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CEO stock-option compensation and the use of credit default swaps in relation to European bank risk

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Abstract

This thesis investigates two main aspects related to the use of credit default swaps (CDS) by European banks. The first area of investigation focuses on the relationship between the CEOs' risk-taking incentives generated by stock option compensation and the usage of CDS by banks.

This thesis contributes to the existing literature in risk management with derivatives, which initially assumes that the use of derivatives is intended to reduce firm risk, by distinguishing between CDS use for hedging purposes and CDS use for trading purposes. The relationship between CEOs' risk-taking incentives and CDS use in banks, and the influence of CDS use on bank's risk are investigated based on the purpose of CDS use.

This thesis utilises the estimates of the Black-Scholes sensitivity of executives' stock option portfolios to stock return volatility (vega) to test the relationship between CEOs' risk-taking incentives and CDS use. In addition, this thesis distinguishes between the effect of risk-taking incentives on CDS use for hedging purposes, and the effect of risk-taking incentives on CDS use for trading (speculating) purposes.

The second key aspect of this thesis is to examine the effect of CDS use on bank risk by distinguishing between the effect of CDS use for hedging purposes and CDS use for trading purposes. The purpose of CDS use that depends upon the managers' risk-taking incentives and the use of CDS can have different implications to the risk profile of the bank.

Data for the period of 2006 – 2011 were hand collected from the annual reports of sixty European banks. The sample comprises publicly listed banks from European stock market indices and premier indices of the European Union countries (EU-27).

In conducting the empirical testing, the two stages regression approach was used to adjust for the potential endogeneity that could arise between the risk-taking incentives of stock option compensation (vega), and CDS use.

The results show a significantly positive relationship between CEOs' risk-taking incentives generated by stock option compensations and CDS use in banks for trading purposes. This implies that higher risk-taking incentives (vega) are associated with greater CDS use for trading purposes. Furthermore, there is a negative linkage between CEOs' risk-taking incentives and CDS use for hedging purposes at weak levels of statistical significance.

The results also show strong evidence of a positive linkage between CDS use for trading purposes and bank risk. CDS use for trading purposes is associated with a higher bank's beta and lower distance to default. Further, the results show a positive and significant relationship between CDS use for hedging purposes and bank risk. CDS use for hedging purposes is also associated with a higher beta of a bank and lower distance to default. These results are consistent with the theoretical predictions of Smith and Stulz (1985), who suggest that stock options can influence managers' decisions to use derivatives and lead to greater alignment between the interests of managers and shareholders by mitigating managerial risk aversion. Thus, stock options provide managers with incentives to take on risk.

Overall, the evidence presented in this thesis suggests that CEOs' risk-taking incentives derived from stock options compensation is a key determinant of CDS use in banks. Moreover, banks' CDS use increases bank risk regardless of the purpose of its use. Both hedging and speculating CDS activities are associated with a bank's higher risk.

This thesis provides an integrated understanding and builds a comprehensive picture of how CEOs' stock option compensation can affect the purpose of CDS use, and how this use influences bank risk. It primarily extends previous empirical literature, which initially looked at derivatives as a risk reduction instrument, by distinguishing between CDS use for hedging purposes from CDS use for trading purposes.

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Chapter 1: Motivation, objectives and outline of the thesis

1.1 Introduction

After the last financial crisis credit derivatives have received great criticism about their potential impact on the financial system. The criticism was very much targeted at the credit default swap (CDS), which is considered as one of the largest components of the credit derivatives market (Minton, Stulz, and Williamson, 2009; Norden, Buston, and Wagner, 2011; Bedendo and Bruno, 2012; Calice, Ioannidis, and Williams, 2012). Indeed, CDS accounted for a proportion of 33% of the credit derivatives market in 2006 and 29% of it in 2008.[1] Statistics from the Bank for International Settlements (BIS) show that the volumes outstanding of over-the-counter (OTC)[2] derivatives expanded at a brisk pace in the first half of 2006. Growth was particularly strong in the credit derivatives segment, where the notional amounts of outstanding CDS increased by 46%.

This debate brings to attention the importance of studying the possible determinant of the use of CDS among firms. Further, it is equally important to analyse the impact of CDS use on firm risk. In fact, credit derivatives in general and CDS in particular have been blamed for the waves of the shockwaves caused by the last credit crisis (Nijskens and Wagner, 2011; Corsi, Hosni, and Marmi, 2011). However, others believe that credit derivatives can play a positive role in improving the financial system (Wagner and Marsh, 2006; Stulz, 2010).

A major structural innovation in the financial system has been the development of a market for credit risk transfer (Calice and Ioannidis, 2012). Economists have generally believed that financial derivatives increase economic welfare by facilitating risk-sharing among investors.

[1] BBA Credit Derivatives Report 2008, May 2009.
[2] OTC market: is a decentralised market where market participants agree on a trade without meeting through an organised exchange.

The use of credit derivatives has contributed to the improvement of the financial system and enabled firms to manage their portfolio of credit risks more efficiently during the period of 2000–2004 (Acharya and Johnson, 2007; Ashcraft and Santos, 2009). Further, CDS are the most liquid instrument of several credit derivatives currently traded and represent the largest sector of the credit derivatives market (Blanco, Brennan, and Marsh, 2005; Minton et al., 2009; Bedendo and Bruno, 2012). Nevertheless, after the last financial crisis credit derivatives in general and CDS in particular have received great criticism about their potential impact on the stability of the financial system (Stulz, 2010).

In search of explanations for the last financial crisis, another line of literature focuses on executives' pay and the risk-taking incentive (Bebchuk, Cohen, and Spamann, 2010; Fahlenbrach and Stulz, 2011; Bai and Elyasiani, 2013; Bruce and Skovoroda, 2013). Many recent studies identified the risk-taking incentives of compensation practices as a factor that contributed to the financial crisis, and believed that executive compensation programmes lead to excessive risk-taking and play a significant role in the financial crisis by encouraging executive to adopt riskier policies, which lead to higher overall firm risk (Bai and Elyasiani, 2013; Bhagat and Bolton, 2014). Much attention has been paid to the role of equity-based compensation and the incentive effects of stock options on the financial stability (Fahlenbrach and Stulz, 2011).

The risk-taking incentives generated by executive compensation in financial firms have generated public concerns after the last financial crisis. In response to these concerns, recent empirical studies have attempted to investigate the impact of executive incentives to increase risk and risk choices made by executives, such as analysing the relationship between executive compensation and merge decisions (Hagendorff and Vallascas, 2011), the relationship between executive compensation and bank performance during the crisis (Fahlenbrach and Stulz, 2011; Tung and Wang, 2011), or executive compensation and bank default risk predictors (Acrey, McCumber, and Nguyen, 2011). However, there is mixed evidence in the literature regarding whether incentive compensation increases risk-taking motivation among managers.

Although prior literature explains the linkage between managerial risk-taking incentives and derivatives use, none of the recent studies, however, have tried to explore the linkage between executive compensation and risk-taking incentives in relation to credit derivatives use. The primary objective of this thesis is to investigate these two subjects in the context of derivatives use by European banks. The first aspect analyses the linkage between executive incentives to increase firm risk generated by stock option compensation and credit derivatives use. The second investigates how the use of credit derivatives influences bank's risk.

1.2 CDS

1.2.1 CDS definition

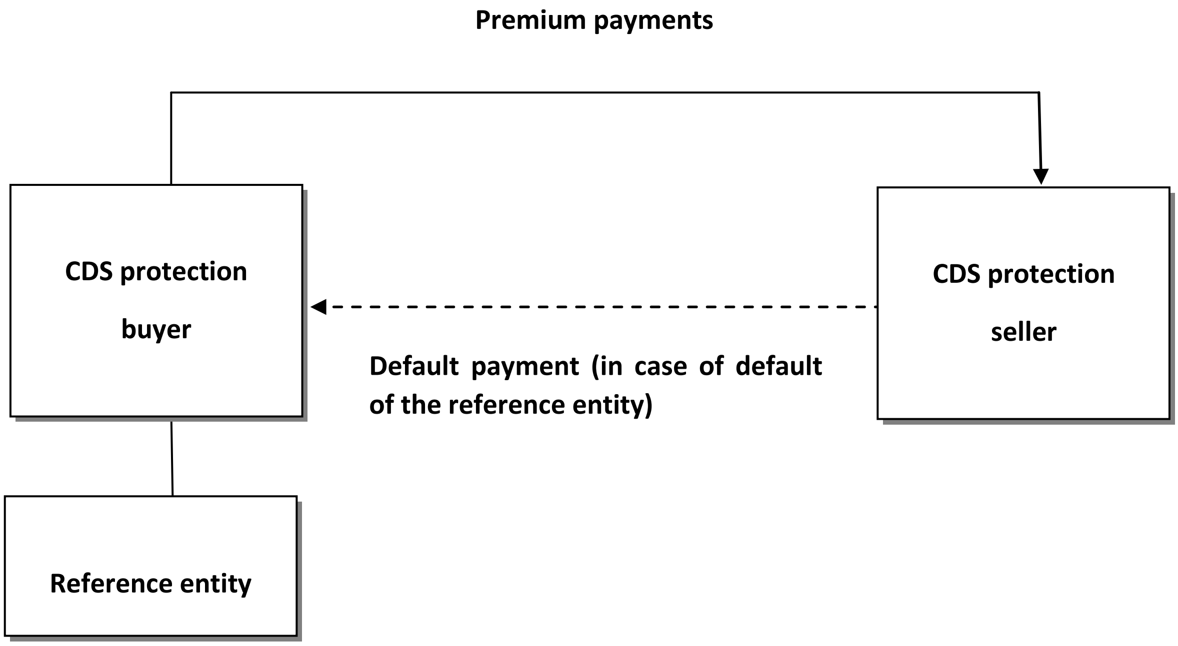
Credit derivatives are financial instruments that can be used to transfer credit risk from the party exposed to the risk (the protection buyer) to another party willing to assume that risk (the protection seller). The payoffs for a credit derivative are conditional on the occurrence of a credit event. The credit event is defined with respect to one or more reference entities and one or more reference assets issued by the reference entity (Blanco et al., 2005). In principle, credit derivatives are tools that enable banks to manage their portfolio of credit risks more efficiently (Minton et al., 2009). According to the International Accounting Standard 39 – Financial Instruments: Recognition and Measurement (IAS 39)[3] a derivative instrument is defined as a financial instrument with all three of the following characteristics: (a) its value changes in response to changes in a specified underlying item; (b) it requires no initial net investment or an initial net investment that is smaller than would be required for other types

[3] Now it is IFRS 9 Financial Instruments (replacement of IAS 39).

of contracts that would be expected to have a similar response to changes in market factors; and (c) it is settled at a future date.

CDS, the most common credit derivative instrument, is a contract that provides protection against the risk of a credit event by a particular firm or country. The buyer of the protection makes periodic payments to the protection seller until the occurrence of a credit event[4] or the maturity date of the contract, whichever comes first. If a credit event occurs, the buyer is compensated for the loss incurred as a result of the credit event. If there is no default event before maturity, the protection seller pays nothing (Tavakoli, 1998; Blanco et al., 2005; Duffee and Zhou, 2001). A diagrammatic illustration of CDS mechanics is presented in Figure. 1.1.

Fig 1.1: A diagram of credit default swaps mechanics



[4] Credit events for CDSs might include some or all of the following: bankruptcy, failure to pay, obligation default or acceleration, repudiation or moratorium, and restructuring (Blanco, Brennan, and Marsh, 2005).

CDS provide a very easy way to trade credit risk. Credit derivatives, especially CDS, allow investors to short credit risk over a longer period of time at a known cost by buying protection. The economic effect of a CDS contract is similar to that of an insurance contract (Duffee and Zhou, 2001; Ashcraft and Santos, 2009). The legal distinction comes from the fact that those buying a CDS can trade in and out of their contracts in a way that is not possible in the insurance market (Stulz, 2010). Thus, CDS contracts do not require an exposure to the underlying credit risk for the protection buyer (Corsi, Hosni, Marmi, 2011). Further, in a CDS contract it is not necessary for the protection buyer to hold an insured asset (the underlying loan) in order to claim "compensation" under a CDS. If the protection buyer does not hold the underlying security the CDS is said to be naked. Naked CDS can then be used to build speculative bets on the default of the third party (Corsi et al., 2011). Speculators can take long (short) positions in credit risk by selling (buying) protection without need to trade the cash instrument (Ericsson, Jacobs, and Oviedo, 2009; Berndt, Jarrow, and Kang, 2007; Blanco et al., 2005).

1.2.2 The credit crisis and derivatives

After the collapse of some of the leading institutions in the financial market such as Bear Stearns and Lehman Brothers, credit derivatives have been blamed for part of institution defaults and financial instability associated with the credit crisis (Minton et al., 2009; Cont, 2010; Stulz, 2010). The financial crisis in 2007 started as a credit crisis that caused major disruption to financial institutions in the United States (US) and Europe. A number of internationally active banking groups, with large credit-related exposure, were severely affected by this financial crisis (Calice and Ioannidis, 2012).

The role of CDS in the financial crisis has been debated since early 2008. On the one hand, critics of CDS argue that the explosive growth of derivative markets and CDS is one of the causes of the crisis and many of the problems highlighted by the crisis were due to credit derivatives use (King and Maier, 2009; Wignall and Atkinson, 2009; Das et al., 2014; Calice et al., 2012). On the other hand, some argue that credit derivatives play a positive role during the crisis and make banks and the financial system sounder (Stulz, 2010; Corsi et al., 2011; Bedendo and Bruno, 2012).

After the last financial crisis CDS and other financial derivatives have clearly lost any presumption of innocence that they once enjoyed among economists, and they probably never had such a presumption with the general public (Stulz, 2010). This negative view about financial innovation and credit derivatives has appeared in the literature even before the crisis began (Rajan, 2006; Partnoy and Skeel, 2006; Instefjord, 2005; Thorbeckc, 1995). For example, Warren Buffett, the chairman, CEO and largest shareholder of Berkshire Hathaway wrote in the 2002 annual report of Berkshire Hathaway that: "derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal."[5]

In contrast, the positive view about the role of derivatives is based on evidence that financial risk management with derivatives remains effective even during times of crises (Norden et al., 2011; Corsi et al., 2011; Bedendo and Bruno, 2012). In a speech about economic flexibility to HM Treasury Enterprise Conference in London, the former head of the Federal Reserve System, Alan Greenspan stated that credit derivatives have contributed “to the development of a far more flexible, efficient, and hence resilient financial system than existed just a quarter-century ago.” [6] Similarly, Paul Tucker argued that ‘‘the innovation of credit derivatives has plausibly taken us a further step toward complete markets, in effect providing

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[5] Buffett, Warren. 2003. "Warren Buffett's Letters to Berkshire Shareholders 1977- 2002." February 21; Available at (www.berkshirehathaway.com/letters/2002pdf.pdf).

[6] Greenspan’s speech ‘‘Economic Flexibility’’ before Her Majesty’s Treasury Enterprise Conference (London, 26 January 2004).

a richer market for credit insurance than previously existed . . . (and) reducing the price of risk.’’[7]

Another line of literature finds no evidence that derivatives use has increased the firm’s risk (Hentschel and Kothari, 2001; Adam and Fernando, 2006). Goodhart (2005) believes that CDS will do most to allow banks to effectively achieve a desired level of diversification. However, he points out that “like all derivatives, CDS can be used for good or ill; what is perhaps most needed by regulators is greater transparency” (p.119).

Introduced in the 1990s as a hedging tool, CDS soon took off as a way to trade (speculate) on the likelihood of a firm defaulting without having to trade its underlying loan. For much of this decade, they have been considered a means of spreading risk around the financial system (Calice and Ioannidis, 2012).

After the last financial crisis, there are concerns about potential problems related to the trading of derivatives (Stulz, 2010). For example, Joseph Stiglitz, the former chief economist of the World Bank and the Nobel prize-winning, believes that large banks should be banned from trading derivatives including CDS. He said that large banks “....need more restrictions, such as no derivative trading.”[8] Stulz (2010) has a different opinion about the use of CDS for trading purposes. He argues that if the CDS market is reduced to include only hedgers, with speculators banned, hedgers will not find counterparties because the market will have no liquidity. Speculators have to be able to trade on either side of a market for trading to occur in that market.

[7] Speech at the Euromoney Global Borrowers and Investors Forum (London, June 23, 2005).

[8] Reported by Bloomberg, October 12, 2009: “Stiglitz Says Banks Should Be Banned From CDS Trading,” by Ben Moshinsky.

In summary, although CDS have been blamed for the shockwaves in the last credit crisis (e.g., Nijskens and Wagner, 2011; Corsi et al., 2011), many others believe that credit derivatives can play a positive role in improving the financial system (e.g., Wagner and Marsh, 2006; Stulz, 2010). The positive view of the role of credit derivatives is related to the notion that the advent of credit derivatives as providing banks with a range of flexible instruments for selling loans and transferring loan risk (Minton et al., 2009). This thesis examines the effect of credit derivatives use on firms' risk. Specifically, it investigates the influence of CDS use on a bank's risk and distinguishes between the influences of CDS use for hedging purposes from the influences of CDS use for trading purposes.

1.2.3 The credit crisis and executive compensation

In the aftermath of the last financial crisis, another strand of academic studies has emerged and has attempted to link the crisis to the incentive effects of executive compensation policies. The focus was on whether firms' performance during the recent credit crisis is related to the chief executive officer's (CEO) incentives before the crisis (Acrey, McCumber, and Nguyen, 2011; Fahlenbrach and Stulz , 2011; Hagendorff and Vallascas, 2011; Tung and Wang, 2011; Bhagat and Bolton, 2014).

Following the last financial crisis, there is widespread concern that executive compensation arrangements could have encouraged excessive risk-taking. For example, Federal Reserve Chairman Ben Bernanke declared that: "Compensation practices at some banking organizations have led to misaligned incentives and excessive risk-taking, contributing to bank losses and financial instability".[9] Some researchers argue that executive compensation represents one of the fundamental causes of the last credit crisis and believe that the incentives built into the compensation plans of many financial firms are correlated with the

[9] Federal Reserve press release, October 22, 2009. http://www.federalreserve.gov/newsevents/press/bcreg/20091022a.htm

excessive risk-taking (Blinder, 2009; Bebchuk, Cohen, and Spamann, 2010; Raviv and Sisli-Ciamarra, 2013; Bhagat and Bolton, 2014).

Prior to the financial crisis of 2007–2008, executive compensation in financial firms was largely overlooked (Tian and Yang, 2014). However, this has changed after the recent financial crisis, governments and regulators have taken steps to restrict executive pay arrangements in the financial firms and executive compensation has consistently been a focus of the reform agenda by regulators (Bhagat and Bolton, 2014; Dong, 2014). An important assumption behind these regulatory reform efforts is the view that incentives generated by executive compensation create excessive risk-taking (Bai and Elyasiani, 2013; Acrey et al., 2011; Bhagat and Bolton, 2014).

The major point of criticism of executive compensation is the potential concern about the risk-taking incentives provided by the equity-based compensation that consists of stock and stock options (Dong, Wang, and Xie, 2010).[10] The use of stock options in executive compensation has become so widespread in financial firms and bank executives have received significant amounts of stock options as incentive compensation over the last decade (Hagendorff and Vallascas, 2011; Bhagat and Bolton, 2014). The popular press and regulators hold the views that stock options were at least partially responsible for some of the high risk of the firms in the last decade (Dong et al., 2010). This is mainly due to a concern that stock options would motivate "excessive" risk-taking incentives.

The literature that investigates these risk-taking incentives has focused on the separation of ownership and control and the structure of executive compensation. The conflicts of interest between shareholders and managers have attracted a great attention amongst researchers working on the theme of the principal-agent problem (Aggarwal and Samwick, 1999; Chen, Steiner, and Whyte, 2006; Coles, Daniel, and Naveen, 2006; John and John, 1993). These

[10] Stock compensation includes CEOs' restricted stock and long term incentive plans (LTIPs).

studies focus on the common argument that compensation with non-linear (convex) payoffs[11] as in stock options should be given to CEOs to remedy the effect of CEO risk aversion and provide the CEO with increased incentives to take on risky projects. This expects to lead to a positive impact on aligning shareholder and managerial risk preferences (Stulz, 1984; Smith and Stulz, 1985).

The conflict of interest between managers and shareholders can be reduced when the management's interests are better aligned with those of shareholders; in other words, if manager's compensation increases when shareholders gain and fall when shareholders lose (Jensen and Meckling, 1976). The managers are undiversified with respect to firm-specific wealth and exposed to more risk compared to diversified shareholders. Accordingly, it is possible that managers will tend to implement less risky policies. The increase in equity-based compensation potentially offsets this tendency. Executive equity-based compensation is widely regarded as an effective way to align managers' interests with those of their shareholders (Guay, 1999b; Knopf et al., 2002; Gao, 2010).

The presence of stock options in the compensation plans induces decisions by managers that are good for shareholders. Shareholders can use stock options to structure managers' wealth as a convex function of firm performance and this will mitigate the effect of managers' risk aversion and provide the CEO with increased incentives to take more risk and increase shareholders' value. Recently, empirical studies tried to investigate whether there is a correlation between compensation structure and the excessive risk-taking by firms contributing to the recent financial crisis and whether the interests of CEOs were aligned with those of their shareholders before the start of the crisis. However, there is mixed evidence

[11] The convexity of the wealth performance relation refers to the sensitivity of managers' wealth to the volatility of equity value. Greater convexity in the wealth-performance relation is expected to reduce manager's risk aversion.

about the incentive compensation and the risk-taking incentives in the literature. On the one hand, some support the association between managers' compensation and risk-taking incentives (e.g., Blinder, 2009; Bebchuk, Cohen, and Spamann, 2010; Tung and Wang, 2011; Bai and Elyasiani, 2013; Bhagat and Bolton, 2014). On the other hand, some provide contrasting results with evidence that bank CEO incentives cannot be blamed for the financial crisis or for the performance of banks during that crisis (e.g., Acrey, McCumber, and Nguyen, 2011; Fahlenbrach and Stulz, 2011).

