        | 0.30    | 0.7626  |

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#### The REG Procedure

Model: MODEL1

Dependent Variable: SYSTRISK Systematic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 6.99856        | 0.77762     | 7.94    | <.0001 |
| Error           | 241 | 23.58859       | 0.09788     |         |        |
| Corrected Total | 250 | 30.58714       |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.31285  | R-Square | 0.2288 |
| Dependent Mean | 1.04629  | Adj R-Sq | 0.2000 |
| Coeff Var      | 29.90145 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.00932            | 0.63698        | 0.01    | 0.9883  |
| BC        | Bank capital              | 1  | 0.01134            | 0.01189        | 0.95    | 0.3414  |
| CV        | Bank charter value        | 1  | 0.36569            | 0.46461        | 0.79    | 0.4320  |
| Size      | Log bank total assets     | 1  | 0.03223            | 0.02010        | 1.60    | 0.1102  |
| LOAN      | Bank loan to total assets | 1  | -0.00050848        | 0.00161        | -0.32   | 0.7522  |
| YEAR05    |                           | 1  | 0.02185            | 0.06536        | 0.33    | 0.7384  |
| YEAR06    |                           | 1  | 0.01546            | 0.06387        | 0.24    | 0.8090  |
| YEAR07    |                           | 1  | 0.24740            | 0.06397        | 3.87    | 0.0001  |
| YEAR08    |                           | 1  | 0.39572            | 0.06617        | 5.98    | <.0001  |
| resid     | Residual                  | 1  | -0.00142           | 0.00507        | -0.28   | 0.7804  |



### 3. Results of Hausman test for running regression idiosyncratic risk on control variables

#### 3.1. To test if variable BC is endogenous

| The REG Procedure                               |                           |                           |                    |                    |         |         |
|---|---------------------------|---------------------------|--------------------|--------------------|---------|---------|
| Model: MODEL1                                   |                           |                           |                    |                    |         |         |
| Dependent Variable: IDIORISK Idiosyncratic risk |                           |                           |                    |                    |         |         |
| Number of Observations Read                     |                           |                           |                    | 265                |         |         |
| Number of Observations Used                     |                           |                           |                    | 251                |         |         |
| Number of Observations with Missing Values      |                           |                           |                    | 14                 |         |         |
| Analysis of Variance                            |                           |                           |                    |                    |         |         |
| Source  | DF                        | Sum of Squares            | Mean Square        | F Value            | Pr > F  |         |
| Model   | 8                         | 268.92843                 | 33.61605           | 81.40              | <.0001  |         |
| Error   | 242                       | 99.93543                  | 0.41296            |                    |         |         |
| Corrected Total                                 | 250                       | 368.86386                 |                    |                    |         |         |
| Root MSE  |                           | 0.64262                   | R-Square           | 0.7291             |         |         |
| Dependent Mean                                  |                           | 1.44992                   | Adj R-Sq           | 0.7201             |         |         |
| Coeff Var                                       |                           | 44.32093                  |                    |                    |         |         |
| Parameter Estimates                             |                           |                           |                    |                    |         |         |
| Variable  | Label                     | DF                        | Parameter Estimate | Standard Error     | t Value | Pr >  t |
| Intercept                                       | Intercept                 | 1                         | 8.06001            | 1.29472            | 6.23    | <.0001  |
| BC  | Bank capital              | 1                         | 0.03408            | 0.02423            | 1.41    | 0.1610  |
| CV  | Bank charter value        | 1                         | -4.81843           | 0.95431            | -5.05   | <.0001  |
| Size  | Log bank total assets     | 1                         | -0.19479           | 0.04071            | -4.78   | <.0001  |
| LOAN  | Bank loan to total assets | 1                         | -0.00153           | 0.00313            | -0.49   | 0.6250  |
| YEAR05  |                           | 1                         | -0.04299           | 0.13425            | -0.32   | 0.7491  |
| YEAR06  |                           | 1                         | -0.00264           | 0.13119            | -0.02   | 0.9839  |
| YEAR07  |                           | 1                         | 0.31112            | 0.13140            | 2.37    | 0.0187  |
| YEAR08  |                           | 1                         | 2.43837            | 0.13591            | 17.94   | <.0001  |
| Parameter Estimates                             |                           |                           |                    |                    |         |         |
|   |                           |                           |                    | Variance Inflation |         |         |
|   | Variable                  | Label                     | DF                 |                    |         |         |
|   | Intercept                 | Intercept                 | 1                  | 0                  |         |         |
|   | BC                        | Bank capital              | 1                  | 1.44216            |         |         |
|   | CV                        | Bank charter value        | 1                  | 1.35379            |         |         |
|   | Size                      | Log bank total assets     | 1                  | 1.58542            |         |         |
|   | LOAN                      | Bank loan to total assets | 1                  | 1.43826            |         |         |
|   | YEAR05                    |                           | 1                  | 1.66729            |         |         |
|   | YEAR06                    |                           | 1                  | 1.74241            |         |         |
|   | YEAR07                    |                           | 1                  | 1.74793            |         |         |
|   | YEAR08                    |                           | 1                  | 1.87007            |         |         |

The REG Procedure  
Model: MODEL1  
Dependent Variable: BC Bank capital

Number of Observations Read 265  
Number of Observations Used 251  
Number of Observations with Missing Values 14

# Analysis of Variance

| Source          | DF             | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|----------------|----------------|-------------|---------|--------|
| Model           | 9              | 768.51091      | 85.39010    | 83.82   | <.0001 |
| Error           | 241            | 245.50485      | 1.01869     |         |        |
| Corrected Total | 250            | 1014.01576     |             |         |        |
|                 |                |                |             |         |        |
|                 | Root MSE       | 1.00930        | R-Square    | 0.7579  |        |
|                 | Dependent Mean | 12.11076       | Adj R-Sq    | 0.7488  |        |
|                 | Coeff Var      | 8.33394        |             |         |        |

## Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 1.84649            | 2.03414        | 0.91    | 0.3649  |
| BC_1      | Lagged BC                 | 1  | 0.66026            | 0.08224        | 8.03    | <.0001  |
| BC_2      |                           | 1  | 0.24936            | 0.08068        | 3.09    | 0.0022  |
| CV        | Bank charter value        | 1  | 0.90093            | 1.51853        | 0.59    | 0.5535  |
| Size      | Log bank total assets     | 1  | -0.08552           | 0.06434        | -1.33   | 0.1851  |
| LOAN      | Bank loan to total assets | 1  | -0.00616           | 0.00498        | -1.24   | 0.2176  |
| YEAR05    |                           | 1  | -0.24531           | 0.21286        | -1.15   | 0.2503  |
| YEAR06    |                           | 1  | -0.65155           | 0.20638        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.19518           | 0.20838        | -0.94   | 0.3499  |
| YEAR08    |                           | 1  | -0.76612           | 0.21612        | -3.54   | 0.0005  |

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## The REG Procedure

Model: MODEL1

Dependent Variable: IDIORISK Idiosyncratic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

# Analysis of Variance

| Source          | DF             | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|----------------|----------------|-------------|---------|--------|
| Model           | 9              | 268.93118      | 29.88124    | 72.06   | <.0001 |
| Error           | 241            | 99.93268       | 0.41466     |         |        |
| Corrected Total | 250            | 368.86386      |             |         |        |
|                 |                |                |             |         |        |
|                 | Root MSE       | 0.64394        | R-Square    | 0.7291  |        |
|                 | Dependent Mean | 1.44992        | Adj R-Sq    | 0.7190  |        |
|                 | Coeff Var      | 44.41218       |             |         |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 8.04565            | 1.30931        | 6.14    | <.0001  |
| BC        | Bank capital              | 1  | 0.03552            | 0.03010        | 1.18    | 0.2391  |
| CV        | Bank charter value        | 1  | -4.83487           | 0.97732        | -4.95   | <.0001  |
| Size      | Log bank total assets     | 1  | -0.19398           | 0.04202        | -4.62   | <.0001  |
| LOAN      | Bank loan to total assets | 1  | -0.00146           | 0.00326        | -0.45   | 0.6535  |
| YEAR05    |                           | 1  | -0.04319           | 0.13455        | -0.32   | 0.7485  |
| YEAR06    |                           | 1  | -0.00219           | 0.13157        | -0.02   | 0.9867  |
| YEAR07    |                           | 1  | 0.31118            | 0.13167        | 2.36    | 0.0189  |
| YEAR08    |                           | 1  | 2.43851            | 0.13620        | 17.90   | <.0001  |
| resid     | Residual                  | 1  | -0.00415           | 0.05094        | -0.08   | 0.9351  |