It is evident from the above studies that there is a need for more research to examine how executives' compensation influences the risk-taking incentives and the potential effect of executives' risk-taking incentives. This thesis empirically addresses the association between executives' equity based compensation and the incentives to increase risk in the banking sector by investigating the linkage between CEOs' risk-taking incentives and CDS use in the banking industry. Moreover, this thesis investigates how the incentive to increase banks' risk is related to the purposes of CDS use (i.e., hedging and speculating).

1.2.4 The rapid growth in the credit derivatives market

The credit derivatives market has been hailed as the fastest growing financial market. While estimates of the volume of derivatives by different agencies differ, it is widely agreed that derivatives had been, prior to 2008, the fastest growing segment of the OTC market (Kothari, 2009).

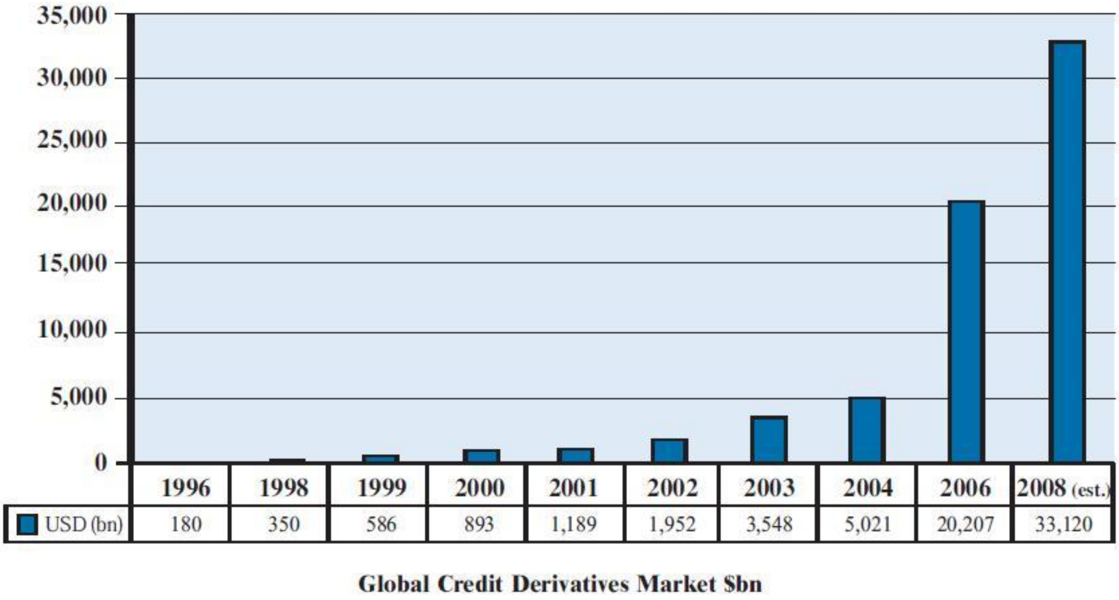
OTC derivative trade typically involves a bank or a broker, and so it is possible to estimate the size of the OTC market for derivatives by surveying financial firms. The BIS has conducted such surveys of financial firms since 1998. It surveys 60 major derivatives dealers and eliminates double counting among the reporting institutions. The BIS reports the size of the OTC derivatives market by adding up the notional amounts of outstanding derivatives.

According to BIS surveys, the notional amount of OTC derivatives markets increased from $633 trillion at the end-2012 to $693 trillion at end-June 2013.

In recent years, banks have dramatically increased their risk transfer activities. For one, they have done this through the use of credit derivatives, and mostly in the form of CDS (Nijskens and Wagner, 2011). In the past several years, credit derivatives have begun to be traded actively in financial markets. Credit derivatives were rapidly becoming one of the most successful financial innovations of the past decade prior to the global crisis (Longstaff, Mithal, and Neis, 2005). The credit derivatives market was developed rapidly during the early 1990s. The derivative market was small but it has grown quickly since the 1990s (Duffee and Zhou, 2001).

From being a fledgling market in the mid-1990s, credit derivative markets have increased tremendously over the last few years. The growth of the global credit derivatives market had outperformed the expectations from the 2004 BBA survey which predicted a market size of $8.2 trillion by 2006. The market exceeded 20 trillion dollars in outstanding notional principal in 2006 (Ericsson et al., 2009). According to the British Bankers Association, the global outstanding of credit derivatives grew from a $180 billion notional value in 1996 to exceed $20 trillion in 2006 (Alnassar, Al-shakrchy, and Almsafir, 2014). Figure 1.2 below shows the size of the credit derivatives since 2001.

Figure 1.2: the size of the credit derivatives since 2001



Source: British Bankers' Association – Credit Derivatives Report 2006

The growth of the credit derivatives market can be explained by the increase of CDS use. As shown by statistics of the International Swaps and Derivatives Association (ISDA)[12] the market for CDS has grown dramatically over the last two decades. The notional amount outstanding of CDS grew from $ 8,422 billions at the end of 2004 to reach its peak of over $ 62,173 billions at the end of 2007, and then decreased to $26,263 billion at the end of 2010. [13] In recent market survey the notional amount of CDS was over $24,349 billions in 2013.[14] Figure 1.3 below shows the size of the CDS since 2001.

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[12] ISDA is an international trade body of dealers, brokers, risk management professionals, and so on, in the derivatives trade.
[13] International Swaps and Derivatives Association market survey, June 2010.
[14] BIS Quarterly Review, June 2014

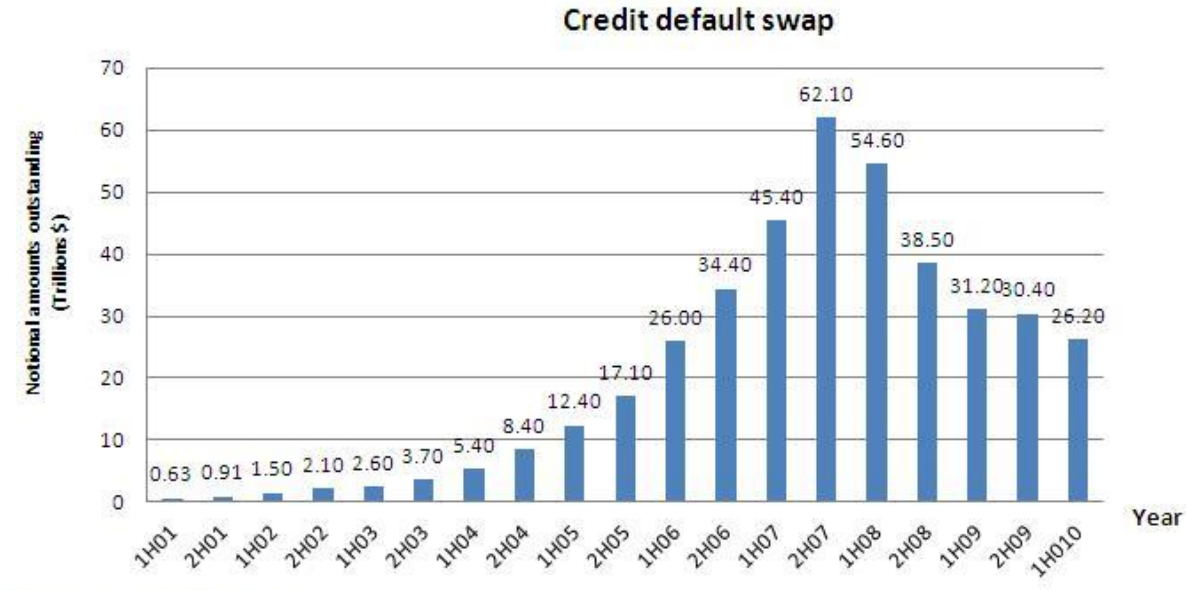


Figure 1.3: the size of the CDS since 2001, compiled based on ISDA data.

This rapid growth in credit derivatives and CDS was mostly driven by an increased desire from banks and other financial institutions to manage their credit exposure (Smithson, Associates, and Mengle, 2006). In addition, the behaviour of the firms has changed to include not only buying credit protection to reduce the credit risk from their own lending activities but also to trade (speculate) in the credit derivatives market by selling protection on credits not currently in their portfolio (Olléon-Assouan, 2004; Smithson et al., 2006; Minton et al., 2009). Using CDS can help banks to increase their lending activities, because the ability of banks to hedge loans that they have made using CDS limits their risk exposure (Stulz, 2010). However, the recent empirical evidence confirms that using CDS to take on credit risk is a common practice in financial firms (Minton et al., 2009; Adam and Guettler, 2010).

Banks also use other derivatives contract, the most common types derivatives contracts used by banks are interest rate derivatives, foreign exchange derivatives, equity derivatives and commodity derivatives.

1.3 Managerial risk-taking incentives and the payoff structure of stock options

1.3.1 Managerial risk-taking incentives

This thesis investigates the relationship between executive stock option compensation and credit derivatives use. Particularly, this research focuses on the linkage between the risk-taking incentives inherent in a CEO's stock option compensation and CDS use for hedging purposes or trading purposes.

Agency theory of the firm presents two models of the conflicts. The first is the conflict between shareholders and managers following the separation of ownership and control in modern corporations. The second discusses the relationships among other stakeholders (Jensen and Meckling, 1976). The first aspect of this thesis is related to manager's shareholders conflicts and the difference between them in risk preferences. The conflict generated by managerial risk aversion combined with an excessive concentration of CEO wealth in a single firm encourages managers to reduce firm risk more than may be desirable from the outside shareholders' perspective.

Managers make the actual decision to hedge using derivatives. If managers and owners are separate, agency problems should affect the hedging decisions of the firm. One possible result is that managers who have their wealth concentrated in their firm may hedge in a manner that does not maximize the shareholders' value (Rogers, 2002). This is because managers have limited ability to diversify their own personal wealth and their career earning from their own employment position is related to the existence of the firm. Therefore, managers seek to reduce the probability of bankruptcy in order to enhance their job security and have the incentives to use derivatives to reduce the firm's risk (Smith and Stulz, 1985).

One mode of mitigating such agency conflict is through the design of executive compensation contracts (Stulz, 1984; Tufano, 1998; Buck, Bruce, Main, and Udueni, 2003).

According to the principal-agent model, the firm's shareholders seek to design the most efficient compensation packages in order to attract and motivate the CEO to maximize firm value. Therefore, shareholders try to design optimal compensation packages that provide CEOs with incentives to align their mutual interests. Jensen and Meckling (1976) suggest that compensation contract can minimize the divergence of interests between shareholders and managers. However, others argue that the effect of managerial compensation depends on the payoff structure of each component and therefore, not all executive compensation components may be equally effective in aligning the risk preferences of shareholders and managers (Guay, 1999b).

The literature on agency costs argues that both executives and shareholders are aware of the potential conflicts of interest and the abuses generated because of this conflict (England, 1988). As a result, the agency costs create incentives for both groups to take action to minimize and control the problem. To protect their interests, shareholders have reasons to develop compensation contracts that are designed to channel the behaviour of executives in desirable directions and limit their ability to engage in unacceptable activities that reduce the firm value. Accordingly, shareholders will prefer compensation components that induce executives to take more risky investments and reduce the compensation that would increase executives' risk aversion.

According to Smith and Stulz (1985), managers whose compensation is a linear function of firm value have incentives to reduce firm's risk. Hence, such managers are expected to use more derivatives and hedge more. Shareholders have incentives to choose a compensation plan that discourages managers from devoting excessive resources to hedging. This can be accomplished by making the manager's compensation a more convex function of firm value. They point out that stock options can make the manager's expected utility a convex function of the value of the firm. Managers with greater stock options would prefer less hedging because the payoff of stock options encourages managers to reduce derivatives use for hedging. They also argue that executives with greater stock holdings would prefer to engage more in financial risk management and use more derivatives for hedging purposes as the stock grants provide linear payoffs as a function of stock prices.

1.3.2 Payoff structure of stock options

Prior empirical studies on equity-based wealth have employed various measures to capture the risk-taking incentives of executive stock options. These measures include binary variables for the presence or absence of stock options, the number of options held by executives, and the value of stock options.

Core and Guay (2002) present a more appropriate approach to measure executive option portfolio value and risk-taking incentives by using the partial derivatives of the dividend-adjusted Black–Scholes equation with respect to stock return volatility and stock price. They propose the use of the sensitivity of managers' option portfolio value to measure their risk-taking incentives by using data from only the current year's annual report.

They estimate the sensitivities of managers' stock option portfolios to stock return volatility (vega) and managers' stock and stock option portfolios to stock price (delta).[15] These sensitivities can act in opposing directions in shaping managers' risk preferences. Literature shows that executive stock options and stock portfolios can be characterised as being either linear or convex depending on the sensitivity of the value of the compensation payoff to

[15] Vega: the sensitivity of the option value with respect to a 1% change in stock volatility. Delta: the sensitivity of the stock and option portfolio to changes in the price of the firm's stock.

movements of either stock price or stock return volatility (e. g., Knopf et al., 2002; Géczy et al., 2007).

1.4 Motivation

The difference between past crises and that which appears to have started in 2007 is the presence of the credit derivatives market (Calice et al., 2012). The use of CDS, which represents the most common credit derivatives instrument, has been blamed for severe losses at a number of banks, hedge funds and insurance companies during the past financial crisis (Adam and Guettler, 2010; Corsi et al., 2011; Nijskens and Wagner, 2011).

At the same time, the event of the last financial crisis has had a great impact on the debate about the role of CEO compensation. Theoretical and empirical literature shows that executive compensation induced risk-taking incentives can influence managers' risk aversion and this can influence how managers use CDS (Rogers, 2002; Bartram et al., 2011).

During the 1990s, executive stock options became the single largest component of CEO compensation (Brisley, 2006). The use of stock option compensation in the banking industry has become more prevalent, and the percentage of stock option compensation relative to total managerial compensation has also increased compared with industrial firms (Chen et al., 2006). Conyon, Core, and Guay (2011) document a 92% increase in median UK CEO pay for the period from 1997 to 2003 and find that risk-adjusted pay for the UK CEOs increased largely due to growth in UK CEO pay over that period. In the same instance, Renneboog and Zhao (2011) show that by 2007, the total remuneration for the CEO had almost doubled relative to 1996 and equity-based compensation represents the most valuable aspect of a CEO compensation package in 1,758 UK companies.

Recently, criticism of the role of executives’ compensation is widely targeting the compensation structure of the executives in the banking industry and considers the excessive risk-taking of executives as one of the causes of the last crisis (Tung and Wang, 2011).

Studying the impact of compensation contract on derivatives use is evidently important as literature shows that executive compensation has grown rapidly in recent years (Perry and Zenner, 2000; Blinder, 2009; Acrey et al., 2010; Fahlenbrach and Stulz, 2011). In fact the relationship between the composition of CEO compensation and financial risk management is relatively unexplored area in finance (Supanvanij and Strauss, 2010). Moreover, there is a dearth of empirical studies on the costs and benefits of CDS and other derivatives, not just in the last two years, but in the last several decades (Stulz, 2010).

1.5 Objectives

This thesis aims to achieve two key objectives. The first objective is to explore the incentive effects of CEO stock options on the use of CDS, and how this is related to the purpose of CDS use (i.e., hedge credit risk or take on credit risk).

The focus on the role of stock option compensation, which is considered as an important component in aligning the incentives of CEO with their shareholders by increasing the risk-taking incentives of the CEO and influence their behaviour to use derivatives through providing the holder with a disincentive to hedge.

This thesis aims to provide a deeper understanding of the interdependent relation that exists between executive compensation and corporate derivatives use by measuring the risk-taking incentive of the managers with vega.

The second objective of this thesis is to explain how the use of CDS influences the firm's risk by distinguishing between the effect of CDS use for hedging and CDS use for trading.

There is an extensive and long established academic literature, which has focused the attention primarily on the idea that derivatives are implemented by firms as a financial risk management tools to reduce risk. There has been, however, little effort made to relate the use of CDS to firms' risk based on the purpose or the strategy of this use in the banking industry.

The data collected to examine these two objectives made it possible to differentiate between two major CDS use strategies: CDS use for hedging purposes and CDS for trading purposes.

In summary, this research not only examines the degree to which executive risk-taking incentive are related to credit derivatives use in the form of CDS in the banking industry, but also distinguishes between banks that use credit derivatives for speculative and banks that use credit derivatives exclusively for hedging. Moreover, this thesis investigates the effects of CDS use on a firm's risk based on CDS strategies which are being used in the banking industry. To my knowledge, there has been no empirical study examining the link between executive compensation induced risk-taking incentives and CDS use, or how the use of CDS affects the banks' risk by distinguishing between the purpose of using CDS in the European banking industry. Accordingly, this thesis will examine the linkage between executive incentive to increase risk generated by stock option compensation and CDS usage and then assess the effect of CDS use on bank's risk using a sample of European banks. Prior empirical literature has provided evidence using a sample from non-financial firms and has found mixed results. The existing empirical evidence on the corporate use of derivatives in the banking industry is limited and largely based on the US firms.

1.6 Contribution

The present research contributes to the existing literature in several ways. Its major contribution lies in two areas related to CDS use in the banking industry. The first is providing an empirical examination of the risk-taking incentives of banks' CEOs stock option compensation and CDS use. The second is investigating the relationship between CDS use and firms' risk in the banking industry. It is well known theoretically that derivatives use is associated with reducing the firm's risk. In practice, however, investigation of such effects is rendered difficult by the fact that researchers are generally unable to identify the exact nature of this use, whose effects could get exacerbated by specific implementation or use of derivatives (Géczy et al., 2007). This thesis takes advantage of a better disclosure requirements in place for firms to report the purpose of CDS use in order to overcome this difficulty.

This thesis contributes to the literature by investigating CDS use in banks and distinguishing between the purposes of CDS use by using information disclosed by banks in their annual reports. Prior empirical studies discuss managers' incentives to use derivatives and assumed that derivatives are used for financial risk management.

This thesis focuses on CDS use in the banking industry. The compensation structure of banks is different from that of industrial firms (Adams and Mehran, 2003).The banking industry is an important context of study for the question due to several distinctive characteristics that banks have, for example, they operate in a more regulated environment, have fewer growth options with substantially greater leverage, and are protected by deposit insurance schemes (Bai and Elyasiani, 2013).

Although several empirical studies have examined the association between managerial compensation and derivatives use for non-financial firms (Supanvanij and Strauss, 2010; Knopf, Nam and Thornton, 2002; Gay and Nam, 1998), little is known about the relationship between compensation induced risk-taking incentives and CDS use in the banking sector (Williams and Michael, 2008).

Previous empirical studies focus more on the nonfinancial industry and mostly use US samples. Relatively small empirical literature exists on credit derivatives. To my knowledge, this is the first attempt to examine the association between executive risk-taking incentives, CDS use and a firm's risk in the banking industry and distinguishing between CDS use for hedging and CDS use for trading.

This thesis contributes to the literature by using a more appropriate measure (vega) to test the incentives of executives to use derivatives. Following Core and Guay (2002), vega is used to measure the CEOs' incentives to increase risk.

Vega is considered a more appropriate measure to capture managers' risk-taking incentives because it can provide a more precise measure for CEOs' stock options comparing to the simple measures such as the number or the value of stock options (Gao, 2010; Cohen et al., 2000; Knopf et al., 2002). Furthermore, vega can be calculated by using data from only the current year's annual report (Core and Guay, 2002).

Theoretically, this thesis contributes to the literature by focusing on the relationship between CEOs' risk-taking incentives and the motive of CDS use (i.e., hedging purposes and trading purposes). Particularly, CDS use for trading which receives little attention compared with derivatives use for hedging. Prior theoretical and empirical literature predominately explains the association between risk-taking incentives and derivatives use for hedging purposes. This thesis examines the linkage between executives' stock option compensation and credit derivatives use for trading in the banking industry in more detail. In addition, it investigates the association between the different purposes of CDS use and banks' risk in the context of the European banking industry.

The empirical findings on the relationship between the risk-taking incentives inherent in stock option compensation and CDS use have important implications for regulators and policy makers and show the effect of stock options in inducing risk-taking in the banking industry.

CEO stock options induce stronger risk-taking incentives. Consistent with the conclusions of Bebchuk et al. (2010) and Bai and Elyasiani(2013), bank regulators should monitor risk-taking incentives of executive compensation, in particular the largest banks, in order to enhance bank stability.

The results presented for the relationship between CDS use and European bank risk show that the use of CDS has a positive effect on banks' risk. Banks participation in CDS markets result in an increase in the riskiness of the banks. This latter finding has clear implications for the regulatory debate and the concern over the consequences of the widespread CDS use.

1.7 The outline of the thesis

Chapter two presents the theoretical and empirical literature about the two aspects of the thesis. First, it discusses the linkage between executive risk-taking incentives of stock option compensation and the use of derivatives. Second, it discusses the relationship between derivatives use and a firm's risk. Chapter three presents the data and methodology adopted in this thesis. The chapter then defines the variables used in both the CDS model and firm's risk model. Data sources and the sample selection criteria are also presented in Chapter three.

Chapter four explores and visualises the data used in this thesis. Chapter five includes the empirical results and discusses the effect of risk-taking incentives from stock option compensation on CDS use for trading purposes. Chapter four also presents the results for the second aspect of this thesis, the influence of CDS use for trading on banks risk. Furthermore, the influence of CDS use for trading on banks risk before, during, and after the financial crisis is discussed in Chapter four.

Chapter six reports the results of empirical analysis which examines the effect of the risk-taking incentives of stock option compensation on CDS use for hedging purposes. The results of how CDS use for hedging influence bank risk are also reported and discussed in Chapter six. The relationship between CDS use for hedging and bank risk before, during, and after the financial crisis is also discussed in Chapter six.

Finally, Chapter seven includes a thesis summary, a further discussion of the research outcomes in general, implications for the financial and economic arena, limitations, future work concerning this research, and the conclusion.

Chapter 2: Theory, empirical evidence, and research questions

2.1 Introduction

The relationship between risk-taking incentives generated by stock option compensation and derivatives use remains a vital topic for economists, regulators and academics who are concerned about derivatives use by banks and the soundness of the financial system.

With the development of the derivatives market, active financial risk management has become an important part of modern corporate strategy, and executives have ranked risk management as one of their most important objectives (Bartram, 2000). Previous literature in this area has deemed corporate derivatives use as part of financial risk management activities and the fundamental assumption in nearly all of this literature has been that managers use derivatives for hedging (e.g., Tufano, 1996; Géczy et al., 1997; Rogers, 2002). In fact, firms use derivatives not only for hedging but also for trading (Allayannis and Ofek, 2001; Chernenko and Faulkender, 2011; Fung et al., 2012). However, for a long time it was believed that risk management is irrelevant to the value of the firm and the arguments were based on the financial irrelevance theories of Modigliani and Miller (1958).