### 3.2. To test if variable CV is endogenous

#### The REG Procedure

Model: MODEL1

Dependent Variable: CV Bank charter value

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 0.49965        | 0.05552     | 117.14  | <.0001 |
| Error           | 241 | 0.11422        | 0.00047393  |         |        |
| Corrected Total | 250 | 0.61387        |             |         |        |

|                |         |          |        |
|----------------|---------|----------|--------|
| Root MSE       | 0.02177 | R-Square | 0.8139 |
| Dependent Mean | 1.05841 | Adj R-Sq | 0.8070 |
| Coeff Var      | 2.05685 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.14462            | 0.04453        | 3.25    | 0.0013  |
| BC        | Bank capital              | 1  | 0.00106            | 0.00082059     | 1.29    | 0.1968  |
| CV_1      |                           | 1  | 0.80536            | 0.07719        | 10.43   | <.0001  |
| CV_2      |                           | 1  | 0.06190            | 0.07662        | 0.81    | 0.4199  |
| Size      | Log bank total assets     | 1  | 0.00001710         | 0.00139        | 0.01    | 0.9902  |
| LOAN      | Bank loan to total assets | 1  | -0.00013380        | 0.00010619     | -1.26   | 0.2089  |
| YEAR05    |                           | 1  | -0.00962           | 0.00461        | -2.09   | 0.0380  |
| YEAR06    |                           | 1  | -0.01407           | 0.00446        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.00397           | 0.00447        | -0.89   | 0.3753  |
| YEAR08    |                           | 1  | -0.04367           | 0.00456        | -9.58   | <.0001  |

The REG Procedure  
Model: MODEL1  
Dependent Variable: IDIORISK Idiosyncratic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
|-----------------|-----|-------------------|----------------|---------|--------|
| Model           | 9   | 272.21837         | 30.24649       | 75.42   | <.0001 |
| Error           | 241 | 96.64549          | 0.40102        |         |        |
| Corrected Total | 250 | 368.86386         |                |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.63326  | R-Square | 0.7380 |
| Dependent Mean | 1.44992  | Adj R-Sq | 0.7282 |
| Coeff Var      | 43.67562 |          |        |

Parameter Estimates

| Variable  | Label                     | DF | Parameter<br>Estimate | Standard<br>Error | t Value | Pr >  t |
|-----------|---------------------------|----|-----------------------|-------------------|---------|---------|
| Intercept | Intercept                 | 1  | 6.36234               | 1.40682           | 4.52    | <.0001  |
| BC        | Bank capital              | 1  | 0.02264               | 0.02421           | 0.94    | 0.3506  |
| CV        | Bank charter value        | 1  | -3.25546              | 1.08727           | -2.99   | 0.0030  |
| Size      | Log bank total assets     | 1  | -0.18150              | 0.04039           | -4.49   | <.0001  |
| LOAN      | Bank loan to total assets | 1  | -0.00142              | 0.00309           | -0.46   | 0.6454  |
| YEAR05    |                           | 1  | -0.04206              | 0.13230           | -0.32   | 0.7508  |
| YEAR06    |                           | 1  | 0.00538               | 0.12931           | 0.04    | 0.9669  |
| YEAR07    |                           | 1  | 0.30998               | 0.12948           | 2.39    | 0.0174  |
| YEAR08    |                           | 1  | 2.48386               | 0.13487           | 18.42   | <.0001  |
| resid     | Residual                  | 1  | -6.20504              | 2.16637           | -2.86   | 0.0045  |

### 3.3. To test if variable Size is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: Size Log bank total assets

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
|-----------------|-----|-------------------|----------------|---------|--------|
| Model           | 9   | 389.69314         | 43.29924       | 1983.45 | <.0001 |
| Error           | 241 | 5.26110           | 0.02183        |         |        |
| Corrected Total | 250 | 394.95424         |                |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.14775  | R-Square | 0.9867 |
| Dependent Mean | 12.35984 | Adj R-Sq | 0.9862 |
| Coeff Var      | 1.19541  |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -0.12680           | 0.30027        | -0.42   | 0.6732  |
| BC        | Bank capital              | 1  | -0.00478           | 0.00556        | -0.86   | 0.3909  |
| CV        | Bank charter value        | 1  | -0.11538           | 0.21930        | -0.53   | 0.5993  |
| Size_1    |                           | 1  | 0.87512            | 0.07352        | 11.90   | <.0001  |
| Size_2    |                           | 1  | 0.12954            | 0.07391        | 1.75    | 0.0809  |
| LOAN      | Bank loan to total assets | 1  | -0.00112           | 0.00071720     | -1.55   | 0.1213  |
| YEAR05    |                           | 1  | 0.44840            | 0.03870        | 11.59   | <.0001  |
| YEAR06    |                           | 1  | 0.44502            | 0.03302        | 13.48   | <.0001  |
| YEAR07    |                           | 1  | 0.49268            | 0.03115        | 15.82   | <.0001  |
| YEAR08    |                           | 1  | 0.54421            | 0.03350        | 16.24   | <.0001  |

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#### The REG Procedure

Model: MODEL1

Dependent Variable: IDIORISK Idiosyncratic risk

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 269.88612      | 29.98735    | 73.02   | <.0001 |
| Error           | 241 | 98.97774       | 0.41070     |         |        |
| Corrected Total | 250 | 368.86386      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.64086  | R-Square | 0.7317 |
| Dependent Mean | 1.44992  | Adj R-Sq | 0.7216 |
| Coeff Var      | 44.19947 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 7.86197            | 1.29767        | 6.06    | <.0001  |
| BC        | Bank capital              | 1  | 0.03590            | 0.02420        | 1.48    | 0.1393  |
| CV        | Bank charter value        | 1  | -4.77588           | 0.95210        | -5.02   | <.0001  |
| Size      | Log bank total assets     | 1  | -0.18569           | 0.04104        | -4.52   | <.0001  |
| LOAN      | Bank loan to total assets | 1  | -0.00118           | 0.00313        | -0.38   | 0.7069  |
| YEAR05    |                           | 1  | -0.04468           | 0.13389        | -0.33   | 0.7389  |
| YEAR06    |                           | 1  | -0.00352           | 0.13083        | -0.03   | 0.9786  |
| YEAR07    |                           | 1  | 0.30783            | 0.13105        | 2.35    | 0.0196  |
| YEAR08    |                           | 1  | 2.43575            | 0.13555        | 17.97   | <.0001  |
| resid     | Residual                  | 1  | -0.43123           | 0.28240        | -1.53   | 0.1281  |

### 3.4. To test if variable LOAN is endogenous

| The REG Procedure                                  |     |                |             |         |        |
|--|-----|----------------|-------------|---------|--------|
| Model: MODEL1                                      |     |                |             |         |        |
| Dependent Variable: LOAN Bank loan to total assets |     |                |             |         |        |
| Number of Observations Read                        |     |                |             | 265     |        |
| Number of Observations Used                        |     |                |             | 251     |        |
| Number of Observations with Missing Values         |     |                |             | 14      |        |
| Analysis of Variance                               |     |                |             |         |        |
| Source   | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model  | 9   | 56249          | 6249.91462  | 355.92  | <.0001 |
| Error  | 241 | 4231.91603     | 17.55982    |         |        |
| Corrected Total                                    | 250 | 60481          |             |         |        |
|  |     |                |             |         |        |
| Root MSE   |     | 4.19044        | R-Square    | 0.9300  |        |
| Dependent Mean                                     |     | 56.87372       | Adj R-Sq    | 0.9274  |        |
| Coeff Var  |     | 7.36798        |             |         |        |

| Parameter Estimates |                       |    |                    |                |         |         |
|---------------------|-----------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                 | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept             | 1  | 9.03037            | 8.47530        | 1.07    | 0.2877  |
| BC                  | Bank capital          | 1  | -0.25965           | 0.15717        | -1.65   | 0.0998  |
| CV                  | Bank charter value    | 1  | 4.32865            | 6.24217        | 0.69    | 0.4887  |
| Size                | Log bank total assets | 1  | -0.64419           | 0.26227        | -2.46   | 0.0147  |
| LOAN_1              |                       | 1  | 0.93467            | 0.07028        | 13.30   | <.0001  |
| LOAN_2              |                       | 1  | 0.01642            | 0.07071        | 0.23    | 0.8165  |
| YEAR05              |                       | 1  | 0.76457            | 0.87516        | 0.87    | 0.3832  |
| YEAR06              |                       | 1  | -1.60715           | 0.85532        | -1.88   | 0.0615  |
| YEAR07              |                       | 1  | 1.11286            | 0.86549        | 1.29    | 0.1997  |
| YEAR08              |                       | 1  | 0.26911            | 0.88980        | 0.30    | 0.7626  |

| The REG Procedure                               |     |                |             |         |        |
|---|-----|----------------|-------------|---------|--------|
| Model: MODEL1                                   |     |                |             |         |        |
| Dependent Variable: IDIORISK Idiosyncratic risk |     |                |             |         |        |
| Number of Observations Read                     |     |                |             | 265     |        |
| Number of Observations Used                     |     |                |             | 251     |        |
| Number of Observations with Missing Values      |     |                |             | 14      |        |
| Analysis of Variance                            |     |                |             |         |        |
| Source  | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model   | 9   | 269.05522      | 29.89502    | 72.19   | <.0001 |
| Error   | 241 | 99.80863       | 0.41414     |         |        |
| Corrected Total                                 | 250 | 368.86386      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.64354  | R-Square | 0.7294 |
| Dependent Mean | 1.44992  | Adj R-Sq | 0.7193 |
| Coeff Var      | 44.38461 |          |        |

| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | 7.95552            | 1.31026        | 6.07    | <.0001  |
| BC                  | Bank capital              | 1  | 0.03576            | 0.02446        | 1.46    | 0.1451  |
| CV                  | Bank charter value        | 1  | -4.81461           | 0.95571        | -5.04   | <.0001  |
| Size                | Log bank total assets     | 1  | -0.19098           | 0.04135        | -4.62   | <.0001  |
| LOAN                | Bank loan to total assets | 1  | -0.00095299        | 0.00331        | -0.29   | 0.7736  |
| YEAR05              |                           | 1  | -0.04370           | 0.13445        | -0.33   | 0.7454  |
| YEAR06              |                           | 1  | -0.00172           | 0.13139        | -0.01   | 0.9896  |
| YEAR07              |                           | 1  | 0.31056            | 0.13159        | 2.36    | 0.0191  |
| YEAR08              |                           | 1  | 2.43821            | 0.13610        | 17.91   | <.0001  |
| resid               | Residual                  | 1  | -0.00577           | 0.01043        | -0.55   | 0.5806  |

## 4. Results of Hausman test for running regression LLP on control variables

### 4.1. To test if variable BC is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: LLP Rate of loan loss provision to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

| Analysis of Variance |     |                |             |         |        |
|----------------------|-----|----------------|-------------|---------|--------|
| Source               | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model                | 8   | 37.05004       | 4.63125     | 10.11   | <.0001 |
| Error                | 242 | 110.81002      | 0.45789     |         |        |
| Corrected Total      | 250 | 147.86006      |             |         |        |

|                |           |          |        |
|----------------|-----------|----------|--------|
| Root MSE       | 0.67668   | R-Square | 0.2506 |
| Dependent Mean | 0.56003   | Adj R-Sq | 0.2258 |
| Coeff Var      | 120.82855 |          |        |

| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | 0.60221            | 1.36334        | 0.44    | 0.6591  |
| BC                  | Bank capital              | 1  | 0.01245            | 0.02552        | 0.49    | 0.6260  |
| CV                  | Bank charter value        | 1  | -0.80775           | 1.00489        | -0.80   | 0.4223  |
| Size                | Log bank total assets     | 1  | 0.01777            | 0.04287        | 0.41    | 0.6788  |
| LOAN                | Bank loan to total assets | 1  | 0.00390            | 0.00330        | 1.18    | 0.2387  |
| YEAR05              |                           | 1  | -0.01405           | 0.14137        | -0.10   | 0.9209  |
| YEAR06              |                           | 1  | -0.01931           | 0.13814        | -0.14   | 0.8890  |
| YEAR07              |                           | 1  | 0.15565            | 0.13836        | 1.12    | 0.2617  |
| YEAR08              |                           | 1  | 0.92069            | 0.14311        | 6.43    | <.0001  |

# Parameter Estimates

| Variable  | Label                     | DF | Variance<br>Inflation |
|-----------|---------------------------|----|-----------------------|
| Intercept | Intercept                 | 1  | 0                     |
| BC        | Bank capital              | 1  | 1.44216               |
| CV        | Bank charter value        | 1  | 1.35379               |
| Size      | Log bank total assets     | 1  | 1.58542               |
| LOAN      | Bank loan to total assets | 1  | 1.43826               |
| YEAR05    |                           | 1  | 1.66729               |
| YEAR06    |                           | 1  | 1.74241               |
| YEAR07    |                           | 1  | 1.74793               |
| YEAR08    |                           | 1  | 1.87007               |

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## The REG Procedure

Model: MODEL1

Dependent Variable: BC Bank capital

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

## Analysis of Variance

| Source          | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
|-----------------|-----|-------------------|----------------|---------|--------|
| Model           | 9   | 768.51091         | 85.39010       | 83.82   | <.0001 |
| Error           | 241 | 245.50485         | 1.01869        |         |        |
| Corrected Total | 250 | 1014.01576        |                |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 1.00930  | R-Square | 0.7579 |
| Dependent Mean | 12.11076 | Adj R-Sq | 0.7488 |
| Coeff Var      | 8.33394  |          |        |

## Parameter Estimates

| Variable  | Label                     | DF | Parameter<br>Estimate | Standard<br>Error | t Value | Pr >  t |
|-----------|---------------------------|----|-----------------------|-------------------|---------|---------|
| Intercept | Intercept                 | 1  | 1.84649               | 2.03414           | 0.91    | 0.3649  |
| BC_1      | Lagged BC                 | 1  | 0.66026               | 0.08224           | 8.03    | <.0001  |
| BC_2      |                           | 1  | 0.24936               | 0.08068           | 3.09    | 0.0022  |
| CV        | Bank charter value        | 1  | 0.90093               | 1.51853           | 0.59    | 0.5535  |
| Size      | Log bank total assets     | 1  | -0.08552              | 0.06434           | -1.33   | 0.1851  |
| LOAN      | Bank loan to total assets | 1  | -0.00616              | 0.00498           | -1.24   | 0.2176  |
| YEAR05    |                           | 1  | -0.24531              | 0.21286           | -1.15   | 0.2503  |
| YEAR06    |                           | 1  | -0.65155              | 0.20638           | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.19518              | 0.20838           | -0.94   | 0.3499  |
| YEAR08    |                           | 1  | -0.76612              | 0.21612           | -3.54   | 0.0005  |



The REG Procedure  
Model: MODEL1  
Dependent Variable: LLP Rate of loan loss provision to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
|-----------------|-----|-------------------|----------------|---------|--------|
| Model           | 9   | 37.13893          | 4.12655        | 8.98    | <.0001 |
| Error           | 241 | 110.72113         | 0.45942        |         |        |
| Corrected Total | 250 | 147.86006         |                |         |        |

|                |           |          |        |
|----------------|-----------|----------|--------|
| Root MSE       | 0.67781   | R-Square | 0.2512 |
| Dependent Mean | 0.56003   | Adj R-Sq | 0.2232 |
| Coeff Var      | 121.03040 |          |        |

Parameter Estimates

| Variable  | Label                     | DF | Parameter<br>Estimate | Standard<br>Error | t Value | Pr >  t |
|-----------|---------------------------|----|-----------------------|-------------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.52058               | 1.37817           | 0.38    | 0.7060  |
| BC        | Bank capital              | 1  | 0.02069               | 0.03169           | 0.65    | 0.5144  |
| CV        | Bank charter value        | 1  | -0.90114              | 1.02872           | -0.88   | 0.3819  |
| Size      | Log bank total assets     | 1  | 0.02242               | 0.04423           | 0.51    | 0.6126  |
| LOAN      | Bank loan to total assets | 1  | 0.00430               | 0.00343           | 1.25    | 0.2112  |
| YEAR05    |                           | 1  | -0.01516              | 0.14163           | -0.11   | 0.9148  |
| YEAR06    |                           | 1  | -0.01674              | 0.13849           | -0.12   | 0.9039  |
| YEAR07    |                           | 1  | 0.15600               | 0.13859           | 1.13    | 0.2614  |
| YEAR08    |                           | 1  | 0.92151               | 0.14336           | 6.43    | <.0001  |
| resid     | Residual                  | 1  | -0.02359              | 0.05362           | -0.44   | 0.6604  |

## 4.2. To test if variable CV is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: CV Bank charter value

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
|-----------------|-----|-------------------|----------------|---------|--------|
| Model           | 9   | 0.49965           | 0.05552        | 117.14  | <.0001 |
| Error           | 241 | 0.11422           | 0.00047393     |         |        |
| Corrected Total | 250 | 0.61387           |                |         |        |

|                |         |          |        |
|----------------|---------|----------|--------|
| Root MSE       | 0.02177 | R-Square | 0.8139 |
| Dependent Mean | 1.05841 | Adj R-Sq | 0.8070 |
| Coeff Var      | 2.05685 |          |        |

# Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.14462            | 0.04453        | 3.25    | 0.0013  |
| BC        | Bank capital              | 1  | 0.00106            | 0.00082059     | 1.29    | 0.1968  |
| CV_1      |                           | 1  | 0.80536            | 0.07719        | 10.43   | <.0001  |
| CV_2      |                           | 1  | 0.06190            | 0.07662        | 0.81    | 0.4199  |
| Size      | Log bank total assets     | 1  | 0.00001710         | 0.00139        | 0.01    | 0.9902  |
| LOAN      | Bank loan to total assets | 1  | -0.00013380        | 0.00010619     | -1.26   | 0.2089  |
| YEAR05    |                           | 1  | -0.00962           | 0.00461        | -2.09   | 0.0380  |
| YEAR06    |                           | 1  | -0.01407           | 0.00446        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.00397           | 0.00447        | -0.89   | 0.3753  |
| YEAR08    |                           | 1  | -0.04367           | 0.00456        | -9.58   | <.0001  |

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## The REG Procedure

Model: MODEL1

Dependent Variable: LLP Rate of loan loss provision to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

## Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 46.84969       | 5.20552     | 12.42   | <.0001 |
| Error           | 241 | 101.01037      | 0.41913     |         |        |
| Corrected Total | 250 | 147.86006      |             |         |        |
| Root MSE        |     | 0.64740        | R-Square    | 0.3169  |        |
| Dependent Mean  |     | 0.56003        | Adj R-Sq    | 0.2913  |        |
| Coeff Var       |     | 115.60116      |             |         |        |

## Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -2.32777           | 1.43824        | -1.62   | 0.1069  |
| BC        | Bank capital              | 1  | -0.00727           | 0.02475        | -0.29   | 0.7691  |
| CV        | Bank charter value        | 1  | 1.88977            | 1.11155        | 1.70    | 0.0904  |
| Size      | Log bank total assets     | 1  | 0.04071            | 0.04129        | 0.99    | 0.3251  |
| LOAN      | Bank loan to total assets | 1  | 0.00409            | 0.00316        | 1.30    | 0.1965  |
| YEAR05    |                           | 1  | -0.01243           | 0.13526        | -0.09   | 0.9268  |
| YEAR06    |                           | 1  | -0.00547           | 0.13220        | -0.04   | 0.9671  |
| YEAR07    |                           | 1  | 0.15368            | 0.13237        | 1.16    | 0.2468  |
| YEAR08    |                           | 1  | 0.99921            | 0.13788        | 7.25    | <.0001  |
| resid     | Residual                  | 1  | -10.70918          | 2.21475        | -4.84   | <.0001  |

### 4.3. To test if variable Size is endogenous

| The REG Procedure                              |                           |                |                    |                |         |         |
|--|---------------------------|----------------|--------------------|----------------|---------|---------|
| Model: MODEL1                                  |                           |                |                    |                |         |         |
| Dependent Variable: Size Log bank total assets |                           |                |                    |                |         |         |
| Number of Observations Read                    |                           |                | 265                |                |         |         |
| Number of Observations Used                    |                           |                | 251                |                |         |         |
| Number of Observations with Missing Values     |                           |                | 14                 |                |         |         |
| Analysis of Variance                           |                           |                |                    |                |         |         |
| Source   | DF                        | Sum of Squares | Mean Square        | F Value        | Pr > F  |         |
| Model  | 9                         | 389.69314      | 43.29924           | 1983.45        | <.0001  |         |
| Error  | 241                       | 5.26110        | 0.02183            |                |         |         |
| Corrected Total                                | 250                       | 394.95424      |                    |                |         |         |
| Root MSE                                       |                           | 0.14775        | R-Square           | 0.9867         |         |         |
| Dependent Mean                                 |                           | 12.35984       | Adj R-Sq           | 0.9862         |         |         |
| Coeff Var                                      |                           | 1.19541        |                    |                |         |         |
| Parameter Estimates                            |                           |                |                    |                |         |         |
| Variable                                       | Label                     | DF             | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept                                      | Intercept                 | 1              | -0.12680           | 0.30027        | -0.42   | 0.6732  |
| BC   | Bank capital              | 1              | -0.00478           | 0.00556        | -0.86   | 0.3909  |
| CV   | Bank charter value        | 1              | -0.11538           | 0.21930        | -0.53   | 0.5993  |
| Size_1   |                           | 1              | 0.87512            | 0.07352        | 11.90   | <.0001  |
| Size_2   |                           | 1              | 0.12954            | 0.07391        | 1.75    | 0.0809  |
| LOAN   | Bank loan to total assets | 1              | -0.00112           | 0.00071720     | -1.55   | 0.1213  |
| YEAR05   |                           | 1              | 0.44840            | 0.03870        | 11.59   | <.0001  |
| YEAR06   |                           | 1              | 0.44502            | 0.03302        | 13.48   | <.0001  |
| YEAR07   |                           | 1              | 0.49268            | 0.03115        | 15.82   | <.0001  |
| YEAR08   |                           | 1              | 0.54421            | 0.03350        | 16.24   | <.0001  |

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| The REG Procedure   |     |                |             |         |        |
|---|-----|----------------|-------------|---------|--------|
| Model: MODEL1   |     |                |             |         |        |
| Dependent Variable: LLP Rate of loan loss provision to total loan |     |                |             |         |        |
| Number of Observations Read                                       |     |                |             | 265     |        |
| Number of Observations Used                                       |     |                |             | 251     |        |
| Number of Observations with Missing Values                        |     |                |             | 14      |        |
| Analysis of Variance  |     |                |             |         |        |
| Source  | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model   | 9   | 41.84642       | 4.64960     | 10.57   | <.0001 |
| Error   | 241 | 106.01364      | 0.43989     |         |        |
| Corrected Total   | 250 | 147.86006      |             |         |        |

|                |           |          |        |
|----------------|-----------|----------|--------|
| Root MSE       | 0.66324   | R-Square | 0.2830 |
| Dependent Mean | 0.56003   | Adj R-Sq | 0.2562 |
| Coeff Var      | 118.42955 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.15900            | 1.34300        | 0.12    | 0.9059  |
| BC        | Bank capital              | 1  | 0.01653            | 0.02504        | 0.66    | 0.5098  |
| CV        | Bank charter value        | 1  | -0.71253           | 0.98536        | -0.72   | 0.4703  |
| Size      | Log bank total assets     | 1  | 0.03815            | 0.04247        | 0.90    | 0.3699  |
| LOAN      | Bank loan to total assets | 1  | 0.00469            | 0.00324        | 1.45    | 0.1494  |
| YEAR05    |                           | 1  | -0.01783           | 0.13857        | -0.13   | 0.8977  |
| YEAR06    |                           | 1  | -0.02126           | 0.13540        | -0.16   | 0.8753  |
| YEAR07    |                           | 1  | 0.14828            | 0.13563        | 1.09    | 0.2754  |
| YEAR08    |                           | 1  | 0.91483            | 0.14028        | 6.52    | <.0001  |
| resid     | Residual                  | 1  | -0.96506           | 0.29226        | -3.30   | 0.0011  |

#### 4.4. To test if variable LOAN is endogenous

#### The REG Procedure

Model: MODEL1

Dependent Variable: LOAN Bank loan to total assets

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 56249          | 6249.91462  | 355.92  | <.0001 |
| Error           | 241 | 4231.91603     | 17.55982    |         |        |
| Corrected Total | 250 | 60481          |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 4.19044  | R-Square | 0.9300 |
| Dependent Mean | 56.87372 | Adj R-Sq | 0.9274 |
| Coeff Var      | 7.36798  |          |        |

#### Parameter Estimates

| Variable  | Label                 | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|-----------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept             | 1  | 9.03037            | 8.47530        | 1.07    | 0.2877  |
| BC        | Bank capital          | 1  | -0.25965           | 0.15717        | -1.65   | 0.0998  |
| CV        | Bank charter value    | 1  | 4.32865            | 6.24217        | 0.69    | 0.4887  |
| Size      | Log bank total assets | 1  | -0.64419           | 0.26227        | -2.46   | 0.0147  |
| LOAN_1    |                       | 1  | 0.93467            | 0.07028        | 13.30   | <.0001  |
| LOAN_2    |                       | 1  | 0.01642            | 0.07071        | 0.23    | 0.8165  |
| YEAR05    |                       | 1  | 0.76457            | 0.87516        | 0.87    | 0.3832  |
| YEAR06    |                       | 1  | -1.60715           | 0.85532        | -1.88   | 0.0615  |
| YEAR07    |                       | 1  | 1.11286            | 0.86549        | 1.29    | 0.1997  |
| YEAR08    |                       | 1  | 0.26911            | 0.88980        | 0.30    | 0.7626  |

The REG Procedure  
Model: MODEL1  
Dependent Variable: LLP Rate of loan loss provision to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
|-----------------|-----|-------------------|----------------|---------|--------|
| Model           | 9   | 37.11431          | 4.12381        | 8.97    | <.0001 |
| Error           | 241 | 110.74574         | 0.45953        |         |        |
| Corrected Total | 250 | 147.86006         |                |         |        |

|                |           |          |        |
|----------------|-----------|----------|--------|
| Root MSE       | 0.67788   | R-Square | 0.2510 |
| Dependent Mean | 0.56003   | Adj R-Sq | 0.2230 |
| Coeff Var      | 121.04385 |          |        |

Parameter Estimates

| Variable  | Label                     | DF | Parameter<br>Estimate | Standard<br>Error | t Value | Pr >  t |
|-----------|---------------------------|----|-----------------------|-------------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.52781               | 1.38018           | 0.38    | 0.7025  |
| BC        | Bank capital              | 1  | 0.01365               | 0.02576           | 0.53    | 0.5967  |
| CV        | Bank charter value        | 1  | -0.80503              | 1.00671           | -0.80   | 0.4247  |
| Size      | Log bank total assets     | 1  | 0.02049               | 0.04356           | 0.47    | 0.6385  |
| LOAN      | Bank loan to total assets | 1  | 0.00431               | 0.00349           | 1.24    | 0.2173  |
| YEAR05    |                           | 1  | -0.01456              | 0.14163           | -0.10   | 0.9182  |
| YEAR06    |                           | 1  | -0.01865              | 0.13840           | -0.13   | 0.8929  |
| YEAR07    |                           | 1  | 0.15525               | 0.13861           | 1.12    | 0.2638  |
| YEAR08    |                           | 1  | 0.92058               | 0.14337           | 6.42    | <.0001  |
| resid     | Residual                  | 1  | -0.00411              | 0.01099           | -0.37   | 0.7087  |

## 5. Results of Hausman test for running regression NPL on control variables

### 5.1. To test if variable BC is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: NPL Rate of non-performing loan to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