The Modigliani and Miller (1958) and Miller and Modigliani (1963) irrelevance propositions suggest that, if the financial market is perfect and in the absence of market imperfections, financial risk management does not increase firm value and the decision to hedge corporate exposures is irrelevant to firm value. Hedging irrelevance proposition to firm value arises because individual investors who are only rewarded for bearing systematic risk can already costless hedge any firm specific risk in their own account through holding a diversified investment portfolio, and then corporate risk hedging cannot add value to the firm or to investors. However, in the real world it is apparent that firms engage in hedging activities on a regular basis and hedging activities represent an important part of corporate objectives that enable executives to manage firm's risk (Froot et al., 1993; Minton et al., 2009; Aretz and Bartram, 2010).

The Modigliani and Miller theorem of 1958-1963 represents the cornerstone of modern corporate finance, financial decisions, and financial risk management literature. However, much of the understanding of corporate risk management is based on models that are driven by relaxing one or more of the MM assumptions.[16] These models describe how various capital market imperfections shape firms' hedging policies and explain why corporate hedging can be rational or value-enhancing.

The theoretical literature explains the relevance of financial risk management decisions to firm value and highlights two classes of determinants on managers' decisions to hedge. The first one focuses on hedging as a means to maximize shareholders' value by reducing the likelihood of costly financial distress, underinvestment costs and expected taxes (Smith and Stulz, 1985; Froot et al., 1993). The second focuses on managerial risk aversion as a driver of financial risk management and show that managers use risk management to maximize their private utility (Stulz, 1984; Smith and Stulz, 1985; Tufano, 1996). In addition to these two determinants of derivatives use, the risk-taking incentive of the managers can play an essential role in corporate use of derivatives.

This thesis focuses on the managerial risk aversion and the risk-taking incentives of the managers, which represent an important factor that can influence a manager's decisions to use derivatives. The manager's risk aversion provides incentives to use derivatives for risk

[16] The basic M&M irrelevance proposition is based on the following key assumptions: 1) Perfect financial markets: no taxes, no transaction costs, no bankruptcy costs, no agency cost; 2) Competitive: perfect competition, no barriers to entry, equivalence in borrowing costs for companies and investors; 3) Rational investors: more return is good and more risk is bad; 4) Equal access to costless information: symmetry of market information, companies and investors have the same information.

management because his compensation is a function of firm value (Stulz, 1984). However, shareholders can counteract the effects of managers' risk aversion through stock option compensation, which increases the risk-taking of the managers. Theory predicts that firms whose managers hold more stock options are less inclined to use derivatives for hedging because of the risk-taking incentives generated by stock option plans (Smith and Stulz, 1985). The conflict of interests resulting from separation of ownership and control of the firm have attracted great attention among researchers working on the theme of the principal-agent problem with attempt to study agency conflicts arising from risk-related incentive when managers make financing choices like hedging by using derivatives (e.g., John and John, 1993; Aggarwal and Samwick, 1999; Chen et al., 2006; Coles et al., 2006).

According to the theory of the risk-related incentives problem, risk-neutral shareholders would like firm executives to undertake all positive net present value (NPV) projects including risky projects. Positive NPV projects will increase firm value and increase shareholders' wealth. However, the risk aversion of the firm's managers results from the significant portion of their wealth invested in the firm, which incentivises them to reduce firm risk. Managers who hold undiversified portfolios relative to shareholders have more concern about the downside of risky projects because managers' wealth is exposed to the risk of project returns. Risk-averse managers would prefer to undertake only less risky positive NPV projects, thus giving up some positive but risky NPV projects that shareholders would like them to undertake (Rajgopal and Shevlin, 2002; Rogers, 2002). A risk-related agency problem arises because managers care about systematic risk as well as firm risk. Shareholders, however, care only about the systematic risk, since they can diversify their portfolios to compensate for the firms' risk. Moreover, corporate managers are actually making investment and financing decisions including the financial risk management decisions in accordance with their risk-taking incentives; therefore the risk-taking incentives of managers is considered an important determinant of corporate hedging policy (Stulz, 1984; Tufano, 1996).

Jensen and Meckling (1976) illustrate that shareholders are expected to tie managers' wealth to the firm's stock price in order to reduce the risk-related agency problem. Shareholders can award some specific forms of stock option compensation to motivate managers to accept high-risk investment projects. Since the pay off of stock options compensation generates a positive relationship between a manager's wealth and firm risk, compensation components with convex payoffs can reduce the divergence of interests between managers and shareholders and induce risk-averse managers to use less derivatives to hedge risk and use more derivatives for trading if they view trading as an investment in valuable risk-increasing projects that they may otherwise forgo (Guay, 1999b). Smith and Stulz (1985) argue that the providing managers with more stock options in their compensation contract will mitigate managerial risk aversion and induce managers to make optimal investment and finance decisions.

This thesis extends the empirical literature on corporate derivatives use and explores how the risk-taking incentives of managers influence their decisions about derivatives use, and the consequences of derivatives activities on a firm's risk using data that distinguish between hedging and speculative purposes motivate by using derivatives. If firms are truly hedging, then a negative association is expected between derivatives use for hedging and a firm's risk. However, investigating the impact of derivatives use on a firm's risk is not separated from the first aspect of this thesis (i.e., risk-taking incentives and derivatives use).

This chapter describes research that has attempted to explain theoretically and empirically the linkage between managerial risk-taking incentives and derivatives use. This chapter also discusses and includes many previous empirical studies that investigate the use of derivatives and their impact on firm's risk. The remainder of this chapter is organised as follows. Section 2.2 provides a detailed overview of the relationship between CEO stock options compensation and derivatives use. The theoretical literature and the empirical studies on the relationship between the risk-taking incentives and derivatives use are discussed separately in subsections. Section 2.3 presents the theoretical literature on the effect of derivatives use on firms' risk based on the purpose of derivatives use. A literature review of the empirical studies on derivatives use and a firm's risk is also summarised. This chapter also outlines the research questions and hypotheses. Section 2.4 summarises the whole chapter.

2.2 Theoretical literature: CEO stock option compensation and derivatives use

2.2.1 CEO risk aversion and derivatives use

Corporate derivatives use for financial risk management can arise as a result of managerial risk aversion (Stulz, 1984; Tufano, 1998). Managers whose human capital and wealth are poorly diversified have an incentive to reduce firm risk more than may be desirable from the perspective of the well-diversified shareholders (Jensen and Meckling, 1976). If the managers have concave utility functions, [17] and the variability of a manager's compensation is positively related to the volatility of the corporate income or cash flows, then corporate volatility can be costly for the managers. If managers believe that it will be less costly for the firm to manage this risk than to manage it on their own account, they will direct their firms to use more derivatives to manage the firm's risk. Therefore, when managers' wealth is related to the firm's performance, the risk-aversion of managers can induce them to pursue financial risk management using more derivatives to hedge the firm's risk (Ertugrul, et al, 2008).

[17] A concave utility function implies that the utility of stock-based wealth increases at a decreasing rate as the sensitivities to price and volatility increase.

Stulz (1984) and Smith and Stulz (1985) describe the nature of the relationship between managerial risk aversion and derivatives use. The manager maximizes expected wealth and utility over his lifetime and managers' expected utility depends on the distribution of the firm's payoffs (i.e., is negatively affected by the variance of the firm's expected profits). Managers have an incentive to reduce the fluctuations in the firm share price to reduce the risk of their wealth invested in the firm.

Hedging can change the distribution of the firm's payoffs and, therefore, change the managers' expected utility (Graham and Rogers, 2002). Managers will benefit from hedging by reducing the uncertainty associated with the level of their wealth as a function of firm value and by reducing the likelihood that they are disciplined for poor firm performance (Whidbee and Wohar, 1999). Derivatives that are used to hedge firm's risk represent a chance for managers to protect their wealth invested in the firm and managers can undertake derivatives use for financial risk management in an attempt to make them better off by reducing the variance of total firm value and a firm's risk exposures.

The managerial risk aversion theory describes one important source of an agency problem between managers and shareholders. Smith and Stulz (1985) argue that a manager's hedging incentives are influenced by managerial risk aversion. Managers are exposed to higher risk compared with shareholders and therefore they will seek to protect their personal wealth and reduce their exposure to firm's risk at the expense of shareholders when the interests of managers are not perfectly aligned with those of the shareholders. This conflict of interests is expected to impact the usage of derivatives and managers tend to use more derivatives for hedging purposes.

The risk-related incentive problem impacts the hedging decisions of the firm. One possible result is that managers may hedge in a manner that does not maximize the value of the firm and tend to use derivatives to hedge as much as possible because their wealth will be higher when firm value is hedged (Adkins et al., 2007). Therefore, the shareholders will be concerned that managers will use derivatives for hedging to reduce their exposure and focus on the firm's specific risk instead of the total risk exposure of the firm. Although it is costly for both outside shareholders and managers to bear market risk, diversified shareholders have a clear cost advantage in bearing firm-specific risk, but managers typically hold large positions in their firms and are thus undiversified (Jin, 2002).

Overall, the managers will direct the firm to use derivatives to hedge when they believe that hedging will reduce their exposure to additional risk and to protect their personal investment portfolio. Further, when agency problems likely exist, managers have incentive to hedge more than is optimal from the perspective of a well-diversified shareholder, leading to suboptimal hedging strategies.

2.2.2 CEO stock option compensation, derivatives use, and risk-taking theory

One method to mitigate managerial risk aversion is to design compensation contracts that have a convex payoff structure of the firm's stock price and to give the managers incentives to choose actions that increase firm value and maximize the shareholders' wealth by increasing the value of their equity invested in the firm (Smith and Stulz, 1985).

Stock option compensation can be useful in motivating risk-averse managers to engage in risky projects preferred by shareholders. In addition to hedging with derivatives, managers can also use derivatives to adopt risky projects. The literature shows that derivatives can be used to hedge market exposure or to speculate on movements in the value of the underlying asset and managers can engage in speculating using derivatives (Stulz, 1996; Hentschel and Kothari, 2001; Adam and Fernando, 2006). Speculating with derivatives generally implies that managers are using derivatives with the primary intention of making a profit or increasing risk (Géczy et al., 2007).

The convexity in the payoff of stock options encourages managers to reduce derivatives use for risk management. Smith and Stulz (1985) based their arguments on the sensitivity of stock options to stock return volatility. Hedging with derivatives enables managers to diversify risk and to be less exposed to stock price volatility. Smith and Stulz (1985) show that more stock options in an executive's compensation package can influence their hedging behaviour and provide a disincentive hedging behaviour. The explanation is that stock options create a convex function between the executives' utility and the firm value. The stock option value has a convex relationship with the underlying stock price and volatility. Thus, the value of managers' stock options increases with the volatility of the firm's stock return. This sensitivity to stock return volatility should encourage managers to take more risk. Therefore, providing managers with more stock options in their compensation package will induce appropriate action by managers, reduce risk-related incentive problems, and align the interests of managers and shareholders. In this case managers will benefit from increased firm risk since this will lead to increase volatility of the firm's value hence the value of their stock options will increase.

Option-based compensation has become an important compensation vehicle for most companies to align the CEO's interest with shareholders (Duan and Wei, 2009; Rogers, 2002; Coles et al., 2006). Further, it is an effective tool for shareholders to mitigate the effects of excessive risk-aversion by giving managers incentives to adopt rather than avoid risky projects (Hirshleifer and Suh, 1992).

Theoretical literature predicts the existence of a positive relationship between option-based compensation and incentives for managers to increase firm risk because stock price volatility increases managers' option values. Such models predict a positive association between the stock option compensation and derivatives use for speculation, even if speculation only increases the volatility of underlying firm value without a commensurate return to risk (Géczy et al., 2007).

Executive stock options and behavioural responses

Some studies argue that stock option compensation may not always result in a better alignment of interests between managers and shareholders. These studies describe how the behavioural responses of managers, such as discretionary accounting practices and earning smoothing can influence the incentive provided by stock option compensation.

The perspective of agency theory states that compensation contract may sometimes motivate managers to manipulate performance results (Moradi et al., 2015). Prior research in earning management, via discretionary accruals, describes many reasons for manipulating the results of operations, one of which is a bonus plan (Gaver et al., 1995; Bergstresser and Philippon, 2006). This shows that executives' decisions to smooth earnings can be related to the contractual motive of executive compensation (Healy and Palepu, 2000). Therefore, earnings smoothing can be viewed as an outcome of executives' opportunistic behaviour to maximize their compensation (Das et al., 2013).

In executive compensation literature, earnings smoothing is defined as under-reporting or over-reporting of earnings via discretionary accruals to manage earnings volatility (Goel and Thakor, 2003; Bouwman, 2014). Thus, earnings smoothing makes reported earnings sometimes higher than economic earnings and sometimes lower.

Prior empirical studies show that managers use their authority to choose accounting methods to achieve their goals (Roychowdhury, 2006; Cohen et al., 2008; Zang, 2012).

Earnings management may occur through the use of discretionary accruals when managers use judgment in financial reporting and in structuring transactions to alter reported results in order to influence the value of their compensation which depend on reported figures (Healy and Wahlen, 1998). For example, Gaver et al. (1995) and Burgstahler and Dichev (1997) show that when earnings before discretionary accruals fall below the lower bound, specified by the bonus plan, managers select income increasing discretionary accruals. This indicates that managers manipulate reported earnings for their own gains and their incentives to use earnings smoothing increase when they have a direct stake in the reported numbers. Accordingly, managers may exploit accounting rules to manage their reported earnings with the intent of obtaining some private gain and they view this as a useful tool to dress up financial statements to increase bonuses and job security at the expense of shareholders (Healey and Wahlen, 1999; Roychowdhury, 2006; Cohen et al., 2008; Zang, 2012).

Large stock option compensation may influence managerial behaviour and provide an incentive to manipulate firms reported earnings, in order to increase the value of their stock options (Rajgopal and Shevlin, 2002). Bergstresser and Philippon (2006) and Das et al. (2013) present empirical evidence that earning management via discretionary accruals is more pronounced at firms where the CEO's total compensation is more closely tied to the value of stock options. They argue that managers with more stock compensation will tend to smooth more, while stock options encourage the manager to increase stock price volatility. This is mainly because higher stock price volatility increases the value of the options. Managers will tend to overstate earnings when the option component is relatively large, and when the sensitivity of the option value to stock price is relatively high (Gao and Shrieves, 2002). Denis, Hanouna and Sarin (2006) find that there is a significant positive association between opportunistic management choices and stock option incentives.

These studies show that providing managers with incentives compensation requires careful consideration of their possible good and ill effects. In this context, earnings management can be viewed as a mechanism that allows managers to avoid the undesirable consequences of risk on the value of their stock options. Such behaviour would make sense for managers whose bonus-linked incentives are focused on meeting explicit targets for earnings.

2.2.3 CDS use for hedging purposes and CDS use for trading purposes

CDS for hedging purposes

The related literature introduces different classifications for risk that investors face. Some categorise risk into three different types: business risk, strategic risk, and financial risk (Jorion, 1997). Others show that risk can be broken into two parts: financial risk and non-financial risk (Cabedo and Tirado, 2004). According to modern portfolio theory, the total risk of the firm can be decomposed into systematic risk (also called aggregate risk or market risk) and Idiosyncratic Risk (firm-specific or non- systematic risk).

Idiosyncratic risk is the risk that is unique to a particular security and can be associated with such risks as business, financial, and liquidity, etc. Shareholders can diversify away the idiosyncratic risk of a particular security by holding a sufficiently large basket of assets. Idiosyncratic risk of an individual security that caused by factors unique to that security can be greatly reduced or even totally eliminated by investors who hold a diversified collection (portfolio) of securities. Hedging with derivatives can be used to reduce and diversify idiosyncratic risk (Tufano, 1996; Berk and DeMarzo, 2001; Jin and Jorion, 2006; Gao, 2010). An example of non-systematic risk is the poor earnings of firms, reputation, or a strike amongst a firm's employees, and the availability of raw materials (Moyer et al., 1998, P 191). While systematic risk (market risk) affects the aggregate market and cannot be eliminated by diversification.

The systematic risk of a security refers to that portion of the return variability caused by factors affecting the security market as whole. Thus, systematic risk is related to broad swings in the stock market and can be described as unavoidable risk (Ross et al., 2000; Berk and DeMarzo, 2001). Some common sources of systematic risk are political, economic and social risks, over which an organisation has little control, such as war, change in purchasing power (inflation), interest rate changes, and currency exchange rate risk. As systematic risk cannot be eliminated through diversification or hedging, it commands returns in excess of the risk free rate investment (while idiosyncratic risk does not command such returns because it can be eliminated by diversification).

Acharya and Bisin (2009) show how the incentive of managers can influence their hedging behaviour. Managers may pass up profitable projects with idiosyncratic risk in favour of standard projects that have greater aggregate risk. This risk-substitution moral hazard arises when managers can affect the risk composition of their firms' cash flow and enables managers to be better diversified. However, such risk substitution occurs at the cost of reducing the firm's market value and may lead to excessive systematic risk.

Literature shows that it is important to distinguish between systematic and idiosyncratic risk when studying the effect of the risk-taking incentives provided by stock option compensation (e.g., Tufano, 1996; Jin and Jorion; 2006). Stock option compensation may induce risk-averse managers to increase total firm's risk by increasing systematic instead of idiosyncratic risk. This is mainly because an increase in systematic risk can result in a greater stock option value compared with an equivalent increase in idiosyncratic risk. This differential risk-taking incentive stems from CEOs' ability to use hedging in order to reduce any unwanted increase in their firm's risk. Therefore stock option compensation might not necessarily induce managers to undertake positive NPV projects that are primarily characterized by idiosyncratic risk when projects with systematic risk are available as an alternative (Armstrong and Vashishtha, 2012).

The risk diversification potential of credit derivatives has been widely discussed and acknowledged (Hirtle, 2009). CDS, which represents the largest sector of the credit derivatives market, are considered an important tool that enables firms to manage their portfolio of credit risks more efficiently (Minton et al., 2009). Indeed, CDS create new hedging opportunities and the development of the CDS market provide managers with a new, less expensive way to hedge or lay off a firm's credit risk (Ashcraft and Santos, 2009).

Managers are responsible for taking many decisions on behalf of the shareholders, such as financial risk management decisions, investment decisions, and financing decisions (Rogers, 2002; Adkins et al., 2007). Financial risk management activity undertaken by a firm's executive can be driven by the objective of protecting managerial interest. Therefore, the effect of managerial incentive can be positively related to the decision to use CDS for hedging purposes.

Managers are viewed as less-diversified compared to the shareholders, and have limited ability to diversify their wealth, which is tied to the firm value (Jensen and Meckling, 1976). These conditions encourage managers to avoid risk-taking by implementing conservative strategies such as using derivatives more to hedge the firm's risk. Therefore, undiversified managers have a higher incentive for firm risk reduction since their compensation and firm-specific wealth invested in the firm, both through stock ownership and human capital which related to the ongoing existence of the firm. Further, managers believe that if they take more risk, all the benefits will go to the shareholders and they will bear all the cost of that excessive risky investment such as losing their jobs (Jensen and Meckling, 1976; Tufano, 1996).

Shareholders can diversify away the non-systematic risk of a particular firm by holding a sufficiently large basket of assets. Consequently, based on the modern portfolio theory shareholders can be considered as risk-neutral investors. However, managers are still considered to be risk-averse to not only market risk but also firm-specific risk and this will increase their incentive to avoid risk using more financial risk management since there is a significant amount of their wealth and income tied to firm performance (Jensen and

Meckling, 1976; Stulz, 1996). This is the assumption underlying the risk-related incentive problem described through the traditional principal agent theory.

A firm's risk represents a "non-systematic or diversifiable" risk that shareholders can eliminate by holding diversified portfolios (Stulz, 1996). Diversification represents an inexpensive risk management tool for shareholders and makes them indifferent to the firm's specific risk. Therefore, shareholders prefer less CDS for hedging and are more willing to invest in risky investment projects, which maximize their value (Stulz, 1984; Rajgopal and Shevlin, 2002). The theory implies that poorly-diversified managers will direct their firms to engage in hedging to protect their interests and they are expected to use more CDS to reduce the firm's risk to a level that conflict with shareholders' interests.

This thesis examines the influence of the risk-taking incentive induced by stock options on the decision to use CDS for hedging purposes by European banks. This thesis is different to prior empirical studies because it is the first to address the influence of managers' risk-taking incentives on CDS use. Further, this thesis takes advantage of the more detailed disclosure requirements that classify derivatives as hedging derivatives or speculating derivatives, where many prior studies have assumed that firms are generally using derivatives for hedging. However, prior empirical literature has provided conclusions that vary by sector, period, country, and econometric techniques used in the analysis, thereby making it difficult to generalize about the real motivations of companies using these financial instruments (Tufano, 1996; Gay and Nam, 1998; Rajgopal and Shevlin, 2002; Chen et al., 2006; Coles et al., 2006).

CDS use for trading purposes

The use of derivatives by firms as assumed in the literature is for managing firm risk, and the empirical evidence in the literature to suggest that derivatives are an instrument used to avoid risk by assuming that firms use derivative for hedging (e.g., Tufano, 1996; Géczy et al., 1997; Gay and Nam. 1998). Alternatively, another interesting application relates the potential for firms to use derivatives to take on risk by using derivatives for trading (speculating).

CDS can increase or decrease firm's risk and the value of the firm, depending on the motive of CDS usage (Fung et al., 2012). Managers can simply use CDS as an extension of taking more credit risk and as tools to increase the firm's credit exposures and increase return volatility (Stulz, 1996; Hentschel and Kothari, 2001; Nijskens and Wagner, 2011; Rossi, 2011). The existing empirical research on credit derivatives use shows that the CDS position of many banks is for dealer (trading) activities and not for credit risk management and that credit derivatives use for hedging is limited (Minton et al., 2009). This show that firms can use CDS for income generation and this likely increases the firms' exposure to credit risk (Fung et al., 2012). Further, banks can increase their risk-taking when managers use CDS to source new credit risk, such as by selling protection in the CDS market. This shows that banks can use CDS to hedge any risk they may have by buying protection using CDS, while at the same time buying credit risk by selling protection in the CDS market (Nijskens and Wagner, 2011). The literature suggests that firms that use more derivatives to speculate are likely to believe that they have a comparative information advantage relative to the market, and hence view speculation as a positive net present value (NPV) and profitable activity (Géczy et al., 2007).