Analysis of Variance

| Source          | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
|-----------------|-----|-------------------|----------------|---------|--------|
| Model           | 8   | 100.62385         | 12.57798       | 12.81   | <.0001 |
| Error           | 242 | 237.68877         | 0.98218        |         |        |
| Corrected Total | 250 | 338.31262         |                |         |        |

|          |         |          |        |
|----------|---------|----------|--------|
| Root MSE | 0.99105 | R-Square | 0.2974 |
|----------|---------|----------|--------|

|                |          |          |        |
|----------------|----------|----------|--------|
| Dependent Mean | 1.29266  | Adj R-Sq | 0.2742 |
| Coeff Var      | 76.66791 |          |        |

| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | 13.74777           | 1.99674        | 6.89    | <.0001  |
| BC                  | Bank capital              | 1  | -0.08307           | 0.03737        | -2.22   | 0.0272  |
| CV                  | Bank charter value        | 1  | -10.31075          | 1.47175        | -7.01   | <.0001  |
| Size                | Log bank total assets     | 1  | -0.02764           | 0.06279        | -0.44   | 0.6602  |
| LOAN                | Bank loan to total assets | 1  | -0.00421           | 0.00483        | -0.87   | 0.3844  |
| YEAR05              |                           | 1  | 0.00217            | 0.20705        | 0.01    | 0.9916  |
| YEAR06              |                           | 1  | -0.16757           | 0.20232        | -0.83   | 0.4084  |
| YEAR07              |                           | 1  | 0.08834            | 0.20264        | 0.44    | 0.6633  |
| YEAR08              |                           | 1  | 0.29072            | 0.20960        | 1.39    | 0.1667  |

| Parameter Estimates |                           |    |  | Variance Inflation |
|---------------------|---------------------------|----|--|--------------------|
| Variable            | Label                     | DF |  |                    |
| Intercept           | Intercept                 | 1  |  | 0                  |
| BC                  | Bank capital              | 1  |  | 1.44216            |
| CV                  | Bank charter value        | 1  |  | 1.35379            |
| Size                | Log bank total assets     | 1  |  | 1.58542            |
| LOAN                | Bank loan to total assets | 1  |  | 1.43826            |
| YEAR05              |                           | 1  |  | 1.66729            |
| YEAR06              |                           | 1  |  | 1.74241            |
| YEAR07              |                           | 1  |  | 1.74793            |
| YEAR08              |                           | 1  |  | 1.87007            |

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The REG Procedure  
Model: MODEL1  
Dependent Variable: BC Bank capital

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

| Analysis of Variance |     |                |             |         |        |
|----------------------|-----|----------------|-------------|---------|--------|
| Source               | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
| Model                | 9   | 768.51091      | 85.39010    | 83.82   | <.0001 |
| Error                | 241 | 245.50485      | 1.01869     |         |        |
| Corrected Total      | 250 | 1014.01576     |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 1.00930  | R-Square | 0.7579 |
| Dependent Mean | 12.11076 | Adj R-Sq | 0.7488 |
| Coeff Var      | 8.33394  |          |        |

# Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 1.84649            | 2.03414        | 0.91    | 0.3649  |
| BC_1      | Lagged BC                 | 1  | 0.66026            | 0.08224        | 8.03    | <.0001  |
| BC_2      |                           | 1  | 0.24936            | 0.08068        | 3.09    | 0.0022  |
| CV        | Bank charter value        | 1  | 0.90093            | 1.51853        | 0.59    | 0.5535  |
| Size      | Log bank total assets     | 1  | -0.08552           | 0.06434        | -1.33   | 0.1851  |
| LOAN      | Bank loan to total assets | 1  | -0.00616           | 0.00498        | -1.24   | 0.2176  |
| YEAR05    |                           | 1  | -0.24531           | 0.21286        | -1.15   | 0.2503  |
| YEAR06    |                           | 1  | -0.65155           | 0.20638        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.19518           | 0.20838        | -0.94   | 0.3499  |
| YEAR08    |                           | 1  | -0.76612           | 0.21612        | -3.54   | 0.0005  |

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## The REG Procedure

Model: MODEL1

Dependent Variable: NPL Rate of non performing loan to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

## Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 104.52086      | 11.61343    | 11.97   | <.0001 |
| Error           | 241 | 233.79175      | 0.97009     |         |        |
| Corrected Total | 250 | 338.31262      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.98493  | R-Square | 0.3089 |
| Dependent Mean | 1.29266  | Adj R-Sq | 0.2831 |
| Coeff Var      | 76.19440 |          |        |

## Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 14.28827           | 2.00264        | 7.13    | <.0001  |
| BC        | Bank capital              | 1  | -0.13760           | 0.04604        | -2.99   | 0.0031  |
| CV        | Bank charter value        | 1  | -9.69238           | 1.49485        | -6.48   | <.0001  |
| Size      | Log bank total assets     | 1  | -0.05842           | 0.06426        | -0.91   | 0.3642  |
| LOAN      | Bank loan to total assets | 1  | -0.00685           | 0.00498        | -1.38   | 0.1701  |
| YEAR05    |                           | 1  | 0.00952            | 0.20580        | 0.05    | 0.9631  |
| YEAR06    |                           | 1  | -0.18455           | 0.20125        | -0.92   | 0.3600  |
| YEAR07    |                           | 1  | 0.08600            | 0.20139        | 0.43    | 0.6697  |
| YEAR08    |                           | 1  | 0.28529            | 0.20832        | 1.37    | 0.1721  |
| resid     | Residual                  | 1  | 0.15617            | 0.07792        | 2.00    | 0.0462  |

## 5.2. To test if variable CV is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: CV Bank charter value

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 0.49965        | 0.05552     | 117.14  | <.0001 |
| Error           | 241 | 0.11422        | 0.00047393  |         |        |
| Corrected Total | 250 | 0.61387        |             |         |        |

|                |         |          |        |
|----------------|---------|----------|--------|
| Root MSE       | 0.02177 | R-Square | 0.8139 |
| Dependent Mean | 1.05841 | Adj R-Sq | 0.8070 |
| Coeff Var      | 2.05685 |          |        |

### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.14462            | 0.04453        | 3.25    | 0.0013  |
| BC        | Bank capital              | 1  | 0.00106            | 0.00082059     | 1.29    | 0.1968  |
| CV_1      |                           | 1  | 0.80536            | 0.07719        | 10.43   | <.0001  |
| CV_2      |                           | 1  | 0.06190            | 0.07662        | 0.81    | 0.4199  |
| Size      | Log bank total assets     | 1  | 0.00001710         | 0.00139        | 0.01    | 0.9902  |
| LOAN      | Bank loan to total assets | 1  | -0.00013380        | 0.00010619     | -1.26   | 0.2089  |
| YEAR05    |                           | 1  | -0.00962           | 0.00461        | -2.09   | 0.0380  |
| YEAR06    |                           | 1  | -0.01407           | 0.00446        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.00397           | 0.00447        | -0.89   | 0.3753  |
| YEAR08    |                           | 1  | -0.04367           | 0.00456        | -9.58   | <.0001  |

The REG Procedure  
Model: MODEL1  
Dependent Variable: NPL Rate of non performing loan to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 100.82434      | 11.20270    | 11.37   | <.0001 |
| Error           | 241 | 237.48827      | 0.98543     |         |        |
| Corrected Total | 250 | 338.31262      |             |         |        |



|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.99269  | R-Square | 0.2980 |
| Dependent Mean | 1.29266  | Adj R-Sq | 0.2718 |
| Coeff Var      | 76.79440 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 13.32868           | 2.20531        | 6.04    | <.0001  |
| BC        | Bank capital              | 1  | -0.08589           | 0.03796        | -2.26   | 0.0245  |
| CV        | Bank charter value        | 1  | -9.92491           | 1.70438        | -5.82   | <.0001  |
| Size      | Log bank total assets     | 1  | -0.02436           | 0.06331        | -0.38   | 0.7008  |
| LOAN      | Bank loan to total assets | 1  | -0.00418           | 0.00484        | -0.86   | 0.3884  |
| YEAR05    |                           | 1  | 0.00240            | 0.20739        | 0.01    | 0.9908  |
| YEAR06    |                           | 1  | -0.16559           | 0.20270        | -0.82   | 0.4148  |
| YEAR07    |                           | 1  | 0.08806            | 0.20298        | 0.43    | 0.6648  |
| YEAR08    |                           | 1  | 0.30195            | 0.21142        | 1.43    | 0.1545  |
| resid     | Residual                  | 1  | -1.53180           | 3.39597        | -0.45   | 0.6523  |

### 5.3. To test if variable Size is endogenous

#### The REG Procedure

Model: MODEL1

Dependent Variable: Size Log bank total assets

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 389.69314      | 43.29924    | 1983.45 | <.0001 |
| Error           | 241 | 5.26110        | 0.02183     |         |        |
| Corrected Total | 250 | 394.95424      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.14775  | R-Square | 0.9867 |
| Dependent Mean | 12.35984 | Adj R-Sq | 0.9862 |
| Coeff Var      | 1.19541  |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -0.12680           | 0.30027        | -0.42   | 0.6732  |
| BC        | Bank capital              | 1  | -0.00478           | 0.00556        | -0.86   | 0.3909  |
| CV        | Bank charter value        | 1  | -0.11538           | 0.21930        | -0.53   | 0.5993  |
| Size_1    |                           | 1  | 0.87512            | 0.07352        | 11.90   | <.0001  |
| Size_2    |                           | 1  | 0.12954            | 0.07391        | 1.75    | 0.0809  |
| LOAN      | Bank loan to total assets | 1  | -0.00112           | 0.00071720     | -1.55   | 0.1213  |
| YEAR05    |                           | 1  | 0.44840            | 0.03870        | 11.59   | <.0001  |
| YEAR06    |                           | 1  | 0.44502            | 0.03302        | 13.48   | <.0001  |
| YEAR07    |                           | 1  | 0.49268            | 0.03115        | 15.82   | <.0001  |
| YEAR08    |                           | 1  | 0.54421            | 0.03350        | 16.24   | <.0001  |

## The REG Procedure

Model: MODEL1

Dependent Variable: NPL Rate of non performing loan to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

## Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 102.49691      | 11.38855    | 11.64   | <.0001 |
| Error           | 241 | 235.81571      | 0.97849     |         |        |
| Corrected Total | 250 | 338.31262      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.98919  | R-Square | 0.3030 |
| Dependent Mean | 1.29266  | Adj R-Sq | 0.2769 |
| Coeff Var      | 76.52350 |          |        |

## Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 13.47080           | 2.00300        | 6.73    | <.0001  |
| BC        | Bank capital              | 1  | -0.08053           | 0.03735        | -2.16   | 0.0321  |
| CV        | Bank charter value        | 1  | -10.25124          | 1.46961        | -6.98   | <.0001  |
| Size      | Log bank total assets     | 1  | -0.01490           | 0.06334        | -0.24   | 0.8142  |
| LOAN      | Bank loan to total assets | 1  | -0.00372           | 0.00484        | -0.77   | 0.4431  |
| YEAR05    |                           | 1  | -0.00018351        | 0.20667        | -0.00   | 0.9993  |
| YEAR06    |                           | 1  | -0.16879           | 0.20194        | -0.84   | 0.4041  |
| YEAR07    |                           | 1  | 0.08374            | 0.20229        | 0.41    | 0.6793  |
| YEAR08    |                           | 1  | 0.28706            | 0.20922        | 1.37    | 0.1713  |
| resid     | Residual                  | 1  | -0.60308           | 0.43589        | -1.38   | 0.1678  |

**5.4. To test if variable LOAN is endogenous**

## The REG Procedure

Model: MODEL1

Dependent Variable: LOAN Bank loan to total assets

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

## Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 56249          | 6249.91462  | 355.92  | <.0001 |
| Error           | 241 | 4231.91603     | 17.55982    |         |        |
| Corrected Total | 250 | 60481          |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 4.19044  | R-Square | 0.9300 |
| Dependent Mean | 56.87372 | Adj R-Sq | 0.9274 |
| Coeff Var      | 7.36798  |          |        |

#### Parameter Estimates

| Variable  | Label                 | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|-----------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept             | 1  | 9.03037            | 8.47530        | 1.07    | 0.2877  |
| BC        | Bank capital          | 1  | -0.25965           | 0.15717        | -1.65   | 0.0998  |
| CV        | Bank charter value    | 1  | 4.32865            | 6.24217        | 0.69    | 0.4887  |
| Size      | Log bank total assets | 1  | -0.64419           | 0.26227        | -2.46   | 0.0147  |
| LOAN_1    |                       | 1  | 0.93467            | 0.07028        | 13.30   | <.0001  |
| LOAN_2    |                       | 1  | 0.01642            | 0.07071        | 0.23    | 0.8165  |
| YEAR05    |                       | 1  | 0.76457            | 0.87516        | 0.87    | 0.3832  |
| YEAR06    |                       | 1  | -1.60715           | 0.85532        | -1.88   | 0.0615  |
| YEAR07    |                       | 1  | 1.11286            | 0.86549        | 1.29    | 0.1997  |
| YEAR08    |                       | 1  | 0.26911            | 0.88980        | 0.30    | 0.7626  |

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#### The REG Procedure

Model: MODEL1

Dependent Variable: NPL Rate of non-performing loan to total loan

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 101.00229      | 11.22248    | 11.40   | <.0001 |
| Error           | 241 | 237.31033      | 0.98469     |         |        |
| Corrected Total | 250 | 338.31262      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.99232  | R-Square | 0.2985 |
| Dependent Mean | 1.29266  | Adj R-Sq | 0.2724 |
| Coeff Var      | 76.76562 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 13.92829           | 2.02037        | 6.89    | <.0001  |
| BC        | Bank capital              | 1  | -0.08598           | 0.03772        | -2.28   | 0.0235  |
| CV        | Bank charter value        | 1  | -10.31735          | 1.47367        | -7.00   | <.0001  |
| Size      | Log bank total assets     | 1  | -0.03422           | 0.06376        | -0.54   | 0.5919  |
| LOAN      | Bank loan to total assets | 1  | -0.00521           | 0.00510        | -1.02   | 0.3078  |
| YEAR05    |                           | 1  | 0.00340            | 0.20732        | 0.02    | 0.9869  |
| YEAR06    |                           | 1  | -0.16916           | 0.20259        | -0.83   | 0.4046  |
| YEAR07    |                           | 1  | 0.08931            | 0.20290        | 0.44    | 0.6602  |
| YEAR08    |                           | 1  | 0.29099            | 0.20987        | 1.39    | 0.1669  |
| resid     | Residual                  | 1  | 0.00997            | 0.01608        | 0.62    | 0.5359  |

## 6. Results of Hausman test for running regression total risk Z-score on control variables

### 6.1. To test if variable BC is endogenous

| The REG Procedure                               |                           |                |                    |                |         |         |
|---|---------------------------|----------------|--------------------|----------------|---------|---------|
| Model: MODEL1                                   |                           |                |                    |                |         |         |
| Dependent Variable: Z_score Distance to default |                           |                |                    |                |         |         |
| Number of Observations Read                     |                           |                |                    | 265            |         |         |
| Number of Observations Used                     |                           |                |                    | 251            |         |         |
| Number of Observations with Missing Values      |                           |                |                    | 14             |         |         |
| Analysis of Variance                            |                           |                |                    |                |         |         |
| Source  | DF                        | Sum of Squares | Mean Square        | F Value        | Pr > F  |         |
| Model   | 8                         | 47476          | 5934.48106         | 6.36           | <.0001  |         |
| Error   | 242                       | 225751         | 932.85743          |                |         |         |
| Corrected Total                                 | 250                       | 273227         |                    |                |         |         |
| Root MSE  |                           | 30.54271       | R-Square           | 0.1738         |         |         |
| Dependent Mean                                  |                           | 44.21211       | Adj R-Sq           | 0.1464         |         |         |
| Coeff Var                                       |                           | 69.08224       |                    |                |         |         |
| Parameter Estimates                             |                           |                |                    |                |         |         |
| Variable  | Label                     | DF             | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept                                       | Intercept                 | 1              | -259.78287         | 61.53632       | -4.22   | <.0001  |
| BC  | Bank capital              | 1              | -2.56474           | 1.15184        | -2.23   | 0.0269  |
| CV  | Bank charter value        | 1              | 298.73809          | 45.35715       | 6.59    | <.0001  |
| Size  | Log bank total assets     | 1              | 1.95810            | 1.93511        | 1.01    | 0.3126  |
| LOAN  | Bank loan to total assets | 1              | -0.06532           | 0.14894        | -0.44   | 0.6614  |
| YEAR05  |                           | 1              | -1.10166           | 6.38095        | -0.17   | 0.8631  |
| YEAR06  |                           | 1              | 1.01132            | 6.23518        | 0.16    | 0.8713  |
| YEAR07  |                           | 1              | -2.77779           | 6.24505        | -0.44   | 0.6569  |
| YEAR08  |                           | 1              | -4.91911           | 6.45956        | -0.76   | 0.4471  |
| Parameter Estimates                             |                           |                |                    |                |         |         |
| Variable  | Label                     | DF             | Variance Inflation |                |         |         |
| Intercept                                       | Intercept                 | 1              | 0                  |                |         |         |
| BC  | Bank capital              | 1              | 1.44216            |                |         |         |
| CV  | Bank charter value        | 1              | 1.35379            |                |         |         |
| Size  | Log bank total assets     | 1              | 1.58542            |                |         |         |
| LOAN  | Bank loan to total assets | 1              | 1.43826            |                |         |         |
| YEAR05  |                           | 1              | 1.66729            |                |         |         |
| YEAR06  |                           | 1              | 1.74241            |                |         |         |
| YEAR07  |                           | 1              | 1.74793            |                |         |         |
| YEAR08  |                           | 1              | 1.87007            |                |         |         |