Speculation can be viewed as a profit-making activity in rational markets if the firm has an information advantage related to the prices of the instruments underlying the derivatives, or it must have economies of scale in transaction costs allowing for profitable arbitrage opportunities. Shareholders are likely to support the use of derivatives for speculation if speculation is a profit-making activity (Géczy et al., 1997; Adam and Fernando, 2006).

From the above it can be clearly noted that the existing literature shows that the reasons behind using derivatives for speculating are obviously different from the reasons behind using derivatives for hedging (Adkins et al., 2007). The actual corporate use of derivatives does not seem to correspond closely to the theory. In practice many companies appear to be using financial risk management to pursue goals other than reducing volatility (Stulz, 1996). Recently, firms have been required to report derivatives used for trading purposes separately from derivatives used for hedging purposes.[18]

2.2.4 Risk-taking incentive and derivatives use: Review of the previous literature

The risk-taking incentive of the stock option-based compensation is considered a determinant of the financial risk management choice. Several empirical studies support this argument (Tufano, 1996; Gay and Nam, 1998; Rajgopal and Shevlin, 2002; Rogers, 2002; Adkins et al., 2007; Supanvanij and Strauss, 2010). In the banking industry the use of stock option compensation has become more prevalent, and the percentage of stock option compensation relative to total managerial compensation has also increased compared with industrial firms (Chen et al., 2006). Appendix A summarises the empirical literature about risk-taking incentives of stock options and derivatives usage.

Several studies have tried to empirically investigate the linkage between compensation induce risk-taking incentives and corporate derivative use. One strand of literature has modelled risk-taking incentives using proportion of stock options. For example, Tufano (1996) uses commodity derivatives to examine financial risk management practices within the gold and mining industry. His sample consists of 48 firms from the period of 1990 to

[18] This is achieved through International Accounting Standard statement number 39 (IAS 39): *Financial Instruments Recognition and Measurement*. IAS 39 determines how financial instruments are classified into various categories depending upon the type of instrument, which then determines the subsequent measurement of the instrument. IAS 39 was reissued in December 2003, applies to annual periods beginning on or after 1 January 2005.

1993. The results support the managerial risk-aversion argument. He argues that firms' managers who hold more options tend to hedge less, while firms' managers who hold more stock follow a more conservative policy and hedge more. He finds that financial risk management is negatively related to the number of options and positively related to the number of stocks held by managers.

Gay and Nam (1998) use a sample of 325 US nonfinancial companies in 1995. They use stock and stock option to proxy for managers' risk aversion. Based on the theoretical prediction of Smith and Stulz (1985) and the empirical findings of Tufano (1996) they predict a positive relationship between managerial shareholding and the use of derivatives, and a negative relationship between stock option-holding and derivative usage. The results contrast with their predictions. They find a positive relationship between option and derivatives usage and a negative linkage between managerial shareholdings and derivatives usage.

Also, Géczy, Minton, and Schrand (1997) who use a different measure for risk-taking incentives over a different time period find a positive relationship between managerial stock options and derivative usage. They use the log of the market value of the shares obtained by using outstanding options. They use a sample of 372 US nonfinancial firms in 1990. This positive relationship between stock options and derivatives use does not support managerial incentives theory of hedging. Similarly, Knopf et al. (2002) find a positive relationship between managerial stock options and hedging derivatives when they measure the risk-taking incentive generated by stock options using the number or the value of the shares that could be obtained by exercising options. The results of Géczy et al. (1997) and Gay and Nam (1998) contradict the theoretical prediction that stock option compensation increases the risk-taking incentives of the executives and provide them with an incentive to reduce the use of derivatives for risk management. These results show the need for further investigation of the relationship between the risk-taking incentive of the stock options and derivative use.

The literature emphasises that a more precise measure of the incentives faced by managers should be used, because using variables such as the number or value of options or stock held are noisy proxies and do not fully capture managers' risk-taking incentives. The correct variables for risk-taking incentive should measure the total sensitivities of wealth to stock price and volatility (Knopf et al., 2002; Core, Guay, and Larcker, 2003).

According to Smith and Stulz (1985) managers will induce the firm to hedge less as the sensitivity of the manager's wealth to stock volatility increases. Guay (1999b) proposes a more direct estimate of sensitivity to measure the managerial risk-taking incentive. He uses vega, which represents the sensitivity of managers wealth to firm risk. Vega measures the changes in managers' options value generated by changes in stock return volatility.[19] Higher vega induces managers to take more risky investment choices, and therefore, to align managers' incentive with those of shareholders.[20] He shows that firms use stock option compensation to control for the risk-related incentive problem and to motivate managers to invest in valuable risk-increasing projects that they may otherwise forgo.

The same sensitivity measure is adopted other empirical studies. Knopf et al. (2002), Rajgopal and Shevlin (2002), and Ertugrul, Sezer, and Sirmans (2008) are among the empirical studies that examine the risk-taking incentive generated by stock options compensation and hedging derivatives. Knopf et al. (2002), Rajgopal and Shevlin (2002), and Ertugrul, Sezer, and Sirmans (2008) implement the procedure introduced by Guay (1999b) to estimate managers' risk-taking incentives (i.e., the option portfolio sensitivity to volatility). Knopf et al. (2002) test the relationship between managers' risk preferences and hedging activities using a sample of 260 US nonfinancial firms in 1996. They use different measures for managerial risk-taking incentives. They use the sensitivity of managers' stock option

[19] Vega is defined as the dollar value change in the executive's option portfolio for a 1% change in the annualised standard deviation of stock returns.

[20] Guay (1999) estimates vega for CEO common stockholdings. However, he finds that common stockholdings provide essentially no risk-taking incentives.

portfolios to stock return volatility (vega) to test the linkage between managers' risk-taking incentives and hedging activities. They document a negative relationship between the sensitivity of the stock option portfolio to stock return volatility, and the firms' use of derivatives. This is consistent with the theoretical prediction in Smith and Stulz (1985).[21]

Some empirical evidence focuses on a single industry to study the effect of stock options on derivative usage. Similar results about the relationship between stock option compensation and risk-taking incentive are reported within a single industry. Rajgopal and Shevlin (2002) use a sample of 117 US firms in the oil and gas industry between 1993 and 1997. They examine how stock options influence managers' incentives to invest in risky projects. They find that the sensitivity of executive stock options to stock return volatility is associated with less hedging. Their results are consistent with the theory that stock options reduce the managerial incentive problem and support the managerial risk-aversion hypothesis. In the same instance, it is indicated that the CEO's sensitivity to stock return volatility is negatively related to hedging in support of managerial risk aversion arguments. Ertugrul et al. (2008) provide evidence from the real estate investment trust industry to support a managerial risk-aversion motive for corporate hedging. They use a sample of 100 firms in 1999, 100 firms in 2000, and 112 in 2001 in the US. They find a significant negative linkage between the sensitivity of a CEO's stock options portfolio to stock return volatility and hedging. Their evidence supports the managerial risk-aversion motive for corporate hedging.

Different measures for risk-taking incentives

Another group of studies proposes a different measure to examine the linkage between financial risk management and risk-taking incentives (Rogers, 2002; Supanvanij and Strauss, 2010). For instance, Rogers (2002) uses the ratio of vega-to-delta to measure risk-taking

[21] Knopf et al. (2002) use the number of the stock option to proxy for the risk-taking incentive and find a positive relation between stock options and derivatives use which contradicts the theoretical prediction in Smith and Stulz (1985).

incentives of CEOs. He investigates the association between a CEO’s risk-taking incentives and the corporate interest rate or foreign currency derivative usage. Rogers’s sample consists of 569 randomly selected US firms whose accounting year ended between December 15, 1994–October 31, 1995. He finds a negative relationship between CEO risk-taking incentives and derivatives holding. More recently, Supanvanij and Strauss (2010) analyse the effect of CEO compensation on the use of derivatives. They use a sample consisting of 198 US nonfinancial firms during 1994–2000. They find a negative linkage between hedging and stock options. They show that executives’ stock options represent one of the significant factors that determine derivative usage.

While much attention has been paid to the linkage between the managerial risk-taking incentives generated by stock option compensation and derivatives usage in industrial firms, extant research has overlooked this issue in the banking sector. Only a few empirical studies test the linkage between the executive risk-taking incentives and derivatives usage in the banking industry. Using a sample of 252 US large bank holding companies from the period of 1996 through 2000, Adkins, Carter, and Simpson (2007) examine how managerial compensation and ownership influence the usage of foreign-exchange derivatives. They conclude that the use of derivatives is negatively related to the value of CEO option awards but positively related to managerial ownership. These results are consistent with the theoretical argument of Smith and Stulz (1985).

There are also different strands of empirical evidence on compensation literature have attempted to address the relationship between stock options and risk-taking incentives of executives in relation to corporate investment and finance decisions, and the effect of risk-taking incentives on the risk choices made by firm executives. These studies investigate how the risk-taking incentive generated by stock options affects observable managerial decisions that can alter a firm’s risk and stock-return volatility. Managers can implement different risk-taking activities other than reducing derivatives use to increase firm risk because stock price volatility increases their stock options' values (Géczy et al., 2007). For example, Coles, Daniel and Naveen (2006) examine the linkage between managerial risk-taking incentive and firm's investment and debt policy. They use a sample of 10,687 US nonfinancial firms from the period 1992 to 2002. They document a positive relationship between the vega of CEO option holdings and firm's risky policy (higher R&D, lower capital expenditures, higher leverage). Another strand of empirical studies explores executive risk-taking in the banking industry. For example, Chen et al. (2006) use a sample of 591 US bank-CEO-years observations between 1992 and 2000. They use four market measures of risk to capture how option compensation induces risk-taking.[22] They show that stock option compensation incentivises risk-taking in the banking industry. They document a positive linkage between the value of stock options and risk taking. Hagendorff and Vallascas (2011) use a sample of 172 US bank merges to investigate how the structure of CEO compensation at the acquiring banks affects the default risk implications of mergers. They find that the executive risk-taking incentive (vega) is associated with a higher riskiness in CEOs' investment choices. Higher vega induces executives to make riskier choices in their mergers and acquisition decisions.

More recently, Bai and Elyasiani (2013) investigate the relationship between the riskiness of banks and their executive compensation structure. They find that higher sensitivity of CEO wealth to stock return volatility (vega) induces the CEOs to implement riskier policies, such as increasing non-traditional banking activities, leading to higher return volatility and lower bank stability. In contrast, Acrey et al. (2011) find that the value of the CEO's stock options seems to mitigate bank risk. Fahlenbrach and Stulz (2011) point out that the banks with higher option compensation for their CEOs did not perform worse during the crisis.

[22] Total, systematic, idiosyncratic, and interest rate risk.

In summary, many empirical studies show that there is no significant linkage between managerial motive and derivative usage (Géczy et al., 1997; Gay and Nam, 1998; Haushalter, 2000; Allayannis and Ofek, 2001). More interestingly, Acrey et al. (2011) find that the use of stock options is negatively correlated with bank risk. In the presence of mixed evidence from prior studies, this study hypothesises that the use of stock options will induce managers to use more derivatives for trading purposes through using CDS, which represent one of the largest components of the credit derivatives market.

2.2.5 Research gap and research questions

Prior empirical studies in this area tried to examine the linkage between executive compensation and the usage of derivatives (e.g., Tufano, 1996; Gay and Nam, 1998; Rajgopal and Shevlin, 2002; Rogers, 2002; Adkins et al., 2007; Supanvanij and Strauss, 2010). However, a review of the empirical and analytical literature in financial risk management shows that previous studies have focused on the linkage between the executive risk-taking incentive and the usage of derivatives by assuming that firms use derivatives for hedging (e.g., Tufano, 1996; Géczy et al., 1997; Gay and Nam, 1998). Some other studies went further to explain why firms use derivatives in connection with executive risk-taking incentives. Their argument suggests that the negative relationship between the risk-taking incentive and derivatives usage is evident that firms use derivatives for hedging and the primary goal is to mitigate the firm's risk. For example, Rogers (2002) and Tufano (1996) illustrate that when there is a negative association between derivatives usage and risk taking-incentive then this is consistent with the notion that derivatives are held for hedging. Géczy et al. (1997) and Knopf et al. (2002) state that their measure of hedging activities might not capture firms that use derivatives for trading purposes instead of hedging. Géczy et al. (2007) try to overcome this issue by using survey data to identify whether firms use derivatives for risk management or speculating purposes. They find that nonfinancial firms whose managers have higher risk-taking incentives are more likely to use derivatives for speculative purposes. However, using surveys is a less accurate method to check how firms use derivatives, because executives might be less explicit in admitting that they hold derivatives to speculate rather than reduce the firm's risk (Supanvanij and Strauss, 2010; Rossi, 2011). In addition, it is difficult to ascertain the roles, which selective or dishonest responses play in survey data (Hentschel and Kothari, 2001).

As indicated above, previous empirical studies consider derivatives as a whole without differentiating them on the basis of the motive of using derivatives. Taking advantage of the recent development on both derivatives and compensation reporting[23], this research advances the credit risk management literature by making these differentiations. Furthermore, prior empirical studies focus on foreign exchange derivatives, interest rate derivatives, and currency and commodity derivatives. This study also contributes to the literature by analysing the linkage between executive risk-taking incentive and credit derivatives by using data on CDS, which are considered one of the largest categories of credit derivative market (Minton et al., 2009; Calice et al., 2012; Norden et al., 2011).[24]

Moreover, many earlier studies have used very simple measures for stock options, such as the number of stock options (Tufano, 1996; Gay and Nam, 1998) and the value of the stock options (Géczy et al., 1997). However, these simple proxies provide weak explanations for the risk-taking incentives of executives (Guay, 1999b). This research follows Core and Guay's (2002) methodology to use vega as a measure for risk-taking incentives. Using vega to measure risk-taking incentives is effectively unbiased and 99% correlated with the

[23] The quality of the published information on the firms' derivatives has increased after the adoption of International Accounting Standards No. 39(IAS 39) and Financial Accounting Standards No. 133 (FAS133) Supanvanij and Strauss (2010).

[24] International Swaps and Derivatives Association, market survey 2007; International Swaps and Derivatives Association market survey, 2009.

measures that would be obtained if the parameters of a CEO's option portfolio were completely known (Gao, 2010). In addition, empirical studies point out that this measure is considered a better way to estimate the impact of the managerial compensation incentive on bank risk (Cohen et al., 2000; Knopf et al., 2002).

Overall, there is no empirical research on the role of executive stock options compensation on CDS use. Although the above studies focus mainly on analysing how stock options encourage managers to become less risk averse, these studies have documented mixed results and show that empirical studies are not consistent with regard to the incentive effects of executives' stock options compensation. Further, a considerable numbers of the existing literature has focused on nonfinancial firms. A limited number of empirical studies have examined financial firms. In addition, most of this work in this area is mainly based on US data.

Thus, based on the previous discussion of the relationship between risk-taking incentives of stock option compensation and derivatives use, the first research question is formulated as follows:

Research Question 1: Do the CEOs' risk-taking incentives generated by stock option compensation influence the use of CDS? This question is extended to include the following sub-questions:

- Do the CEOs' risk-taking incentives of stock option compensation influence the use of CDS for hedging purposes?
- Do the CEOs' risk-taking incentives of stock option compensation influence the use of CDS for trading purposes?

The above questions will be investigated based on the following hypotheses:

H_1 (a): higher risk-taking incentives of stock option compensations are associated with less CDS use for hedging purposes.

H_2 (a): higher risk-taking incentives of stock option compensations are associated with greater CDS use for trading purposes.

2.3 CDS usage and firm risk

2.3.1 Impact of CDS use for hedging purposes on firm risk

In a classic Modigliani and Miller (1958) world with perfect capital markets, hedging should be irrelevant. Hedging financial risk does not increase firm value because shareholders can undo any financial risk management activities implemented by the firm at the same cost. In other words, shareholders possess the requisite tools and information to create their desired risk profiles, and therefore, there is no reason for a firm to hedge. The theoretical literature on hedging relaxes Modigliani and Miller's (1958) assumptions and develops specific reasons why individual firms may choose to hedge (Smith and Stulz, 1985; Froot et al., 1993).

Prior studies in financial risk management show that derivatives use that reduces return volatility is viewed as hedging derivatives (Hentschel and Kothari, 2001; Fung et al., 2012). Smith and Stulz (1985) show that hedging reduces the firm's return volatility that result from imperfections in the capital market. They show that return volatility is costly and that firms use financial risk management with derivatives to reduce stock return volatility. Therefore, when firms use derivatives to hedge, the stock return volatility of firms should fall after they start using derivatives (Stulz, 2004). In recent years, firms have dramatically increased their risk transfer activities through the use of credit derivatives, and mostly in the form of CDS (Nijskens and Wagner, 2011).

Hedging can increase shareholders value because it reduces the cost associated with financial distress. According to Smith and Stulz (1985) firms with existing debt can benefit from using derivative for hedging, as hedging may reduce the cost of debt by reducing the volatility of a firm's cash flows or earnings and smoothing the cash flow, which reduces the probability of default. Hedging activities reduce the probability of financial distress and reduce the present value of financial distress. Consequently, hedging increases shareholders' wealth because it decreases the expected value of direct bankruptcy costs. Moreover, hedging can increase shareholder value because hedging reduces the variability of the taxable income and increases the present value of tax shields by smoothing out earnings. Another rational for financial risk management is the cost of underinvestment problem. Froot at al. (1993) show that when the cost of external financing is higher than the cost of internal financing, hedging can mitigate the underinvestment problem because it ensures the availability of more internally generated funds that could be used to undertake the available investment opportunities. Accordingly, firm with greater volatility in stock return or cash flows have greater potential benefits of using hedging derivatives because hedging alleviates their return volatility and ensures that a firm has sufficient internal funds by reducing unnecessary fluctuations (Géczy et al., 1997; Haushalter, 2000).

Based on these theoretical arguments, the empirical literature has attempted to investigate why companies use derivatives. These theories implicitly assume that firms reduce the risks they face by using more derivatives. Therefore, the managerial risk aversion hypothesis assumes that risk management strategies are implemented, principally, to enhance the position of the firm's management and to reduce firm's risk. Empirical evidence in this area is relatively limited to a very small number of US studies.

2.3.2 Impact of CDS use for trading purposes on firm risk

The theoretical literature about managerial risk-taking incentives make an intuitive prediction of a positive relationship between option-based compensation and incentives for managers to take risks with respect to derivatives because stock price volatility increases call option values. Accordingly a positive association is predicted between the sensitivity of a manager's compensation to equity price volatility and speculation, even if speculation only increases the volatility of underlying firm value without a corresponding return to risk (Géczy et al., 2007). Stulz (1996) argues that firm compensation schemes can lead managers to speculate when their compensation packages reward them for such behaviour. In general, firms for which options are a more important component of managerial compensation are less likely to use derivatives to hedge (Bartram, Brown, and Conrad, 2011). Managers who hold options benefit from increases in volatility, since their options will be worth more if the stock price rises, but the option will never be worth less than zero if the stock price falls (Stulz, 2004).

Managers can use derivatives to speculate. Since speculative activity is not expected to be correlated, on average, with firms' underlying exposures, derivative securities used for this purpose are anticipated to increase firm risk (Guay, 1999a). The potential motives of managers to speculate is higher when they believe that they have a comparative information advantage relative to the market, and hence to view speculation as a positive net present value (NPV) and profitable activity (Stulz, 1996; Géczy et al., 2007). Stulz (1996) uses the term "selective hedging" to refer to the strategies of managers who incorporate their market views into their hedging policy.

In addition, managers in highly leveraged firms are subject to a greater risk-shifting problem because high leverage allows shareholders to capture most of the gains from the risky projects while the downside risk of those projects is largely born by depositors and deposit insurers (Jensen and Meckling, 1976). Therefore, if the interest of the executives is aligned with those of the shareholders, then executives have greater incentives to shift risk on behalf of shareholders (Whidbee and Wohar, 1999; Bai and Elyasiani, 2013). The shareholders have an incentive to provide managers with more stock option compensation in order to induce them to take on additional risk like using more CDS for trading purposes. Hence, increased option-based compensation may aggravate the risk-shifting problem associated with leverage in financial firms (Bai and Elyasiani, 2013).

The existing theories of corporate hedging assume that the use of derivatives does not itself increase a firm's value. Rather, the use of derivatives is thought to add value by alleviating a variety of market imperfections through hedging (Smith and Stulz, 1985; Froot et al., 1993). However, it is possible that managers believe they can create value for shareholders by incorporating speculative elements into their hedging programmes.

Empirical literature provides evidence that most of the banks use credit derivatives for trading purposes more than for the hedging of loans (Hentschel and Kothari, 2001; Adam and Fernando, 2006; Minton et al., 2009; Fung et al., 2012). Whidbee and Wohar (1999) mentioned that banks use derivatives for speculative purposes, but most firms in the banking industry argue that the primary objective for using derivatives is to reduce risk exposures. Rossi (2011) also confirms that firms are using derivatives for speculating purposes. He finds a significant number of non-financial firms speculate in the derivatives market.

Despite the importance of the topic and the great debate about the role of credit derivatives after the last financial crisis, it appears that derivatives use for trading purposes is not well-explained by existing financial risk management theory and it seems to be essentially no theoretical model that explains the link between derivatives use for trading purposes and a firm's riskiness (Tufano, 1996; Aretz and Bartram, 2010).

There are however, two notable indirect exceptions. Instefjord (2005) provides a simple model driven by costs of financial distress to discuss if credit derivative use has a destabilizing effect on the banking sector. He believes that derivatives use for trading purposes makes banks riskier and considered them to be a potential threat to bank stability. There are also theories that predict that firm owners might use derivatives to increase firms' risk. These theories build on the Black and Scholes (1973) analogy between options and corporate claims. The analogy suggests that high volatility is beneficial to equity shareholders at the expense of debtholders. In leverage firms, shareholders' claim on firm value has the properties of a call option on the assets of the firm. Therefore shareholders will capture most of the gain from risky projects, while the debtholders will face the downside risk of those projects. Accordingly, shareholders have a rationale to provide their managers with incentives to use derivatives if they believe that this will increase their equity value at the expense of debtholders. However, Duffee and Zhou (2001) argue that the introduction of a credit-derivatives market does not necessarily benefit the bank. They point out that theory alone cannot determine whether a market for credit derivatives will help banks better manage their loan credit risks. They also believe that this issue is ultimately an empirical one. Empirically, literature provides limited evidence to bear on the implications that these theories have for the firms' use of derivatives. In large part, this lack of evidence can be related to poor data availability.

Overall, the relationship between credit derivatives and a firm's risk is highly important in banking since banks dominate most derivatives markets and are considered to be heavy users of credit derivatives (Minton et al., 2009). Several theoretical models have been developed, and different empirical methodologies have been adopted in order to investigate the market implications of using hedging derivatives. However, after the rapid growth in the credit derivative market and the great debate about the role of CDS in the stability of the banking industry, derivatives trading activities have become increasingly important.

2.3.3 Derivatives use and firm risk: Review of the previous literature

Literature on financial risk management examines which theory of hedging is consistent with the use of derivatives. A large number of studies have examined the extent and nature of derivatives use. Indeed, most empirical studies tried to find evidence on the purpose of using derivatives.

However, existing financial risk management studies ignore the linkage between the purposes of derivatives usage and a firm's risk. Prior empirical analysis tried to answer whether firms use derivatives to hedge or to speculate. The net impact of derivative usage on a firm's risk is, therefore, an empirical issue. There is no study in the existing literature exploring the linkage between CDS usage and a firm's risk, which distinguishes between CDS use for hedging purposes and CDS use for trading purposes in European banks.

Moreover, the majority of the empirical works have focused on nonfinancial firms to discuss this issue. Some of these studies are based on survey data, such as Géczy et al. (2007). They use survey data to identify speculators among 341 US publicly traded nonfinancial firms. They investigate the linkage between managerial compensation and speculation and find that speculating firms try to encourage managers to speculate through incentive-aligning compensation. They believe that riskier companies will use more derivatives for speculating purposes.

Tufano (1996) uses a sample of 48 gold mining firms. He reports evidence that is consistent with the use of derivatives for hedging to reduce risk in response to risk aversion by managers and owners. Allayannis and Ofek (2001) examine whether firms use foreign currency derivatives for hedging purposes or for speculative purposes. They use a sample of S&P 500 nonfinancial firms in 1993. They suggest that using derivatives for hedging will reduce a firm's foreign exchange-rate exposure. The results suggest that firms use derivatives for hedging purposes. They find a negative association between foreign currency derivative use and firm exchange-rate exposure. In contrast, Faulkender (2005) uses data for 133 US firms in the chemical industry from the period of 1994 to 1999. He finds evidence of speculation in firms' interest rate risk-management practices. He argues that firms use interest rate derivatives not to hedge firm-specific interest rate exposure.

Rossi (2011) uses data from a sample of 200 nonfinancial companies in 2007-2009 to examine derivative usage in publicly-traded Brazilian companies. He analyses the net position of companies in currency derivatives and their foreign exchange exposure. He concludes that a large number of Brazilian companies use currency derivatives to speculate during the financial crisis because these firms have some informational advantage in the exchange market. He identifies two main types of speculators: companies that speculate by increasing the volume of derivatives but used them in accordance with their currency exposure and companies that speculate by adopting positions contrary to their exchange rate exposure. Nevertheless, he points out that both types tried to obtain gains.

Another line of empirical studies examines the impact of derivatives usage on firm value. For example, Tufano (1998) discusses the theoretical implications of corporate hedging in relationship to firm value. His theoretical model produces both costs and benefits associated with derivatives usage. According to Tufano, the existence of agency costs between managers and shareholders when using derivatives can reduce firm value. Using a sample consisting of 1746 nonfinancial US firms during the year of 1991 through 2000, Fauver and Naranjo (2010) contend that greater agency and monitoring problems are important factors that explain why firms use derivatives to speculate and this usage reduces a firm's value on average. Looking at a sample of 720 large US nonfinancial firms between 1990 and 1995, Allayannis and Weston (2001) examine the use of foreign currency derivatives and their impact on firm value. They find a positive association between derivatives usage and firm value. Jin and Jorion (2006) examine the hedging activities of 119 US oil and gas firms from 1998 to 2001 and find insignificant effects of hedging on market value. In contrast, Adam and Fernando (2006) use a sample of 92 US gold mining firms from 1989 to 1999. They document that firms have consistently realised economically significant cash flow gains from their derivatives transactions and this increases shareholders' value.

Guay (1999a) uses a sample of 254 non-financial firms from 1990 to 1995. He finds that firms use derivatives to hedge risk. He finds that derivatives usage is associated with the reduction in the total risk, idiosyncratic risk, and risk exposures to interest rate changes, but he finds no significant change in the market risk. In contrast with the previous empirical evidence, using a sample of 425 large US corporations between 1991 and 1993, Hentschel and Kothari (2001) investigate whether the use of derivatives reduces or increases a firm's riskiness. They do not find a significant difference between derivative users and nonusers. Further, they do not find a linkage between the volatility of a firm's stock return and the size of its derivatives position.

Adam and Guettler (2010) examine the use of CDS in the US mutual fund industry. They use a sample of the largest 100 corporate bond funds in the US between 2004 and 2008. They conclude that fund managers use CDS to take on credit risk rather than to hedge credit risk. They explain that managers increase fund risk to improve their relative performance. They document that funds, which use CDS exhibit lower returns and the same or slightly higher standard deviations than funds that do not use CDS.

Two recent papers by Bartram, Brown and Conrad (2011) and Fung et al. (2012) deal with the linkage between derivatives usage and a firm's risk. Bartram et al. (2011) investigate the effects of derivatives on a firm's risk and value. They conduct their study using a sample comprising 6,888 nonfinancial firms from 47 countries. They find that firms that use derivatives have lower estimated values of both total and systematic risk, suggesting that derivatives are used to hedge risk.

The empirical study most closely related to the second aspect of this research (i.e., CDS use and firm risk) is a study by Fung, Wen, and Zhang (2012). They empirically distinguish between the purposes of derivatives usage. Fung et al. (2012) examine the effects of CDS usage on the risk profile and firm value of US insurance companies for the period 2001-2009.

They use a sample consisting of 113 Property/Casualty and 78 life insurance companies. They distinguish between the usage of CDS for hedging purposes and for income generation.[25]For the life insurance sample, the results indicate that the CDS transactions for hedging or income generation are associated with higher market risk, idiosyncratic risk, and total risk. For PC insurers, risk is significantly and positively impacted by CDS transactions for the purpose of income generation.

A few recent related studies investigate derivatives usage in the banking industry. For instance, Minton, Stulz, and Williamson (2009) examine the use of credit derivatives by US bank holdings. They use a sample of 395 banks from 1999 to 2005. They find that only 23 large banks out of 395 use credit derivatives and most of their derivatives positions are held for trading activities rather than for hedging of loans. They note that the use of credit derivatives by banks to hedge loans is limited.

In a sample of 335 US commercial banks for the years 2003 through 2009, Cyree, Huang, and Lindley (2012) document no difference on the bank values from CDS use, neither in high growth periods nor in the low growth periods.[26] They prove that derivatives generally did not cause the last financial crisis because they find no significant evidence that derivatives use has increased banks' speculating behaviour and significantly contributed to the loss of value during the last crisis.

Nijskens and Wagner (2011) investigate the relationship between credit risk transfer activities at banks and their riskiness. They examine the association between the use of CDS and a bank's risk as measured by a bank's share price beta. Their CDS sample consists of 38 banks from 1998 to 2006. They find that the use of CDS is associated with an increase in a bank's

[25] Income generation involves writing derivatives, which can involve speculation.

[26] High growth period is the pre-crash period of 2003–2005; low growth period is the period 2007–2009 during the crash.

risk. They believe that CDS use increases bank risk more in the short run because banks use CDS to source new credit risk.

Derivatives use and the changes in firm risk

There is an extensive empirical literature discussing the determinants of derivatives use for hedging and focuses mainly on explaining scenarios in which firms benefit from derivatives use for hedging and how derivatives use for hedging leads to a reduction in firm risk. However, there is empirical evidence in the literature suggesting that under some circumstances this argument may not hold true in all cases.

Several studies find that firm risk is not influenced by derivatives use. For example, Hentschel and Kothari (2001) investigate the effects of derivatives use on firms' risk characteristics and conclude that the risk characteristics of firms that use derivatives intensively and hold large derivatives positions are not different from the risk characteristics of the firm that do not use derivatives. Their results show that firms' risk is not increased because of derivatives use. In the same time derivatives use does not lead to mitigate firm risk. Using a sample from the mutual fund industry, Koski and Pontiff (1999) also document no differences in risk between mutual fund that use derivatives and those that do not. They argue that if managers use derivatives to hedge, they will be able to maintain desired risk exposure more easily by combining derivatives use with non-derivatives use (non-derivatives investments) to maintain target risk levels comparable to those of funds that do not use derivatives.

In line with the studies mentioned above, Shiu, Moles, and Shin (2010) present empirical evidence from the banking industry showing that bank risk is not influenced by derivatives use. However, they argue that banks use currency derivatives as an alternative tool to establish the desired level of risk-taking through the use of exchange rate derivatives for trading purposes.

Derivatives use for hedging purposes can increase firm risk

Empirical literature on risk management also indicates that derivatives use for hedging purposes can contribute to a higher firm risk. Minton et al. (2009) and Nijskens and Wagner (2011) illustrate that banks are using CDS to source new credit risk by hedging any undiversified exposures they may have, and in the same time taking more credit risk by selling protection in the CDS market.

In summary, although the theoretical literature in risk management discusses corporate derivatives use as a risk reduction instrument (Smith and Stulz, 1985; Froot et al., 1993), evidence provided by empirical studies indicates that one potential result of firms' derivatives use is an increase in firm riskiness. Banks that shed part of their risk exposure using derivatives can have an incentive to take on more risk which offsets the risk reduction achieved through the use of derivatives and leave the overall level of bank risk unaffected or even higher.

Much debate has taken place on the issue of how firms use derivatives and what constitutes the main purpose of using derivatives. However, it seems that the issue of how the usage of these derivatives influences the firm's risk has received little attention. One of the objectives of this study is to examine the linkage between a firm's risk and the usage of the derivatives for hedging purposes and for trading purposes separately. In particular, this study asks whether executive usage of CDS for hedging reduces a firms' risk or not. Further, it asks whether executive usage of CDS for speculating leads to more or less firm risk. Appendix (B) summarises the empirical literature about derivatives usage and a firm's risk.

2.3.4 Research gap and research questions

The existing theories of corporate risk management assume that the use of derivatives adds value to the firm by alleviating a variety of market imperfections and hedging a firm's risk. In practice, firms are using derivatives not only for hedging, but also for trading (Géczy et al., 1997; Hentschel and Kothari, 2001). Managers can use derivatives to increase a firm's risk when they try to create value for shareholders by incorporating speculative elements into their derivatives use (Faulkender, 2005; Géczy et al., 2007)

The earlier empirical research in this area has tried to primarily examine how firms use derivatives and what strategy the managers are following when they use derivatives (e.g., Tufano, 1996; Allayannis and Ofek, 2001; Faulkender, 2005; Adam and Guettler, 2010). A review of the empirical literature in derivatives use shows that previous studies have generally overlooked the effect of derivatives use on a firm's risk. This is possibly due to a lack of adequate firm-specific data on derivatives usage (Adam and Fernando, 2006). In fact, although data on derivatives use have become available in the last 2 decades, very few empirical studies discuss the effect of derivatives use on a firm's risk and provide mixed evidence (Bartram et al., 2011). Much of the empirical evidence provided in the literature assumes that managers engage in derivatives use mainly to minimize a firm's risk and tries to determine whether firms use derivatives for risk management or for speculative (Allayannis and Ofek, 2001; Chernenko and Faulkender, 2011). Yet, little research has been devoted to examine the effect of derivatives use on a firm's risk and little is known about the effect of credit derivatives activity on a firm's risk.

In addition to the above, the limited available empirical evidence of the effect of derivatives on a firms risk focuses on the consequence of derivatives use in general without differentiating between the purpose of derivatives use (Allayannis and Ofek, 2001; Faulkender, 2005). Taking advantage of the recent development on derivatives reporting, this research advances the literature on derivatives use by studying the linkage between the purposes of CDS use and the firm's risk.

Prior empirical studies focus on foreign exchange derivatives, interest rate derivatives, and currency and commodity derivatives (Allayannis and Ofek, 2001; Hentschel and Kothari, 2001; Guay and Kothari, 2003; Bartram, Brown, and Fehle, 2009). Surprisingly, research investigating the consequence of credit derivatives use on a firms' risk has not received the same attention in the existing finance literature. Such research is important because with the recent developments in the credit derivatives market, it is possible that firms use CDS to reduce or to increase their risk exposures (Minton et al., 2009). Moreover, after the last financial crisis the effect of CDS use has been a principal concern and significant issue for economists and regulatory entities (Stulz, 2010; Adam and Guettler, 2011; Bedendo and Bruno, 2012). Furthermore, although the derivative securities that have caused the most harm during the last financial crisis have been those held by financial firms, less attention has been paid to the effect of derivatives use on a firm's risk in financial firms (Bartram et al., 2011). One purpose of this thesis is to fill this gap in the literature by examining the difference between the effect of CDS use for hedging and CDS use for trading on a firm's risk.

Overall, earlier empirical research primarily tried to examine firms' use of derivatives by assuming that managers engage in derivatives mainly to minimize firms' risk and to hedge risk exposure. Little empirical research discusses the impact of credit derivatives use on a firm's risk, and the focus of these studies was mainly on derivatives use in general without differentiation between the effects of derivatives use for hedging from derivatives use for trading.

Thus, based on the previous discussion of the relationship between derivatives use and firm risk, the second research question is formulated as follows:

Research Question 2: Does CDS use influence bank risk? This question is extended to include the following sub-questions:

- Does CDS use for hedging purposes influence bank risk?
- Does CDS use for trading purposes influence bank risk?

The above questions will be investigated based on the following hypotheses:

H1 (b): there is a negative association between CDS use for hedging purposes and bank risk.

H2 (b): there is a positive association between CDS use for trading purposes and bank risk.

2.4 Summary

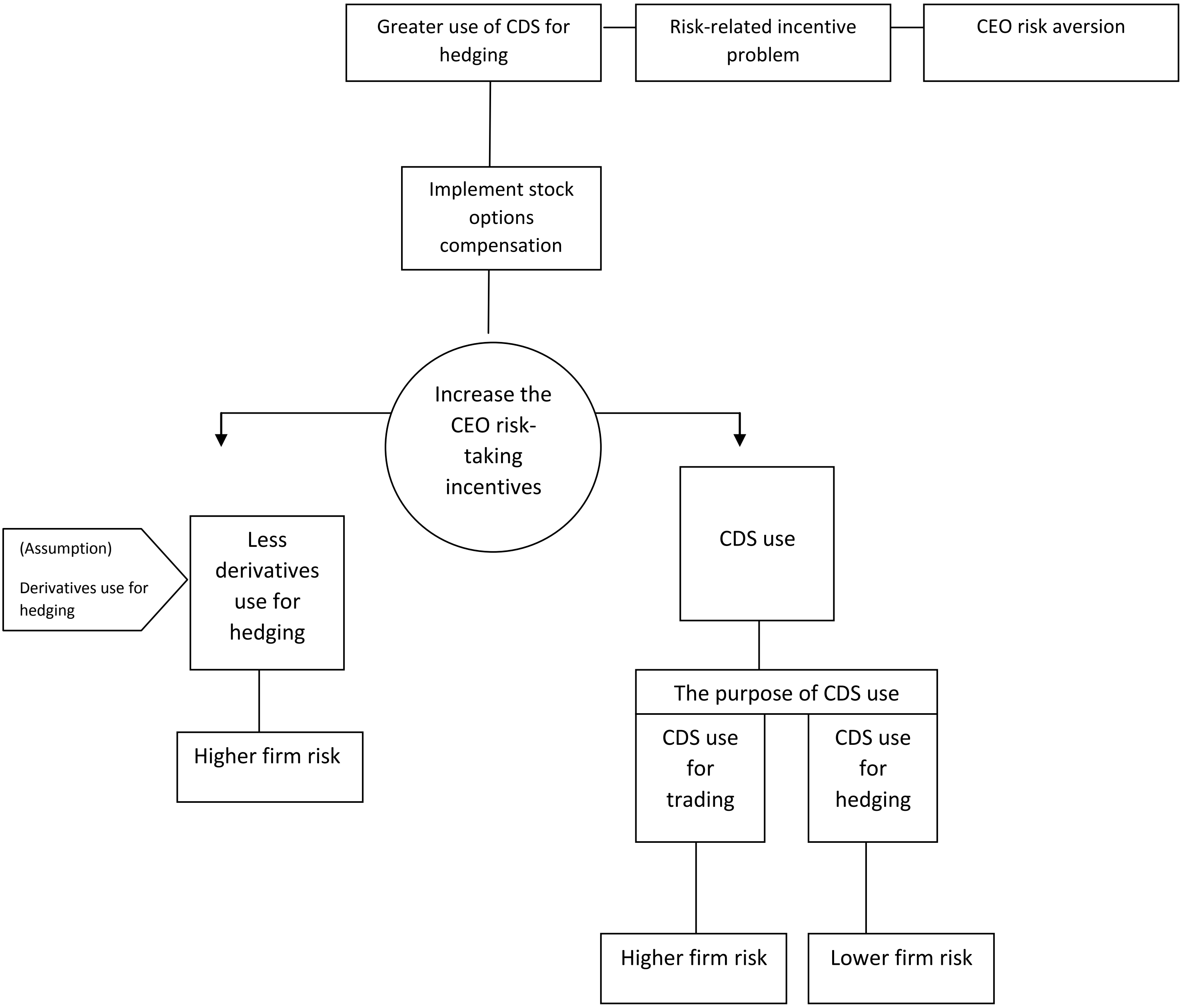
The above sections have shown a detailed overview of the key aspects of the relationship between executives' risk-taking incentives generated by stock option compensation and corporate derivatives use. The basis of the theoretical arguments of corporate derivatives use assumes that maximising shareholder wealth and managerial risk aversion can explain a firm's use of derivatives. The theoretical literature highlights that risk management practices are associated with managerial risk aversion. Managers who are more risk-averse than shareholders would be more likely to use derivatives for hedging to reduce risk. The greater risk aversion would be associated with greater concavity of the utility function and thus stronger incentives to manage risk with derivatives. Therefore, managers' private preferences seem to impact corporate derivatives use decisions and would induce them to hedge more than is optimal from the perspective of the well-diversified shareholders.

The risk-taking incentive of managers generated by stock option compensation is considered an important determinant of corporate derivatives use (Stulz, 1984; Tufano, 1996). Smith and Stulz (1985) suggest that shareholders can impact management's risk aversion through stock options compensation; more stock options can influence managerial derivatives use and align the risk-taking incentives of the managers with their shareholders. They indicate that the convexities of stock options compensation provide greater incentives for managerial risk-seeking preference and reduce derivatives use for hedging purposes. The stock options provide convex payoffs and induce managers to take on greater risk and manage less of firm's risk because hedging derivatives may reduce the volatility and the value of their option. This thesis investigates how the risk-taking incentive generated by stock option compensation influences managers' derivatives use decisions.

The second part of this chapter summarises the theoretical and empirical literature that investigates the linkage between a firm's risk and derivatives use. Smith and Stulz (1985) and Guay (1999a) focus on managerial risk aversion and built their argument on the basis that derivatives are hedging instruments used to mitigate a firm's risk. Most of the empirical studies focus mainly on investigating the purpose of derivatives use and tried to determine whether firms use derivatives to reduce risk or to take more risk (e.g., Allayannis and Ofek, 2001; Hentschel and Kothari, 2001; Haushalter, 2000). However, very few studies test directly the linkage between derivatives use and the firm's risk. These studies focus generally on derivatives use without distinguishing between derivatives that are used for hedging from derivatives used for trading. This thesis extends the literature by classifying CDS use into CDS use for hedging and CDS use for trading to examine the linkage between CDS use and a firm's risk.

Prior empirical evidence in these two areas is relatively limited to a very small number of US studies. Furthermore, while several empirical studies have examined the association between managerial compensation and derivatives use for non-financial firms, little has been known of the relationship between using derivatives and risk-taking incentives in the banking sector. This thesis examines the relationship between risk-taking incentives of stock option compensation and CDS. Furthermore, this thesis empirically investigates how the purpose of CDS use influences a firm's risk.

Figure 2.1: An illustration of the theoretical framework



Chapter 3: Research methods

3.1 Introduction

This chapter describes and explains the methodological aspect applied to examine two main issues: 1) the first issue is the relationship between the risk-taking incentives of CEO's stock options compensation and CDS use; 2) the second issue is the effect of CDS use on firm's risk. This chapter explores the sample background, data collection process, sample selection criteria, and data sources.

This chapter starts with a summary of the research questions and hypotheses. Section 3.3 presents the discussion of the sample of this research, the sample selection criteria, and the data source. Section 3.4 defines the key variables and how these variables are measured. Section 3.5 presents the control variables. This is followed by Section 3.6 which is devoted to discuss the endogeneity issues. The two stages regression approach is described in Section 3.7. Section 3.8 explains the various robustness tests.

3.2 Sample and data sources

This thesis uses secondary data collected mainly from the European banks' annual reports and Datastream. The importance of CDS comes from the fact that this financial instrument represents the largest sector of the credit derivatives market that are intended to mitigate a firm's credit risk (Longstaff, Mithal, and Neis, 2005; Minton et al., 2009).

The data used in this thesis is balanced panel data. There are several advantages of using panel data such as, more accurate inference of model parameters because panel data captures variation across time; controlling the impact of omitted variables; and avoids the problem that arises from the differences across individuals in the number of measurements (Kennedy, 2003; Hsiao, 2007). Further, using balanced panel data reduces the noise introduced by firm heterogeneity because it allows an observation of the same bank every year (Baltagi, 2001).