The REG Procedure  
Model: MODEL1  
Dependent Variable: BC Bank capital

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

| Analysis of Variance |     |                   |                |         |        |
|----------------------|-----|-------------------|----------------|---------|--------|
| Source               | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
| Model                | 9   | 768.51091         | 85.39010       | 83.82   | <.0001 |
| Error                | 241 | 245.50485         | 1.01869        |         |        |
| Corrected Total      | 250 | 1014.01576        |                |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 1.00930  | R-Square | 0.7579 |
| Dependent Mean | 12.11076 | Adj R-Sq | 0.7488 |
| Coeff Var      | 8.33394  |          |        |

| Parameter Estimates |                           |    |                       |                   |         |         |
|---------------------|---------------------------|----|-----------------------|-------------------|---------|---------|
| Variable            | Label                     | DF | Parameter<br>Estimate | Standard<br>Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | 1.84649               | 2.03414           | 0.91    | 0.3649  |
| BC_1                | Lagged BC                 | 1  | 0.66026               | 0.08224           | 8.03    | <.0001  |
| BC_2                |                           | 1  | 0.24936               | 0.08068           | 3.09    | 0.0022  |
| CV                  | Bank charter value        | 1  | 0.90093               | 1.51853           | 0.59    | 0.5535  |
| Size                | Log bank total assets     | 1  | -0.08552              | 0.06434           | -1.33   | 0.1851  |
| LOAN                | Bank loan to total assets | 1  | -0.00616              | 0.00498           | -1.24   | 0.2176  |
| YEAR05              |                           | 1  | -0.24531              | 0.21286           | -1.15   | 0.2503  |
| YEAR06              |                           | 1  | -0.65155              | 0.20638           | -3.16   | 0.0018  |
| YEAR07              |                           | 1  | -0.19518              | 0.20838           | -0.94   | 0.3499  |
| YEAR08              |                           | 1  | -0.76612              | 0.21612           | -3.54   | 0.0005  |

The REG Procedure  
Model: MODEL1  
Dependent Variable: Z\_score Distance to default

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

| Analysis of Variance |     |                   |                |         |        |
|----------------------|-----|-------------------|----------------|---------|--------|
| Source               | DF  | Sum of<br>Squares | Mean<br>Square | F Value | Pr > F |
| Model                | 9   | 48286             | 5365.09891     | 5.75    | <.0001 |
| Error                | 241 | 224941            | 933.36704      |         |        |
| Corrected Total      | 250 | 273227            |                |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 30.55106 | R-Square | 0.1767 |
| Dependent Mean | 44.21211 | Adj R-Sq | 0.1460 |
| Coeff Var      | 69.10110 |          |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -251.99028         | 62.11889       | -4.06   | <.0001  |
| BC        | Bank capital              | 1  | -3.35091           | 1.42815        | -2.35   | 0.0198  |
| CV        | Bank charter value        | 1  | 307.65333          | 46.36785       | 6.64    | <.0001  |
| Size      | Log bank total assets     | 1  | 1.51431            | 1.99340        | 0.76    | 0.4482  |
| LOAN      | Bank loan to total assets | 1  | -0.10342           | 0.15449        | -0.67   | 0.5039  |
| YEAR05    |                           | 1  | -0.99567           | 6.38371        | -0.16   | 0.8762  |
| YEAR06    |                           | 1  | 0.76642            | 6.24242        | 0.12    | 0.9024  |
| YEAR07    |                           | 1  | -2.81154           | 6.24687        | -0.45   | 0.6531  |
| YEAR08    |                           | 1  | -4.99737           | 6.46187        | -0.77   | 0.4401  |
| resid     | Residual                  | 1  | 2.25158            | 2.41691        | 0.93    | 0.3525  |

## 6.2. To test if variable CV is endogenous

#### The REG Procedure

Model: MODEL1

Dependent Variable: CV Bank charter value

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 0.49965        | 0.05552     | 117.14  | <.0001 |
| Error           | 241 | 0.11422        | 0.00047393  |         |        |
| Corrected Total | 250 | 0.61387        |             |         |        |
| Root MSE        |     |                |             |         |        |
|                 |     | 0.02177        | R-Square    | 0.8139  |        |
| Dependent Mean  |     |                |             |         |        |
|                 |     | 1.05841        | Adj R-Sq    | 0.8070  |        |
| Coeff Var       |     |                |             |         |        |
|                 |     | 2.05685        |             |         |        |

#### Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | 0.14462            | 0.04453        | 3.25    | 0.0013  |
| BC        | Bank capital              | 1  | 0.00106            | 0.00082059     | 1.29    | 0.1968  |
| CV_1      |                           | 1  | 0.80536            | 0.07719        | 10.43   | <.0001  |
| CV_2      |                           | 1  | 0.06190            | 0.07662        | 0.81    | 0.4199  |
| Size      | Log bank total assets     | 1  | 0.00001710         | 0.00139        | 0.01    | 0.9902  |
| LOAN      | Bank loan to total assets | 1  | -0.00013380        | 0.00010619     | -1.26   | 0.2089  |
| YEAR05    |                           | 1  | -0.00962           | 0.00461        | -2.09   | 0.0380  |
| YEAR06    |                           | 1  | -0.01407           | 0.00446        | -3.16   | 0.0018  |
| YEAR07    |                           | 1  | -0.00397           | 0.00447        | -0.89   | 0.3753  |
| YEAR08    |                           | 1  | -0.04367           | 0.00456        | -9.58   | <.0001  |

The REG Procedure  
Model: MODEL1  
Dependent Variable: Z\_score Distance to default

Number of Observations Read 265  
Number of Observations Used 251  
Number of Observations with Missing Values 14

Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 48784          | 5420.43502  | 5.82    | <.0001 |
| Error           | 241 | 224443         | 931.30054   |         |        |
| Corrected Total | 250 | 273227         |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 30.51722 | R-Square | 0.1785 |
| Dependent Mean | 44.21211 | Adj R-Sq | 0.1479 |
| Coeff Var      | 69.02456 |          |        |

Parameter Estimates

| Variable  | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|---------------------------|----|--------------------|----------------|---------|---------|
| Intercept | Intercept                 | 1  | -293.63406         | 67.79561       | -4.33   | <.0001  |
| BC        | Bank capital              | 1  | -2.79266           | 1.16684        | -2.39   | 0.0175  |
| CV        | Bank charter value        | 1  | 329.90357          | 52.39621       | 6.30    | <.0001  |
| Size      | Log bank total assets     | 1  | 2.22314            | 1.94639        | 1.14    | 0.2545  |
| LOAN      | Bank loan to total assets | 1  | -0.06311           | 0.14883        | -0.42   | 0.6719  |
| YEAR05    |                           | 1  | -1.08295           | 6.37565        | -0.17   | 0.8653  |
| YEAR06    |                           | 1  | 1.17125            | 6.23144        | 0.19    | 0.8511  |
| YEAR07    |                           | 1  | -2.80054           | 6.23987        | -0.45   | 0.6540  |
| YEAR08    |                           | 1  | -4.01200           | 6.49940        | -0.62   | 0.5376  |
| resid     | Residual                  | 1  | -123.72741         | 104.39889      | -1.19   | 0.2371  |

### 6.3. To test if variable Size is endogenous

The REG Procedure  
Model: MODEL1  
Dependent Variable: Size Log bank total assets

Number of Observations Read 265  
Number of Observations Used 251  
Number of Observations with Missing Values 14

Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 389.69314      | 43.29924    | 1983.45 | <.0001 |
| Error           | 241 | 5.26110        | 0.02183     |         |        |
| Corrected Total | 250 | 394.95424      |             |         |        |

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.14775  | R-Square | 0.9867 |
| Dependent Mean | 12.35984 | Adj R-Sq | 0.9862 |
| Coeff Var      | 1.19541  |          |        |

| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | -0.12680           | 0.30027        | -0.42   | 0.6732  |
| BC                  | Bank capital              | 1  | -0.00478           | 0.00556        | -0.86   | 0.3909  |
| CV                  | Bank charter value        | 1  | -0.11538           | 0.21930        | -0.53   | 0.5993  |
| Size_1              |                           | 1  | 0.87512            | 0.07352        | 11.90   | <.0001  |
| Size_2              |                           | 1  | 0.12954            | 0.07391        | 1.75    | 0.0809  |
| LOAN                | Bank loan to total assets | 1  | -0.00112           | 0.00071720     | -1.55   | 0.1213  |
| YEAR05              |                           | 1  | 0.44840            | 0.03870        | 11.59   | <.0001  |
| YEAR06              |                           | 1  | 0.44502            | 0.03302        | 13.48   | <.0001  |
| YEAR07              |                           | 1  | 0.49268            | 0.03115        | 15.82   | <.0001  |
| YEAR08              |                           | 1  | 0.54421            | 0.03350        | 16.24   | <.0001  |

#### The REG Procedure

Model: MODEL1

Dependent Variable: Z\_score Distance to default

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |

#### Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 9   | 47523          | 5280.33849  | 5.64    | <.0001 |
| Error           | 241 | 225704         | 936.53236   |         |        |
| Corrected Total | 250 | 273227         |             |         |        |
| Root MSE        |     | 30.60282       | R-Square    | 0.1739  |        |
| Dependent Mean  |     | 44.21211       | Adj R-Sq    | 0.1431  |        |
| Coeff Var       |     | 69.21817       |             |         |        |

| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | -261.17318         | 61.96766       | -4.21   | <.0001  |
| BC                  | Bank capital              | 1  | -2.55195           | 1.15551        | -2.21   | 0.0282  |
| CV                  | Bank charter value        | 1  | 299.03681          | 45.46588       | 6.58    | <.0001  |
| Size                | Log bank total assets     | 1  | 2.02203            | 1.95972        | 1.03    | 0.3032  |
| LOAN                | Bank loan to total assets | 1  | -0.06284           | 0.14964        | -0.42   | 0.6749  |
| YEAR05              |                           | 1  | -1.11349           | 6.39373        | -0.17   | 0.8619  |
| YEAR06              |                           | 1  | 1.00518            | 6.24751        | 0.16    | 0.8723  |
| YEAR07              |                           | 1  | -2.80090           | 6.25819        | -0.45   | 0.6549  |
| YEAR08              |                           | 1  | -4.93749           | 6.47279        | -0.76   | 0.4463  |
| resid               | Residual                  | 1  | -3.02732           | 13.48523       | -0.22   | 0.8226  |