This study is based on a sample extracted from European publicly listed banks. The decision to choose European banks and this time span was taken because the relatively rich data available related to the disclosure of derivatives after introducing the International Accounting Standard IFRS 9 Financial Instruments (replacement of IAS 39) which became effective for European firms from the accounting period beginning on or after 1 January 2005 (Duh, Hsu, and Alves, 2012). Firms should disclose their objectives for holding derivatives and distinguish between derivatives held for trading and those that are held for hedging (Barth and Landsman, 2010). Before the beginning of the financial year in which IAS 39 was first adopted, the disclosure of derivatives use was not mandated and data on derivatives usage by firms outside the US was disclosed on a largely voluntary basis (Bartram et al., 2009). When firms apply common international accounting standards this make it more practical to study international derivative use in the banking industry.

The influence of the risk-taking of executive stock options on derivatives use has been previously studied for industrial firms by a number of studies (e.g., Supanvanij and Strauss, 2010; Knopf, et al., 2002; Gay and Nam, 1998; Géczy et al., 1997). However, the results for nonfinancial firms are not necessarily applicable to the financial firms (Chen et al., 2006; Bai and Elyasiani, 2013). Early findings in the literature prove that compensation packages in the banking industry tend to be structured differently from other industries (Adams and Mehran, 2003). Moreover, the use of stock option compensation in the banking industry has witnessed a dramatic increase (Chen et al 2006; Conyon et al., 2013).

Houston and James (1995) find that CEOs in banks receive less cash compensation and have a smaller percentage of their total compensation in the form of options and stock, compared to CEOs in other industries. They explain this difference in compensation structure by the different nature of the firm's assets and investment opportunity set in banks compared to nonbanking industries. They document little evidence that CEO's compensation packages in banking are designed to encourage excessive risk taking.

In contrast, recent empirical studies (e.g., Becher et al., 2005) show that the differences in executives' compensation structure between banks and industrial firms appear to diminish as the banks are further deregulated. As a result, banks are turning toward the use of more stock and stock options to align shareholder and executive interests, and bank compensation structures are becoming more comparable with those of the industrial firms (Bai and Elyasiani, 2013).

Despite this change in executives' compensation structure, earlier studies (e.g., Chen et al., 2006; Bai and Elyasiani, 2013) stress that CEOs' risk-taking incentives in the banks have traditionally been dissimilar to the industrial firms. The differences in risk-taking incentives between banks and industrial firms can be explained in large part by the fact that banks operate in a regulated industry, have fewer growth options, substantially greater leverage, and coverage by deposit insurance schemes which bear some of the costs of financial distress (Bai and Elyasiani, 2013).

3.2.1 Sampling process and selection criteria

The list of European banks is drawn from two main indices: European stock market indices and premier indices of the European Union countries (EU-27) (Fasshauer, Glaum, and Street, 2008). The number of banks included in these indices is 112 banks. However, since 38 banks are cross-listed, the initial potential sample size is 72 banks. Some banks are also dropped from the sample based on the following criteria: not providing English copy of the annual reports, merger or acquisition, and missing data. Table 3.1 summarises the Sample selection process.

Taking all of the abovementioned reasons together, additional 12 companies were dropped from the sample. The final sample consists of 60 banks that were listed on 22 European stock exchanges indices or included in one of three European indices (i.e., FTSE Eurotop 100 Index, FTSE Eurofirst 300 Index, and Euronext100 Index).[27]

Table 3.1: Sample selection process	Reasons for including	Listed banks
Criteria 1		
Banks listed in these European stock market indices	FTSE Eurotop 100 Index	**13**
	FTSEurofirst 300 Index	**21**
	Euronext100	**6**
Criteria 2		
Banks included in the premier indices of 27 European countries	Premier segment of 27 European stock exchanges.	**72**
Deleted	**Reasons for excluding**	
Cross-listed	Listed on more than one of the indices	**38**
Annual report not available in English	An English copy is not available	**1**
Merger or acquisition	Merged or acquired during the sample period	**3**
Missing data	Banks that do not provide enough details of CEO compensation	**10**
Total sample companies		**60**

This set of publicly listed banks is chosen for two important reasons. Firstly, publicly listed firms are more likely to comply with accounting standards and disclose detailed information about their executives compensation (Bai and Elyasiani, 2013; Conyon et al., 2011; Gao, 2010). Moreover, publicly traded firms are incited by international accounting standards/international financial reporting standards (IASs/IFRSs) to report their derivatives activities in their annual financial statements and this increases the availability of richer data because of the mandatory disclosure requirements (Judge, 2006). As of 2005, almost all publicly listed firms in European and many other countries are required to prepare financial statements in accordance with International Financial Reporting Standards, and firms that

[27] Fasshauer, Glaum and Street (2008) adopt the same approach to analysis the defined benefit pension disclosure of European companies.

adopt IAS appear to provide higher accounting quality (Barth, Landsman, and Lang, 2008; Fasshauer, Glaum, and Street, 2008).

Secondly, listed firms are normally large and more likely to engage in credit derivatives activities because they benefit from economies of scale (Minton et al., 2009; Supanvanij and Strauss, 2010; Hagendorff and Vallascas, 2011).[28] A positive association between large firms and derivatives disclosure level has been recognised in derivatives-reporting literature (e.g., Beretta and Bozzolan, 2004; Linsley and Shrives, 2006; Zhou and Wang, 2013).

The limited amount of previous empirical studies in this area can be explained by the lack of publicly available information on corporate hedging activity (Mian, 1996; Supanvanij and Strauss, 2010). In the absence of specific reporting requirements, firms have not voluntarily disclosed derivatives activities in their financial statements in a uniform manner.

Banks and insurance companies are major groups of active participants in CDS markets (Fung et al., 2012). However, the core aim of this thesis is to examine CDS use in the banking industry. There is a notable difference between derivatives use in insurance companies compared to the banking industry (Castries and Claveranne, 2010). Insurance companies are using derivatives mostly for hedging purposes, and have regulatory or legal restrictions on their ability to enter into derivatives contracts (Cummins et al., 2001; Castries and Claveranne, 2010). In addition, using reported data from only one industry will help to control for cross-industry differences in investment opportunity sets, reporting practices, and regulatory environment (Colquitt and Hoyt, 1997).[29]

Virtually all firms belong at least to one of these European indices: FTSE Eurotop 100 Index, FTS Eurofirst 300 Index, and Euronext100, and premier indices of EU-27. Table 3.2 presents a summary of the sample based on the country, stock market index, number of banks

[28] The benefits from economies of scale for large firm are related to the disclosure costs, information and transaction costs on derivative.

[29] Hentschel and Kothari (2001) also exclude insurance companies because of the wide range of financial activities by insurance firms that makes it difficult to classify them into financial and non-financial corporations.

used in the sample and mentioned in the stock market index, and number of publicly listed banks in the stock market.

Table 3.2: A summary of the sample based on the country, market index, number of banks included, and number of publicly listed banks in the stock market.

Country	Market index	Number of banks in stock market	Number of banks in the sample and the percentage	Country	Market index	Number of banks in stock market	Number of banks in the sample and the percentage
UK	FTSE100	9	5 (55.6%)	Denmark	OMX 20	28	2 (7.1%)
Italy	MIB-30	19	6 (31.6%)	Belgium	BEL20	4	2(50%)
Spain	IBEX 35	10	5 (50%)	Sweden	OMXS 30	4	4(100%)
Germany	DAX 30	13	3(23.1%)	Austria	ATX	8	1(12.5%)
France	CAC40	20	4(20%)	Bulgaria	SOFIX	5	3(60%)
Portugal	PSI-20	4	4(100%)	Lithuania	OMX Vilnius	2	2(100%)
Malta	MSE	4	3(75%)	Hungary	BUX	2	2(100%)
Poland	WIG20	16	3 (18.8%)	Switzerland	SMI	24	1(4.2%)
Slovenia	LJSE	3	3 (100%)	Ireland	ISEQ-20	2	1(50%)
Romania	BET	3	2 (66.7%)	Norway	OBX	22	1(4.5%)
Cyprus	CySE 20	4	2 (50%)	Czech republic	PX Index	1	1(100%)
Total		105	40			102	20

Banks are classified as users or non-users of CDS based on a search of their annual reports for information about the use of CDS. Appendix C shows the complete list of the banks classified as CDS user or CDS non-user, and their market capitalisation.

Banks in the following 22 countries will be included in the sample: the UK, Italy, Spain, Germany, Austria, Belgium, Denmark, Ireland, France, Portugal, Sweden, Cyprus, Bulgaria, Lithuania, Czech Republic, Hungary, Malta, Poland, Romania, Slovenia, Switzerland, and Norway. The sample used in this thesis represents about 83% (£670,494 millions) of the market capitalisation of European publicly listed banks (£804,196.42 millions).

3.2.2 Sample period

The sample examined in the present research comprises 60 European banks and covers 6 year periods from 2006 to 2011. Thus, in total 360 annual reports were sought, obtained and analysed. This thesis covers a period which witnesses an increase in the quality of financial reporting after the mandatory IAS/IFRS adoption for listed companies in European countries (Duh et al., 2012; Palea, 2013).

In 2002 the European Union agreed that from January 2005 international accounting standards/international financial reporting standards (IASs/IFRSs) would apply for the consolidated accounts of the EU listed companies (Barth et al, 2008). Starting from 2005, IAS/IFRS adoption has been mandatory in all the member states of the European Union with the ultimate goal of increasing transparency in financial reporting.

In addition, this time period (2006-2011) covers the period before, during and after the last credit crisis. The event of the last crisis attracted the interest of regulators and academics about the role of both risk-taking incentives arising from stock options and CDS use in the crisis. Thus, investigating these issues over a six-year period enables the sample to be divided into three different subsamples: a pre-crisis period, crisis period, and post-crisis period.

3.2.3 Data sources

In this thesis, secondary data is used to answer the two research questions. The data has been collected from two main sources: bank's annual reports and Datastream database. Data is collected as follows:

***CDS and derivatives data*:** Consistent with many prior empirical studies on derivatives use, the data on CDS is hand-collected from banks' annual reports (e.g., Allayannis and Ofek, 2001; Rajgopal and Shevlin, 2002; Supanvanij and Strauss, 2010). CDS users are identified by searching the annual reports for key words like credit default swap, default contract, single-name default swaps, default swap, and CDS. The details about the notional value of CDS contracts are collected from banks' balances sheet and the additional disclosure in the notes.

Derivatives disclosure practice of European banks is in fact diverse. For example, the UK banks provide a common reporting framework and more detailed information compared with other European countries. This makes the data collection of CDS and other derivatives labour and time intensive. Some annual reports only disclose the total value of credit derivatives contracts without classifying the figures into different credit derivatives categories. However, they clearly explain that most of their credit derivatives positions are in the form of CDS.

Remuneration data: Unlike US firms, compensation data for European firms is not readily available in machine-readable form, and there is no database which provides a complete classification of compensation data for European firms (Conyon et al., 2011; Renneboog and Zhao, 2011). Therefore, compensation data requires hand-collection using banks' annual reports. Empirical studies point out that assembling data on executive compensation across European countries is difficult due to the different country governance structures, legal and accounting systems and alternative ways of measuring executive compensation (e.g., Abowd and Bognanno, 1993; Carpenter and Yermack, 1999). Data is collected for the following components of CEO compensation:

1) Stock option data: Consistent with previous studies, the value of stock option compensation is calculated using the Black-Scholes (1973) option valuation model. For this purpose, the following details about stock option compensation are obtained from bank's annual reports:

- Total number of options at the end of the year.
- Exercise price.
- Time to expiration (time-to-maturity).
- Price of the underlying stock

These key parameters for Black-Scholes option pricing model are normally disclosed in details in the directors' remuneration reports. The Black-Scholes formula has become standard practice in executive compensation literature to estimate the value of executive options (Conyon and Murphy, 2000; Coles et al. 2006). Appendix A describes the option valuation model in more details.

2) Cash compensation: The total annual cash compensation (annual salary and annual cash bonus) data is obtained from bank's annual reports. Salary and cash bonuses represent an important and common proportion of executive compensation (Balsam, 2001). It is common for empirical studies to use the value of executive cash pay as the measure for risk aversion (Coles, et al., 2006).

3) Stock Grants: The bank's annual report is also used to collect data on executive stock compensation (restricted stock and long term incentive plan). To calculate the value of executive stock compensation the total number of stock holding is multiplied by closing stock price. Executive ownership as a percentage of stock holding at the end of the year is also included.

CEO characteristics: Data on CEO characteristics (i.e., age and tenure) is hand-collated from bank annual reports.

Recently, more detailed information about managerial compensation has been made available in annual reports, especially after adopting the Greenbury Report (1995), Hampel Report (1998) and Directors' Remuneration Report Regulations (2002). Furthermore, in a 2004 report, the European Union (EU) Commission formally recommended that all listed companies in the EU report details on individual executives' compensation packages (Conyon, et al., 2013).[30]

The reason for choosing annual reports as a main source for the key variables in this thesis is because banks' annual reports are considered a more dominant, reliable, and significant source of information (Cowton, 1998). Moreover, both CDS and compensation data disclosed

[30] Hand-collecting data of European CEO Compensation data is both labour and time-intensive This is because compensation data is not reported in the same tabular form across different European companies, making data collection more difficult (Conyons et al., 2011).

in annual reports is edited and complies with the reporting requirements (Bartram et al., 2011; Conyon et al., 2011).

The second source of data used in this thesis is the Datastream database. Datastream was used to collect data on banks' characteristics and control variables. Data on banks' book value of debt and book value of assets are used to estimate banks' leverage. Furthermore, Datastream is used to obtain data on market-to-book value of assets and total sales to measure growth opportunities and bank size respectively.

Datastream is also used to gather data on the number of geographical segments to measure diversification. There are different inputs used to measure vega, delta, and beta are obtained from Datastream, such as the volatility of the bank's stock return, the volatility of the market's return index, and risk-free rate.

Datastream covers a large number of stock markets and financial data for companies. In addition, it is a major source of data for global stock markets and empirical research for European companies. If accounting data is missing in Datastream, the company annual report is used. Datastream has also been used as a source in previous studies (e.g., Bartram et al., 2011; Renneboog and Zhao, 2011). All figures have been translated into the pound sterling currency using the Datastream exchange rate at the annual report date. Data was analysed using the Statistics Data Analysis (STATA) 10.

3.3 Research philosophy: Positivism

There are various philosophical assumptions which have a direct implication for adopting a specific research methodology and influencing the selection process of an appropriate research paradigm. These assumptions are views about the nature of reality, the nature of knowledge and of human nature. These philosophical assumptions influence the research process of examining, collecting, analysing and interpreting findings (Burrell and Morgan, 1979).

Empiricism as a philosophical position comes from arguments about the nature of knowledge and how to acquire knowledge. Empiricism takes the point of view that logic and mathematics are tools for exploring the implications of observed knowledge. Traditionally, empiricists accepted that:

1. Certainty of belief in what we know can only be approached through perceived experience.
2. Ultimately, all knowledge is derived from experience.
3. In the realm of discourse statements are either true or false because of the way the world is or because of some formal properties of the language we use.

Empiricism leads quite naturally to the idea that science should be 'value free', that is free from beliefs and ideologies which cannot be justified in terms of the objects of experience under study.

The influence of empiricism has been extremely pervasive and has led to one of the most significant philosophical movements of modern times: positivism. Positivism is now regarded as rather *passé* in certain quarters although it has been particularly influential in the recent development of the disciplines of finance, economics and accounting.

Research based on positivist approach usually involves a deductive process and is underpinned by the belief that reality is independent from the researcher and the goal is to empirically discover knowledge using information that can be verified scientifically (Bryman, 2004).

Social researchers adopting a positivist paradigm are goal orientated and focus on theories to explain or predict social phenomena (Bailey, 1996). Within this paradigm, theories provide the basis for explanation, permitting anticipation of phenomena, and predicting their occurrence. The positivist position can be described by the following:

i. There is a mind-independent reality, which can be described by objective observation language.

ii. Statements are only meaningful if they are synthetic (representing contingent or empirical truths) or analytic (representing formal truths).

iii. Synthetics statements cannot be known a priori.

iv. All metaphysical statements (which contain statements of value or non-observable reality) may be said to be meaningless.

v. The meaning of a statement is derived from the method of its verification[31](Ryan et al, 1992, P6)

In the present research a positivist approach is adopted in order to investigate the validity of the theoretical arguments of Smith and Stulz (1985), who suggests that stock options compensation can reduce executives risk aversion and influence their derivatives use.

3.4 Key Variables and regression model

There are two primary objectives of this research: The first one is to examine the relationship between CDS use and risk-taking incentives generated by a CEO's stock option compensation. The second is to investigate how CDS use influences bank's risk. The structure of the test may be expressed by the following two stage equation:

CDS = *f* (CEO Risk-taking incentives + control variables) (1)

$$CDS_{i,t} = \beta 0 + \beta 1.vega_{i,t} + \beta 2.Salary_{,t} + \beta 3.Cash\ bonus_{i,t} + \beta 4.Stock\ grant_{i,t} + \beta 5.Ownership_{i,t} + \beta 6.Hedging\ derivatives_{i,t} + \beta 7.Trading\ derivatives_{i,t} + \beta 8\ Investment\ opportunities_{i,t} + \beta 9.Leverage_{i,t} + \beta 10.\ Size_{i,t} + \beta 11.\ Diversification_{i,t} + \mu_t + \acute{\varepsilon}_{i,t}$$

Firm risk = *f* (CDS + control variables) (2)

$$Risk_{i,t} = \beta 0 + \beta 1.CDS_{i,t} + \beta 2.Age_{,t} + \beta 3.Tenure_{,t} + \beta 4.\ Leverage_{i,t} + \beta 5\ Investment\ opportunities_{i,t} + \beta 6.Size_{i,t} + \beta 7.Salary_{i,t} + \beta 8\ bonus_{i,t} + \beta 9.\ Diversification_{i,t} + \mu_t + \acute{\varepsilon}_{i,t}$$

[31] A verification principle added by logical positivism.

Equation (1) provides a specification for modelling the purpose of CDS use as a function of the CEO's risk-taking incentives generated by stock option compensation. Ordinary Least Squares (OLS) is used to examine how the risk-taking incentives influence CDS use. Eq. (2) specifies the influence of the CDS use on the firm's risk.

3.4.1 Risk–taking incentives (Vega)

The measure of CEO incentives to increase risk induced by stock options is referred to as vega. Vega measures the changes in managers' options value generated by changes in stock return volatility. Core and Guay (2002) methodology for measuring the risk-taking incentive effects arising from CEO stock option compensation is employed. Vega is measured based upon the partial derivative of the dividend-adjusted Black–Scholes equation with respect to the annual standard deviation of stock returns. The partial derivative is then multiplied by 0.01 to represent the pound change in option value from a 1% change in the standard deviation. The CEO incentive to increase risk is then calculated by multiplying the generated value with the number of stock options (Guay, 1999b; Core and Guay, 2002; Rogers, 2002; Hagendorff and Vallascas, 2011; Gao, 2010).[32]

Core and Guay's approximation method is widely-used in the empirical compensation literature (e.g., Rajgopal and Shevlin, 2002; Coles et al. 2006; Hagendorff and Hagendorff, 2011). The Core and Guay (2002) procedure allows researchers to apply a Black-Scholes option pricing model to accurately measure managerial incentives to increase risk using data that is typically available in a single corporate annual report.[33] In particular, the data needed for estimating the risk-taking incentives of the stock option compensation are: the number of stock options, exercise price, stock price, and time-to-maturity of all the options in the

[32] Guay (1999b) find that vega of stock holdings is zero. Following much prior literature the calculation of vega is based on stock options compensation (e.g. Rogers, 2002; Fahlenbrach and Stulz, 2011; Hagendorff and Vallascas, 2011).

[33] Therefore they refer to this technique as the "one-year approximation" (OA) method.

portfolio of stock options held by each CEO.[34] Most publicly-listed banks provide the information necessary for computation of a Black-Scholes value for CEO's stock options. Core and Guay (2002) suggest that the method they propose to measure risk-taking incentives of CEO option portfolios would be useful in a study of financial risk management. Further details on the Black-Scholes model and the calculation of the risk-taking incentives of stock options are provided in Appendix (D 1).

Some empirical studies use different measures for the risk-taking incentives of stock option compensation such as using binary variables for existence or absence of stock options (Conyon and Freeman, 2004) or the number of options (Tufano, 1996; Gay and Nam, 1998; Allyannis and ofek, 2001) or the value of the stock options compensation (Datta et al., 2001; Ryan and Wiggins, 2002). These studies rely on the readily available measures (i.e., existence or absence of stock options, number of options, value of stock options) because they were constrained by the data availability of more detailed information of stock option compensation (Core and Guay, 2002). However, using such simple measures for the risk-taking incentives of stock options does not fully capture managers' incentive to alter a firm's risk and are expected to suffer from predictable measurement error (Core and Guay, 2002; Coles et al., 2006). In this thesis vega is used because it has been recognised as an effective and unbiased proxy that provides a better estimation for the risk-taking induced by stock options (Knopf et al., 2002; Gao, 2010).[35] The complete list of the variables and definitions are presented in Table 3.3.

Similar to previous empirical studies (e.g., Géczy et al. 1997; Datta et al., 2001; Knopf et al., 2002; Adkins et al., 2007) stock options value are used as an alternative measure of the risk-

[34] Stock return volatility, dividend yield, and the risk-free rate are also inputs to the Black-Scholes model that can be computed using data available on Datastream. More details on these variables are in Appendix B

[35] Vega as a measure for risk-taking incentive is effectively unbiased and 99% correlated with the measures that would be obtained if the parameters of a CEO's option portfolio were completely known (Gao, 2010).

taking incentives generated by stock option compensation. Black-Scholes model is used to calculate the total value of CEO stock options at the end of the year.

Table 3.3: Variables definitions and data sources

Variable	Definition	Data source
Salary	The natural logarithm of the CEO's annual base salary.	Annual report
Cash bonuses	The natural logarithm of the total CEO's cash bonuses.	Annual report
Stock grants	The natural logarithm of the value of shares held by the CEO at the end of the year.	Annual report
Option value	The natural logarithm of the value of stock options held by the CEO at the end of the year.	Annual report
Delta	The pay performance sensitivity: the change in the dollar value of CEO wealth for a 1% change in stock price, measured by partial derivatives of Black-Scholes value of options and value of stock holdings with respect to stock price (measured by natural logarithm).	Annual report & Datastream
Vega	The pay-risk sensitivity: the change in the dollar value of CEO wealth for a 0.01 change in stock return volatility, measured by partial derivatives of Black-Scholes value of options with respect to stock return volatility (measured by natural logarithm).	Annual report & Datastream
Ownership	The percentage of the bank common stock owned by CEO.	Annual report
CDS (Hedging)	Total notional value of a CDS hedging contracts scaled by total assets.	Annual report
CDS (Trading)	Total notional value of a CDS trading contracts scaled by total assets.	Annual report
Derivatives (Hedging)	The natural logarithm of total notional value of derivative contracts scaled by total assets.	Annual report
Derivatives (Trading)	The natural logarithm of total notional value of CDS hedging contracts scaled by total assets.	Annual report
Growth opportunities	The natural logarithm of the market-to-book value of assets.	Datastream
Leverage	Book value of debt / book value of asset.	Datastream
Size	The natural logarithm of total sales.	Datastream
Diversification	Number of geographical segments.	Datastream
Default risk (DD)	The number of standard deviations that the market value of bank assets are above default point (the point where the market value of assets is less than the book value of total liabilities)	Datastream
Beta	The volatility of the firm's stock return in relation to the volatility of the market's return index.	CAPM & Datastream
Age	CEO age	Annual report
Tenure	The natural logarithm of the number of years of the CEO has held the position of CEO at bank	Annual report

3.4.2 CDS

The extent of CDS use is measured using the notional values of the CDS contracts reported by the bank at the end of the year. Previous empirical studies on the topic also used the notional value of derivatives contracts (e.g., Gay and Nam, 1998; Hentschel and Kothari, 2001; Supanvanij and Strauss, 2010). Similarly to previous studies (e.g., Knopf et al., 2002; Rogers, 2002) the notional value of a CDS contract is scaled by total assets.

The literature illustrates that assessing the extent of corporate derivatives use represents one of the significant challenges that faces most empirical studies (Allayannis and Ofek, 2001; Aretz and Bartaram, 2010). For this reason many studies typically use binary variables to test theories of corporate risk management to indicate whether a firm uses derivatives or not (e.g., Nance, Smith, and Smithson, 1993; Mian, 1996; Géczy, et al., 1997; Allayannis and Weston, 2001; Judge, 2006; Lin and Smith, 2007; Kim, Nam, and Thornton, 2008; Bartram, Brown, and Fehle, 2009). Previous literature has used binary variables to test whether or not the managers have an incentive to use derivatives.

In contrast to previous studies, more recent empirical studies have used a notional value of the derivative contract. These empirical studies prefer the notional value because it represents a continuous variable to study the determinants of the amount of derivatives use (Allayannis and Ofek, 2001; Hentschel and Kothari, 2001; Borokhovich, Brunarski, and Crutchley, 2004; Adam and Guettler, 2010; Supanvanij and Strauss, 2010).

More recently, Gay, Lin, and Smith (2010) use binary and the notional amount of derivatives holdings to measure a firm's derivatives use. They use indicator variable equal to one if a firm reports the use of derivatives, and zero otherwise. They also use firm's total notional amount of derivatives scaled by its total assets. In this thesis, a binary variable is used for CDS use decision and the notional value of CDS contract is used to measure the extent of credit derivatives use in the bank. Similarly to previous studies, variables are transformed to the natural logarithm and scaled with total assets in the case of skewed distribution where appropriate (Rogers, 2002; Guay and Kothari, 2003; Chen et al., 2006; Bai and Elyasiani, 2013).

3.4.3 Firm risk

3.4.3.1 Distance to default

This thesis examines the effect of CDS use on banks' risk and uses two different measures for banks' risk. The first one is Merton Distance-to-Default which provides a direct assessment of default likelihood of the bank default using both accounting and market data (Saldías, 2013). Distance to default is a market-based measure of corporate default risk which is based on evaluation of firm's assets in the stock markets, and book values of short-term debts. This model measures both solvency risk and liquidity risk (Harada, Ito, and Takahashi, 2010).

Empirical studies use Merton distance to default model to assess the risk of insolvency of firms using firm's balance sheet and market data. The distance to default represents the number of standard deviations away from the default point, where the default point is defined as the point when the assets of the bank are just equal to its liabilities (Gropp, Vesala, and Vulpes, 2006). In other words, distance to default measure the probability that the firm fails to repay the debt (Gestel and Baesens, 2009). The advantage of using distance to default to capture banks' risk is that it implicitly captures a bank's expected returns via the inclusion of the market value of assets (Hagendorff and Vallascas, 2011). Distance to default reflects three crucial factors of bank risk-fragility: the market value of the firm's assets, leverage, and the volatility of assets. Therefore, it is considered as an appropriate indicator of banks' risk (Gropp et al., 2006; Hagendorff and Vallascas, 2011; Bai and Elyasiani, 2013).

Distance to default is calculated for each bank in the sample and for each time period, using that period's equity market data and balance sheet data. A shorter distance-to-default (i.e., lower distance to default) indicates higher bank's risk (Gropp et al., 2006). The calculation of distance to default requires data on bank share prices and accounting information. Data to compute annual distance to default were gathered from Datastream. Further details on the estimated DD are provided in Appendix (D 2).

3.4.3.2 Beta

The second measure is firm's beta which is obtained from the CAPM model (Nijskens and Wagner, 2011; Chen et al. 2006). Empirical studies in financial risk management (e.g., Bartram et al., 2011) have examined the association between derivatives usage and beta to capture the impact of derivatives use on banks' risk. Beta measures the volatility of the firm's stock return in relation to the volatility of the market's return index and defined as the relative change in the bank stock return with respect to stock index return (Bessis, 1998). In this thesis, each domestic stock market index is used as a benchmark to estimate the market beta for the banks in the sample. The data on banks' stock return and market index return are obtained from Datastream. Following prior research (e.g., Chen et al. 2006; Nijskens and Wagner, 2011; Fung et al., 2012) banks' betas are calculated as follows:

$$\beta = \frac{COV_{i;M}}{\sigma^2_M}$$

where :

$COV_{i;M}$ is the covariance of the annual banks' stock with the market index return using monthly returns from Datastream.

σ^2_M is the variance of the annual market index return using monthly returns from Datastream.

3.5 Control variables

The control variables used in this thesis were selected based on previous literature. Including the variables that previous researchers have shown to influence firm derivatives use will improve the explanatory power of the model (Knopf et al., 2002).

3.5.1 Control variable for "CDS model"

Drawing upon the existing literature in derivatives use, CDS use is modeled as a function of CEOs' risk-taking incentives generated by stock options compensation (vega) and the following control variables: growth opportunities, financial distress (leverage), firm focus (diversification), managers' risk aversion, delta, bank size, and other derivatives.

Growth opportunities are considered in previous studies to affect derivatives use (Froot et al., 1993; Supanvanij and Strauss, 2010). A positive association between growth opportunities and derivatives has been proposed in existing literature (Froot et al., 1993; Gay and Nam, 1998). Firms with greater growth opportunities are more likely to derive greater benefits from derivatives use. As this is mainly related to the reduction in underinvestment problems; derivatives use helps ensure that managers have the sufficient internal funds to take advantage of available risky positive NPV projects that they might otherwise forgo (Tufano, 1996; Géczy., et al., 1997; Coles et al., 2006; Supanvanij and Strauss, 2010). Growth opportunities are measured with the book to market ratio (e.g., Gay and Nam, 1998; Graham and Rogers, 2002; Rogers, 2002; Géczy et al., 2007).

According to Smith and Stulz (1985), firms that face higher expected costs of financial distress have larger incentives to use derivatives because derivatives can reduce the present value of bankruptcy and the probability of financial distress. Firms can use derivatives to reduce the variance of a firm's cash flow or earnings which enable a firm to have sufficient cash flow to fulfill its fixed payment obligations and reduce the probability of financial distress (Aretz and Bartram, 2010; Supanvanij and Strauss, 2010). Similarly to previous studies, leverage is used as a proxy for financial distress (e.g., Tufano, 1996; Rogers, 2002; Aretz and Bartram, 2010). Leverage is measured with the ratio of total debt to book value of assets (e.g., Coles et al; 2006).

I include diversification as a control variable for firm focus. Earlier empirical studies (e.g., Tufano, 1996; Géczy et al., 2007) suggest a negative relationship between the degree of diversification and derivatives use. Firms can choose to reduce firm risk through changing the level of diversification (Coles et al., 2006; Bartram et al., 2011). For all the banks in the sample, data is collected on the number of geographical segments of the firm at the end of each year to measure the degree of diversification (Géczy et al., 1997; Fung et al., 2012). The primary source of data on the number of segments is Datastream supplemented with the hand-collection of missing items from the annual reports.

In line with empirical literature, data were also collected on CEO's cash and share compensation and included in the control variables to control for CEO's risk aversion. Literature predicts that CEO's fixed salaries and cash bonuses will be positively associated with derivatives use (e.g., Barton, 2001; Adkins et al., 2007). Higher fixed salaries and cash bonuses may increase the likelihood of derivatives; this is because the CEO of the firm is likely to have little diversification in personal wealth (Whidbee and Wohar, 1999; Coles et al., 2006; Adkins et al., 2007).[36] Consistent with the existing literature, data is collected on CEO base salary, cash bonuses using banks' annual reports.

In addition to cash compensation, the literature suggests a positive association between executives' share compensation and derivatives use. Based on the arguments of Smith and Stulz (1985), when executives hold more shares they are likely to use more derivatives to reduce firm's risk in order to protect their private wealth in the firm. Stock-based

[36] Others argue that higher cash compensation will be negatively related to derivatives use for hedging (e,g., Knopf et al., 2002; Ertugrul et al ., 2008; Supanvanij and Strauss, 2010). They believe that higher cash compensation will make it easier for the CEO to build wealth that is not tied to firm value, thus make the CEO's better diversified.

compensation increases the risk aversion of non-diversified managers and provides the managers with an incentive to reduce the fluctuations in the firm share price to reduce the risk of their wealth invested in the firm. The value of CEO stock grant is calculated by multiplying the number of the CEO's stock by the price of the bank stock at the end of the fiscal year (Tufano, 1996; Rajgopal and Shevlin, 2002; Géczy et al., 2007; Kim et al., 2008). The percentage of CEO shareholdings of all shares outstanding also included controlling for the effect of managerial ownership (Whidbee and Wohar, 1999).

The sensitivity of CEOs' stock and stock options to stock price (delta) is also included. The effects of delta on firm risk are of some interest, because delta can provide risk preference and risk avoidance incentives (Coles et al., 2006). Higher delta increases the expected payoff to the managers and could induce managers to accept higher risky positive NPV projects because managers share gains with shareholders. Nevertheless, higher delta will expose the undiversified managers to more risk compared with the shareholders when stock prices decrease, which induces managers to adopt more conservative strategies and to choose less risky projects (Guay, 1999b). CEOs' with large deltas are more sensitive to firm performance which may increase managers' risk aversion (Knopf, et al., 2002; Rogers, 2002). Core and Guay (2002) find a positive association between delta and derivatives use, executives' with a higher delta are more likely to use derivatives to hedge firm risk. In line with existing literature, delta is mainly used as a control variable (Coles et al., 2006).

Several of the previous empirical studies of derivative use show a positive relationship between firm size and derivatives use (e.g., Tufano 1996; Allayannis and Ofek, 2000). Large banks are expected to use more derivatives because they are more able to take advantage of economies of scale that generate transactions and information cost advantage (Mian, 1996; Géczy et al., 1997; Haushalter, 2000; Judge, 2006). In this thesis, bank size is measured by natural logarithm of total sales (Supanvanij and Strauss, 2010).

In this thesis, the use of other derivatives by banks is also considered as a control variable. Empirical studies in credit derivatives indicate that CEOs can use other types of derivatives like interest-rate, foreign exchange, equity, and commodity derivatives to manage firm risk (Minton et al., 2009). Fung et al., (2012) find a positive association between CDS use and the use of other derivatives. The notional amount of other derivatives has been hand-collected from banks' annual reports.

3.5.2 Control variables for "firm risk model"

The firm risk model involves a regression analysis control for a set of variables that are expected to be associated with bank risk. The control variables that are used as determinants of the firm's risk are all based on existing literature (e.g., Guay, 1999a; Coles et al., 2006; Bai and Elyasiani, 2013). These control variables are as follows: investment opportunities, leverage, size, tenure, age, diversification, and the cash compensation component (CEO's salary and CEO's bonus).

The market value of assets to book value of assets is included as a proxy for growth opportunities (Rajgopal and Shevlin, 2002; Coles et al., 2006; Bartram, Brown, and Stulz, 2011). Earlier empirical studies control for the effect of firm investment opportunities on firm risk (e.g., Cohen et al., 2000; Coles et al., 2006). Literature shows that firm risk is expected to be positively associated with investment opportunities (Smith and Watts, 1992; Bartram, Brown, and Stulz, 2011). Smith and Watts (1992) document evidence that firms with substantial investment opportunities use compensation package to mitigate managers' risk-related incentive problems and induce them to invest in risky projects. Therefore, firms with greater investment opportunities are expected to undertake riskier projects (Rajgopal and Shevlin; 2002).

Among the control variables, total debt to book value of assets serves as a measure of bank leverage (Guay and Kothari, 2003; Coles at al., 2006). Leverage is expected to be positively associated with banks' risk, because higher leverage translates into higher probability of financial distress and hence higher firm risk (Tufano, 1996; Coles et al., 1996). In this thesis the total debt to book value of assets is used to control for leverage (e.g., Coles et al; 2006).

Consistent with the existing literature (e.g., Guay, 1999; Whidbee and Wohar, 1999; Cohen et al., 2000; Coles et al., 2006) CEO tenure and, CEO age are used as proxy for the CEO characteristics. CEO cash compensation (salary and bonus) are also used to proxy for the level of risk aversion. The natural logarithm of total sales is used as a proxy for bank size. Firm diversification is also included because it can be used to reduce risk (Gao, 2010; Bartram, Brown, and Conrad, 2011). In this thesis the number of geographical segments is used as a proxy for bank diversification.

3.6 Endogeneity Issues

3.6.1 CDS model

This thesis contributes to the corporate derivatives literature by analysing the risk-taking incentives of CEOs generated from stock options in relation to the CDS use by the European banks. Prior literature in compensation and derivatives suggest the presence of endogeneity problems in the relationship between risk-taking incentives and derivatives use when CEO risk-taking incentives and derivatives usage are jointly determined (Rogers, 2002; Kim et al., 2008; Supanvanij and Strauss, 2010). In the CDS model, the problem of endogeneity could result due to the potential of joint determination of the decisions to use CDS and CEO risk-taking incentives.

Many of the previous empirical studies on derivatives assumed that managers' risk-taking incentives of stock options are exogenous, rather than choice variables in examining the determinants of derivatives use (e.g., Tufano, 1996; Géczy et al., 1997; Whidbee and Wohar, 1999; Haushalter, 2000; Knopf et al., 2002; Kim et al., 2008). However, modelling CEO risk-taking incentive as an exogenous variable could bias the results towards finding no relationship between the CEO incentives to increase risk and derivatives use when the independent variable is endogenously determined along with the dependent variable or due to an omitted control variable (Rogers, 2002; Coles et al., 2006).

Using a model that controls the endogeneity problem can provide a more efficient estimate of the relationship between the variables and isolate the endogeneity effects (e.g., Rajgopal and Shevlin, 2002; Rogers, 2002, Supanvanij and Strauss, 2010). In this thesis, the analysis is conducted using two approaches; the first analysis assumes that the CEO risk-taking incentives are exogenous variables, where in the second analysis the CEO risk-taking incentives are modelled as an endogenous variable.

In the first part of the analysis the risk-taking incentives generated by stock option compensation are assumed to be exogenous variables to test the effect of risk-taking incentives on CDS use (Tufano, 1996; Géczy et al., 1997; Gay and Nam, 1998; Whidbee and Wohar, 1999; Haushalter, 2000).

The presence of endogeneity represents an empirical challenge and potential shortcoming that may limit the conclusions that can be drawn from some of the existing evidence provided by the literature on the relationship between CEO risk-taking incentives and derivatives use (Aretz and Bartram, 2010). Few studies try to address this issue with models that may remedy endogeneity effects and take a step toward yielding unbiased estimates of the relationship since risk-taking incentives and derivatives usage can be determined simultaneously.

In order to address the endogeneity problem, the risk-taking incentive generated by stock option (vega) is included as a choice variable in the second part of the analysis. The specifications used to predict vega are based on variables used elsewhere in the literature. The regression specifications closely follow those in the existing literature (Guay, 1999b; Rogers, 2002; Rajgopal and Shevlin, 2002; Coles et al., 2006). vega is regressed with the following variables: CEO’s cash compensation (salary and bonuses), delta, bank size, growth opportunities, leverage, and risk. Table 3.4 summarises the variables used by previous empirical studies to predict the CEO’s risk-taking incentives.

Table 3.4: A summary of the main variables that are considered in modelling the CEO’s risk-taking incentives

Guay (1999b)	Cash compensation, age, investment opportunities, firm size, and sensitivity of wealth to stock price.
Rogers (2002)	Firm risk, cash compensation, growth opportunities, leverage, firm size, marginal tax rate, and regulated industry dummy.
Rajgopal and Shevlin (2002)	Investment opportunities, cash compensation, sensitivity of wealth to stock price, liquidity, and firm size.
Coles, Daniel, and Naveen (2006)	Leverage, firm risk, growth opportunities, age, delta, firm size, CEO tenure, and cash compensation.
Bai and Elyasiani (2013)	CEO pay share, leverage, cash compensation, firm risk, and firm size

Literature includes CEO cash compensation as the proxy for the CEO’s level of risk aversion (Rogers, 2002; Nam et al., 2003; Coles et al., 2006). CEOs with higher cash compensation are more likely to become more risk averse. CEO’s with high cash compensation will seek to avoid risk.[37] Cash compensation is measured using the natural logarithm of the salary and the natural logarithm bonus. Following existing literature (e.g., Rajgopal and Shevlin, 2002) the sensitivity of CEO wealth to stock price is also included as an additional control variable for CEO risk aversion in the risk-taking incentive model.

Guay (1999b) documents a positive relationship between firm size and CEO risk-taking incentives. Firm size is measured as the total sales at the end of the year. Previous empirical studies show that growth opportunities are also expected to be positively related to CEO risk-

[37] Guay (1999) and Ertugrul et al. (2008) suggest that higher CEO’s total cash compensation is an indicator for a better diversified manager. He argues that higher cash compensation increases the CEOs’ degree of diversification because they have more money to invest outside the firm, thus they become less risk averse.

taking incentives (Rajgopal and Shevlin, 2002; Coles et al., 2006). Consistent with earlier compensation studies, the market-to-book value of assets is used as a proxy for growth opportunities. In contrast, leverage is expected to be negatively associated with the risk-taking incentives (Rogers, 2002). Financial leverage increases the probability of financial distress increase and, therefore, there is lesser need to provide the CEO with a risk-taking incentive. Debt ration (book value of debt to book value of assets) is utilised as a proxy for leverage (Rogers, 2002).

Similar to previous studies, this thesis controls for the effect of risk on the risk-taking incentives generated by stock options (e.g., Guay, 1999; Rogers, 2002). Firm's stock return volatility should play a role in determining CEO incentives (Rogers, 2002). Guay (1999) shows that vega is a positive function of stock return volatility, executives at risky firms may prefer a riskier pay package that is associated with a higher risk levels. Thus, vega is expected to depend positively on risk level. The stock return volatility of the firm is included to control for the risk level (Coles et al., 2006). As a proxy for the total risk of the firm, each bank's annualised standard deviation was calculated using monthly stock returns data over a 12 months (Rogers, 2002).

As shown in existing literature vega and delta are jointly determined, and shareholders consider a combination of delta and vega when they choose an executive compensation contracts. Thus, the CEO's risk-taking incentives can be affected by the CEO's delta (Coles et al., 2006; Gao, 2010). Shareholders consider a combination of delta and vega when they choose executive compensation contract. As in previous literature (e.g., Rajgopal and Shevlin, 2002; Coles et al., 2006) delta is mainly used as a control variable.

In line with the existing literature, delta is also predicted as a function of growth opportunities, vega, CEO tenure, volatility, leverage, and size (Rogers, 2002; Coles et al., 2006). Consistent with the existing literature, cash compensation (salary and cash bonuses), CEO stock value, CEO ownership, derivatives use, investment opportunities, leverage, bank size, and diversification are included as control variables in the CDS model.

Based on the above, the structure of the CDS model after including the risk-taking incentives as endogenous variable may be expressed by the following system:

CDS = *f* (Predicted risk-taking incentives (vega) + control variables) (3)

3.6.2 Risk model

The firm risk is also subject to endogeneity issues. Literature shows that the effect of derivative use on firm risk is sensitive to endogeneity concerns (Guay, 1999a; Bartram et al., 2011; Fung et al., 2012). Endogeneity is an issue that has received great attention in recent accounting research (Aretz and Bartram, 2010; Fung et al., 2012).

Endogeneity, in the context of the risk model, refers to the fact that CDS use can impact firm risk. However, firm risk which is determined by a set of variables can simultaneously influence firm CDS use. The endogeneity arises from the simultaneity or joint determination of derivatives use and firm risk.

These endogeneity issues are expected to make observing the change on firm risk from derivatives use difficult (Guay, 1999a). In an attempt to mitigate this concern and to adjust for the potential endogeneity of CDS usage with respect to firm risk, CDS use is treated as an endogenous variable using the predicted value of the CDS model measured by the risk-taking incentives; predicted value is then incorporated as an independent variable in the risk model (Bartram et al., 2011; Fung et al., 2012).

3.7 Two stage tests of risk-taking incentives and credit risk management

3.7.1 First stage test of risk-taking incentives and credit risk management

This thesis investigates the relationship between CDS use and different alternative proxies for CEO’s risk-taking incentives (vega or the value of the CEO's stock options) in one-stage regressions (Eq. 1). It also examines how CDS use influences firm risk using different alternative proxies for firm risk (Eq. 2). Similar to many previous empirical studies (e.g., Tufano, 1996; Géczy et al., 1997; Haushalter, 2000) the first stage represents estimation for the relationship between CDS use and the risk-taking incentives by modelling CEOs' risk taking-incentives as an exogenous variable.