## 6.4. To test if variable LOAN is endogenous

#### The REG Procedure

Model: MODEL1

Dependent Variable: LOAN Bank loan to total assets

|  |     |
|--|-----|
| Number of Observations Read                | 265 |
| Number of Observations Used                | 251 |
| Number of Observations with Missing Values | 14  |



| Analysis of Variance |                |                |             |         |        |
|----------------------|----------------|----------------|-------------|---------|--------|
| Source               | DF             | Sum of Squares | Mean Square | F Value | Pr > F |
| Model                | 9              | 56249          | 6249.91462  | 355.92  | <.0001 |
| Error                | 241            | 4231.91603     | 17.55982    |         |        |
| Corrected Total      | 250            | 60481          |             |         |        |
|                      |                |                |             |         |        |
|                      | Root MSE       | 4.19044        | R-Square    | 0.9300  |        |
|                      | Dependent Mean | 56.87372       | Adj R-Sq    | 0.9274  |        |
|                      | Coeff Var      | 7.36798        |             |         |        |

| Parameter Estimates |                       |    |                    |                |         |         |
|---------------------|-----------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                 | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept             | 1  | 9.03037            | 8.47530        | 1.07    | 0.2877  |
| BC                  | Bank capital          | 1  | -0.25965           | 0.15717        | -1.65   | 0.0998  |
| CV                  | Bank charter value    | 1  | 4.32865            | 6.24217        | 0.69    | 0.4887  |
| Size                | Log bank total assets | 1  | -0.64419           | 0.26227        | -2.46   | 0.0147  |
| LOAN_1              |                       | 1  | 0.93467            | 0.07028        | 13.30   | <.0001  |
| LOAN_2              |                       | 1  | 0.01642            | 0.07071        | 0.23    | 0.8165  |
| YEAR05              |                       | 1  | 0.76457            | 0.87516        | 0.87    | 0.3832  |
| YEAR06              |                       | 1  | -1.60715           | 0.85532        | -1.88   | 0.0615  |
| YEAR07              |                       | 1  | 1.11286            | 0.86549        | 1.29    | 0.1997  |
| YEAR08              |                       | 1  | 0.26911            | 0.88980        | 0.30    | 0.7626  |

The REG Procedure  
Model: MODEL1  
Dependent Variable: Z\_score Distance to default

Number of Observations Read 265  
Number of Observations Used 251  
Number of Observations with Missing Values 14

| Analysis of Variance |                |                |             |         |        |
|----------------------|----------------|----------------|-------------|---------|--------|
| Source               | DF             | Sum of Squares | Mean Square | F Value | Pr > F |
| Model                | 9              | 47558          | 5284.26565  | 5.64    | <.0001 |
| Error                | 241            | 225669         | 936.38571   |         |        |
| Corrected Total      | 250            | 273227         |             |         |        |
|                      |                |                |             |         |        |
|                      | Root MSE       | 30.60042       | R-Square    | 0.1741  |        |
|                      | Dependent Mean | 44.21211       | Adj R-Sq    | 0.1432  |        |
|                      | Coeff Var      | 69.21275       |             |         |        |

| Parameter Estimates |                           |    |                    |                |         |         |
|---------------------|---------------------------|----|--------------------|----------------|---------|---------|
| Variable            | Label                     | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
| Intercept           | Intercept                 | 1  | -262.44893         | 62.30309       | -4.21   | <.0001  |
| BC                  | Bank capital              | 1  | -2.52179           | 1.16305        | -2.17   | 0.0311  |
| CV                  | Bank charter value        | 1  | 298.83558          | 45.44403       | 6.58    | <.0001  |
| Size                | Log bank total assets     | 1  | 2.05536            | 1.96625        | 1.05    | 0.2969  |
| LOAN                | Bank loan to total assets | 1  | -0.05050           | 0.15735        | -0.32   | 0.7485  |
| YEAR05              |                           | 1  | -1.11977           | 6.39330        | -0.18   | 0.8611  |
| YEAR06              |                           | 1  | 1.03486            | 6.24746        | 0.17    | 0.8686  |
| YEAR07              |                           | 1  | -2.79211           | 6.25704        | -0.45   | 0.6558  |
| YEAR08              |                           | 1  | -4.92304           | 6.47178        | -0.76   | 0.4476  |
| resid               | Residual                  | 1  | -0.14727           | 0.49601        | -0.30   | 0.7668  |

## APPENDIX 8: DESCRIPTION OF THE SYSTEM GMM ESTIMATION

Our model used in the first empirical research is as follows (Section 5.4.4.1):

$$Risk_{i,j,t} = \begin{cases} \alpha_o + \beta_1 Compensation_{i,j,t-1} + \beta_2 Size_{i,j,t-1} + \beta_3 BC_{i,j,t-1} + \beta_4 BC_{i,j,t-1}^2 \\ + \beta_5 CV_{i,j,t-1} + \beta_6 LOAN_{i,j,t-1} + \sum \phi_i Y_{i,t} + \varepsilon_{i,j,t} \end{cases} \quad (48)$$

The above model examines the relationship between CEO compensation and bank risk in a panel dataset of 63 countries for 5 years (2004-2008). Some econometric issues may arise from estimating this research model:

1. Dependent of each measure of bank risk, *Size*, *BC*, *CV* may be endogenous following the obtained results from running the Hausman Test for endogeneity.
2. The explanatory variables may be related to time-invariant country characteristics (fixed effect) (e.g. geography or culture).
3. The panel has a short time dimension with T=5 years and a large country dimension with n=63.

We rely on the Arellano-Bond system GMM estimator (Arellano and Bover, 1995, Blundell and Bond, 1998) to conduct our research. Following the Arellano-Bond estimator, lagged levels of the endogenous variables are used as instrumental variables. By this way, it makes the endogenous regressors pre-determined thus not related to the error term in equation. Problem 1 therefore is solved. The system GMM uses both the level equation (48) and the difference equation (77) to solve problem.

$$\Delta Risk_{i,j,t} = \begin{cases} \alpha_o + \beta_1 \Delta Compensation_{i,j,t-1} + \beta_2 \Delta Size_{i,j,t-1} + \beta_3 \Delta BC_{i,j,t-1} + \beta_4 \Delta BC_{i,j,t-1}^2 \\ + \beta_5 \Delta CV_{i,j,t-1} + \beta_6 \Delta LOAN_{i,j,t-1} + \Delta \varepsilon_{i,j,t} \end{cases} \quad (77)$$

By transforming the regressors, equation (77) removes all possible fixed country-specific effect (problem 2). The system GMM was specially designed for small T and large N dimension. Consequently problem 3 is also solved.

## Résumé

La crise financière de 2008 a été largement imputée à une prise de risque excessive par les banques US et du monde entier, qui ont été mises en grande difficulté. Une des questions principales que se posent les scientifiques et les régulateurs concerne le rôle joué par les modes de rémunération des dirigeants des banques dans l'incitation à la prise de risque. Le but de cette recherche est d'étudier si les modes de rémunération des dirigeants des banques induisent la prise de risque et contribuent à la crise financière. Nous nous proposons d'analyser séparément les effets de chaque composante de la rémunération des PDG (le salaire, la prime, les autres rémunérations annuelles, le pourcentage du salaire, le pourcentage de la prime, le pourcentage des autres rémunérations annuelles, et les rémunérations qui sont fondées sur une participation au capital de la banque) sur la prise de risque dans le secteur bancaire. Nous tenterons aussi de déceler plus spécifiquement une éventuelle responsabilité de ces modes de rémunération dans le déclenchement de la crise financière et les manifestations du risque bancaire dans les deux premières années de crise. Pour les risques bancaires, nous utilisons de nombreuses mesures différentes : le risque total, le risque systématique, le risque idiosyncratique, le ratio de la provision pour pertes sur prêts en pourcentage des crédits, le ratio des prêts non performants en pourcentage des crédits, le risque de défaut mesuré par la distance par rapport au défaut (Z-score), le changement de la CDS, le changement de la notation des banques et la chute de la valeur des actions. En utilisant un échantillon de 63 grandes banques d'Europe, du Canada et des États-Unis couvrant une période de 5 ans de 2004 à 2008, nous trouvons que le salaire et la prime des PDG diminuent l'essentiel des risques bancaires, alors que les autres rémunérations annuelles des PDG les augmentent. Ces modes de rémunération des PDG n'ont pourtant aucun lien avec les changements du risque bancaire dans la crise. En ce qui concerne les rémunérations fondées sur une participation au capital de la banque, nous trouvons que l'utilisation des actions gratuites en rémunération pendant la période pré-crise n'a pas d'effet sur les changements anormaux du risque bancaire dans la période de crise. Au contraire, l'utilisation des options d'achat d'actions pendant la même période est une des raisons des manifestations du risque bancaire dans la récente crise financière.

**Mots-clés :** rémunération des dirigeants, rémunération des PDG, risque bancaire, crise financière.