3.7.2 *S*econd stage test of risk-taking incentives and credit risk manageme*nt*

In this thesis, the risk-taking incentive of stock option compensation utilised in the CDS model is considered also as a choice variable. This choice is modelled by first solving for a specification of CEO risk-taking incentives as suggested by prior empirical studies. The predicted value from the risk-taking incentives model in the first stage regression is then incorporated as an explanatory variable in the CDS model.

In the firm risk regression, CDS is treated as a choice variable to correct for the endogenity problem. The predicted value from the CDS model choice in Eq. 3 (which corrects for the endogenity problem of the risk-taking incentives) incorporates into the model of firm risk. Based on the above, the structure of the relationship between firm risk and CDS use after including the CDS as an endogenous variable may be expressed by the following system:

Firm risk = *f* (predicted CDS + control variables) **(4)**

In the risk model (Eq.4) CDS use is modelled as an endogenous variable. In doing so, the design of the empirical analysis addresses the potential endogenity issues in the CDS model and in the firm risk model by using control variables suggested by prior literature, and using the predicted value of vega and CDS as an instrumental variable.

3.8 Robustness checks

In this thesis, several robustness checks are conducted. Tobit and probit models are used to check the robustness of the results from OLS model. Tobit model is used to investigate the relationship between risk-taking incentives (vega) with respect to the extent of CDS use. In tobit model, the extent of CDS use is regressed on risk-taking incentives provided by stock options, and other compensation variables such as salary, cash bonuses, stock grant, and ownership, as well as, control variables for other derivatives, leverage, investment opportunities, diversification, and size.

The decision of the extent of CDS use can be correlated in their unobserved components (erros) and tobit is required for the statistical analysis. The tobit specification assumes that an unobserved latent variable determines the level of the dependent variable:

$$y_{it} = x_{it}\beta + \mu_{it} \quad \text{if} \quad x_{it}\,\beta + \mu_{it} > 0,$$
$$= 0 \quad \text{Otherwise}$$

In the model above, y_{it}, equals CDS use of bank i in year t. The latent variable, $x_{it}\,\beta$, models the risk-taking incentives provided from stock options; the regressions above estimate the β coefficients. Tobit regression for the CDS model (Equation 1) can be written as follow:

The extent of CDS $_{i,t} = \beta 0 + \beta 1.\text{vega}_{i,t} + \beta 2.\text{Salary}_{,t} + \beta 3.\text{Cash bonus}_{i,t} + \beta 4.\text{Stock grant}_{i,t} + \beta 5.\text{Ownership}_{i,t} + \beta 6.\text{Hedging derivatives}_{i,t} + \beta 7.\text{Trading derivatives}_{i,t} + \beta 8\ \text{Investment opportunities}_{i,t} + \beta 9.\text{Leverage}_{i,t} + \beta 10.\ \text{Size}_{i,t} + \beta 11.\ \text{Diversification}_{i,t} + \mu_t + \acute{\varepsilon}_{i,t}$

Where the extent of $\text{CDS}_{i,t}$ use is measured using the notional value of CDS contracts at the end of the year and vega is the risk-taking incentives provided by stock options. The decision to use CDS may be different from the decision of how much to use CDS. It is possible that common factors affecting these decisions are either unobserved or unobservable (Adkins et al., 2007).

A bank makes two decisions: (1) whether to use CDS and (2) if the extent CDS use. In this thesis the association between the risk-taking incentives and the decision to use derivatives or not is investigated using probit model. The effect of risk-taking incentives on the decision to use derivatives can be different from the effect of the extent of using derivatives (Haushalter, 2000; Ertugrul, et al., 2008). Probit regression for the CDS model (Equation 1) can be written as follow

CDS use decisison $_{i,t} = \beta 0 + \beta 1.\text{vega}_{i,t} + \beta 2.\text{Salary}_{,t} + \beta 3.\text{Cash bonus}_{i,t} + \beta 4.\text{Stock grant}_{i,t} + \beta 5.\text{Ownership}_{i,t} + \beta 6.\text{Hedging derivatives}_{i,t} + \beta 7.\text{Trading derivatives}_{i,t} + \beta 8\ \text{Investment opportunities}_{i,t} + \beta 9.\text{Leverage}_{i,t} + \beta 10.\ \text{Size}_{i,t} + \beta 11.\ \text{Diversification}_{i,t} + \mu_t + \acute{\varepsilon}_{i,t}$

The dependent variable in the probit estimation is a dummy variable equal to one if the bank uses CDS and zero otherwise. In the following section the key variables (dependent and independent) utilised in each model are discussed in more details. The tobit and probit models have many analogies to OLS regression: they have coefficients for every independent variable, a pseudo R-squared statistic to summarise the strength of the relationship. Unlike OLS regression, however, tobit regression in general has less stringent requirements on the normality of the variables (Davidson and Mackinnon, 2004; Gujarati, 2003). Random effects regressions are also used to predict the relationship between risk-taking incentive and CDS use for trading purposes.[38]

As part of a robustness check for CEO risk-taking incentives of stock option, the CEO risk-taking incentive is measured using the natural logarithm of the value stock option as utilized in many prior empirical studies (e.g., Tufano, 1996; Géczy et al., 1997).

Firm risk is measured using two proxies. The first one is firm's Beta which is obtained from the CAPM (Nijskens and Wagner, 2011; Chen et al., 2006). The second measure is Merton distance to default (Hagendorff and Vallascas, 2011; Bai and Elyasiani, 2013).

The second part of the analysis (i.e., firm's risk model) is also conducted using OLS regressions to predict the relationship between firm's risk and CDS use. Furthermore, random effects regressions are employed where appropriate.

[38] The Hausman test is used to choose between fixed and random effect model in panel data.

In this thesis, regressions are expanded to broaden the scope of the investigation each round by using four sets of subsamples to examine the relationship between the variables. The first regression is based on the full sample and the control variables. The second regression is the full sample, the control variables and dummy variable based on the number of banks operating in each country (the dummy variable equals 1 if the country has more than 3 banks, 0 otherwise). The third regression is based on the full sample, control variables and countries' dummy variables (Germany, Italy, Spain, Denmark, France, Portugal, and others).[39] The fifth regression is based on the full sample, control variables and the countries' dummy variables based on the number of banks operating in each country (dummy equals 1 if the bank operates in one of the following countries: the UK, France, Italy, Portugal, Spain and Sweden, 0 otherwise).[40] The list of the four samples and classification criteria are presented in Appendix E.

3.9 Summary

In closing, this chapter describes the research methods and sample selection criteria used in the present thesis. The measurement methods used to measure the main variables in both the CDS model and the risk model are also explained and discussed in depth. Furthermore, sample period and data sources are presented.

This chapter highlights the importance of controlling for endogeneity problems that could exist between the risk-taking incentives of stock option compensation and CDS use when CEO risks-taking incentives and CDS usage are jointly determined. Furthermore, this chapter discusses the possible endogeneity problem in the relationship between CDS use and firms risk. The control variable used in the CDS model and in the risk model, and the various robustness checks are explained at the end of the present chapter.

[39] These countries have the highest number of hedging observations.

[40] The number of banks: 5 in the UK, 4 in France, 6 in Italy, 4 in Portugal, 5 in Spain and 4 in Sweden.

Chapter 4: Data Visualisation

This chapter explores and visualizes the data used in this thesis. This chapter tries to give some insight into the data by identifying patterns within the data and visualizing different variables in this thesis, such as: sample of the study, CDS users and non-users, correlation matrix per year, risk-taking incentives, CDS use for trading and for hedging, bank's risk, banks' leverage, the main CDS users by countries, and the average age of CEOs. In addition, this chapter visualizes the different types of executive compensation like cash based compensation (salary and bonuses), and stock-based compensation (stock grant and stock options).

4.1 Sample of the study

The sample of the study is taken from different European countries. Figure 1.1 provides a breakdown of the sample by country and the number of banks included from each country.

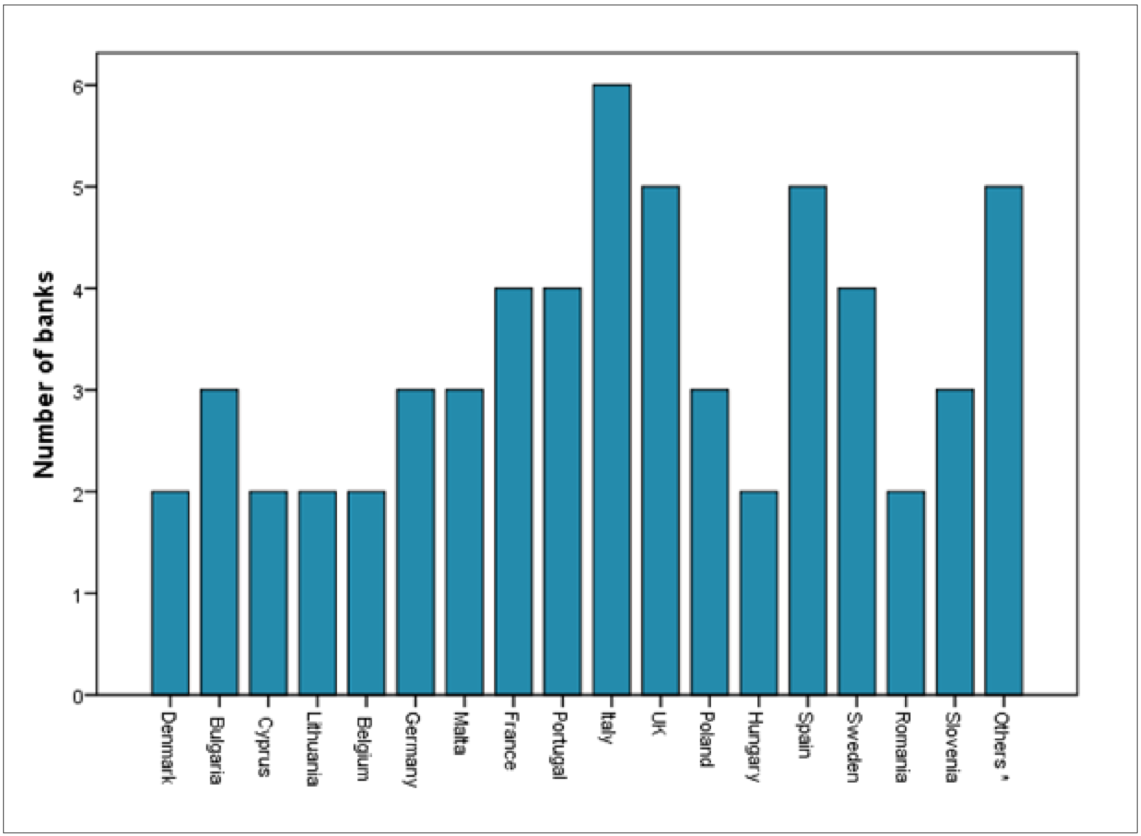


Figure 4.1: The number of banks included from each country.

Italy has the largest number of banks included in the sample and accounts for 10% of the sample size with six banks. UK and Spanish banks represent together 16% of the sample with five banks for each. France, Portugal and Sweden account for four banks from each country. Three banks are included from Germany, Malta, Poland, Slovenia and Bulgaria. Six European countries account for 20% (2 banks from each country) of the sample these are Denmark, Cyprus, Lithuania, Belgium, Hungary and Romania. The other European countries represent countries with one bank such as Czech Republic, Ireland, Switzerland, Norway and Austria. This indicates that executive compensation and derivatives disclosure in annual reports covers different European countries.

The banks in the sample can be also CDS user or non-user. Table 4.1 classifies the sample of the study into CDS user and non-users with detailed information about the country and size.

Table 4.1: CDS users and non-users and their market capitalisation

	CDS users		**Non-users**			
Country	No. of banks	Total market capitalisation (£m)	No. of banks	Total market capitalisation (£m)	Total banks	Total market capitalisation (£m)
Austria	1	8,856	0	-	1	8,856
Belgium	2	20,296	0	-	2	20,296
Bulgaria	0	-	3	470	3	470
Cyprus	1	1,949	1	2,608	2	4,557
Czech Republic	0	-	1	4,411	1	4,411
Denmark	2	11,710	0	-	2	11,710
France	4	102,774	0	-	4	102,774
Germany	3	40,814	0	-	3	40,814
Hungary	0	-	2	4,948	2	4,948
Ireland	0	-	1	4,113	1	4,113
Italy	5	46,702	1	1,965	6	48,667
Lithuania	0	-	2	140	2	140
Malta	0	-	3	759	3	759
Norway	0	-	1	9,902	1	9,902
Poland	0	-	3	12,946	3	12,946
Portugal	4	10,228	0	-	4	10,228
Romania	0	-	2	2,793	2	2,793
Slovenia	0	-	3	598	3	598
Spain	2	97,121	3	14,903	5	112,024
Sweden	2	31,478	2	15,362	4	46,840
Switzerland	0	-	1	5,310	1	5,310
United Kingdom	5	217,336	0	-	5	217,336
	31	589,264 (88%)	29	81,228 (12%)	60	670,492 (100%)

Across all countries, 51.67% of the banks in the sample use CDS at least one year during the sample period 2006 - 2011. The CDS users are mainly from UK, Portugal, Italy, Germany, and France. Data reported in table 4.1 shows that all banks operating in UK, Portugal, France, and Germany are CDS users, and that 5 Italians banks out of 6 are CDS users,

The CDS non-users are mainly from Bulgaria, Hungary, Lithuania, Malta, Poland, Romania, Slovenia, and Spain. Though CDS users vary across countries, some clear patterns emerge. CDS users are in general large banks (Total market capitalisation is about £589,264 million), whereas CDS non-users are small banks (£81,228 million). Although the number of CDS users in the sample is 31 banks out of 60, CDS users represent about 88% of the total market capitalisation of the sample banks. This is consistent with existing empirical studies on derivatives use that provide evidence that large firms are more likely to use derivatives (Nance et al., 1993; Mian, 1996; Graham and Rogers, 2002, Minton et al., 2009).

Table 4.2: Yearly correlation matrix

		CDS trading	Derivative trading	CDS hedging	Derivatives hedging	Beta	Vega	Salary
2006	CDS trading	1	0.476**	0.092	0.274*	0.090	0.334**	0.356**
	Derivative trading	0.476**	1	0.002	0.573**	0.092	0.277*	0.522**
	CDS hedging	0.092	0.002	1	0.418**	0.087	0.108	0.140
	Derivatives hedging	0.274*	0.573**	0.418**	1	0.077	0.076	0.434*
	Beta	0.090	0.092	0.087	0.077	1	0.085	-0.002
	Vega	0.334**	0.277*	0.108	0.076	0.085	1	0.178
	Salary	0.356**	0.522**	0.140	0.434**	-0.002	0.178	1
2007	CDS trading	1	0.499**	-0.045	0.276*	0.118	0.544**	0.359**
	Derivative trading	0.499**	1	-0.071	0.537**	0.253	0.265*	0.442**
	CDS hedging	-0.045	-0.071	1	0.124	-0.010	0.068	0.020
	Derivatives hedging	0.276*	0.537**	0.124	1	0.184	0.093	0.309*
	Beta	0.118	0.253	-0.010	0.184	1	0.221	0.368**
	Vega	0.544**	0.265*	0.068	0.093	0.221	1	0.191
	Salary	0.359**	0.442**	0.020	0.309*	0.368**	0.191	1
2008	CDS trading	1	0.544**	-0.155	0.442**	0.291*	0.194	0.274*
	Derivative trading	0.544**	1	-0.057	0.743**	0.359**	0.129	0.409**
	CDS hedging	-0.155	-0.057	1	-0.045	0.030	-0.185	0.096
	Derivatives hedging	0.442**	0.743**	-0.045	1	0.321*	0.058	0.284*
	Beta	0.291*	0.359**	0.030	0.321*	1	-0.091	0.463**
	Vega	0.194	0.129	-0.185	0.058	-0.091	1	-0.086
	Salary	0.274*	0.409**	0.096	0.284*	0.463**	-0.086	1
2009	CDS trading	1	0.554**	0.086	0.392**	0.264*	0.376**	0.334**
	Derivative trading	0.554**	1	0.041	0.673**	0.466**	0.143	0.427**
	CDS hedging	0.086	0.041	1	0.283*	0.010	-0.038	0.141
	Derivatives hedging	0.392**	0.673**	0.283*	1	0.419**	0.079	0.366**
	Beta	0.264*	0.466**	0.010	0.419**	1	0.326*	0.563**
	Vega	0.376**	0.143	-0.38	0.079	0.326*	1	0.171
	Salary	0.334**	0.427**	0.141	0.366**	0.563**	0.171	1
2010	CDS trading	1	0.530**	0.150	0.395**	0.250	0.361**	0.315*
	Derivative trading	0.530**	1	0.086	0.653**	0.289*	0.153	0.408**
	CDS hedging	0.150	0.086	1	0.391**	-0.091	0.003	0.139
	Derivatives hedging	0.395**	0.653**	0.391**	1	0.188	0.072	0.375**
	Beta	0.250	0.289*	-0.091	0.188	1	0.255*	0.352**
	Vega	0.361**	0.153	0.003	0.072	0.255*	1	0.059
	Salary	0.315*	0.408**	0.139	0.375**	0.352**	0.059	1
2011	CDS trading	1	0.562**	0.237	0.442**	0.324*	0.483**	0.287*
	Derivative trading	0.562**	1	0.184	0.649**	0.400**	0.235	0.492**
	CDS hedging	0.237	0.184	1	0.320*	0.002	0.142	0.046
	Derivatives hedging	0.442**	0.649**	0.320*	1	0.425**	0.015	0.363**
	Beta	0.324*	0.400**	0.002	0.425**	1	0.078	0.543**
	Vega	0.483**	0.235	0.142	0.015	0.078	1	0.067
	Salary	0.287*	0.492**	0.046	0.363**	0.543**	0.067	1

All variables are defined in Table 3.3
** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 2 displays a yearly univariate correlations matrix for the main variables. These are CDS trading, derivatives trading, CDS hedging, derivatives hedging, beta, vega, and salary.

The banks CDS use for trading is positively correlated with the CEO vega (ranging from 0.334 to 0.544) and positively correlated with salary (ranging from 0.274 to 0.359). These results suggest that bank CDS trading variable is associated positively with CEO risk-taking incentives (vega) and does in fact capture basic attributes of risk-taking incentives. CDS hedging is positively correlated with hedging derivatives for the period before and after the financial crisis.

The bank risk measure (beta) is positively correlated with CDS trading (ranging from 0.291 to 0.324), derivatives trading (ranging from 0.289 to 0.466), and CEO salary (ranging from 0.357 to 0.563) in between 2008 and 2011. The correlations between the other explanatory variables are reported in table in table (3.1).

4.2 Risk-taking incentives (vega)

It is important to understand the association between risk-taking incentives of CEOs and risk for the banking industry in general because top managers play a crucial role in decisions concerning the stability of the financial system. Figure 4.2 displays the average vega of bank CEOs during the period from 2006 to 2011.

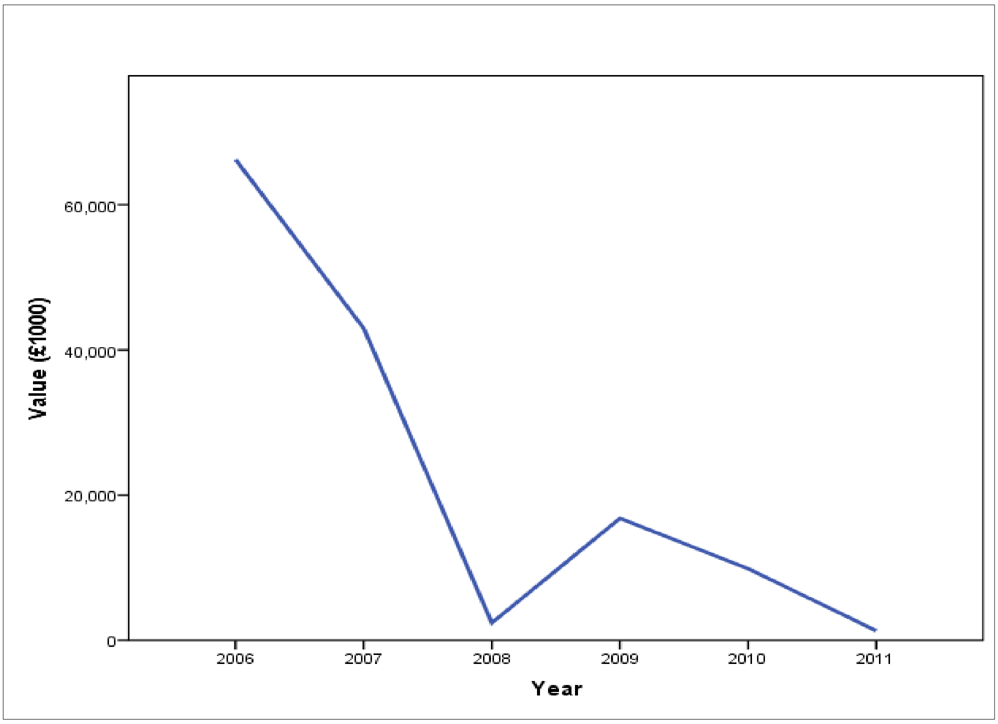


Figure 4.2: CEO vega (pay sensitivity to stock return volatility) of European banks.

This figure shows that vega was very high before the start of the financial crisis and decreased sharply during the financial crisis in 2007and 2008. In 2009 vega increased, this increase indicates that the CEOs in the banking industry were taking more risks after the end of the financial crisis to increase the value of their stock options. The increase in 2009 is possibly due to the announcements of bank rescue packages and government interventions. Duchin and Sosyura (2014) find an increase in risk-taking incentives in banking sector as a result of government intervention. Banks approve riskier loans and shift investment portfolios toward riskier strategies. Indeed, figure 4.3below illustrates that in 2009 European banks increased the use of CDS for trading activities. However, vega in 2009 and 2010 is still very low compared with vega in 2006 and 2007.

In 2010 and 2011 the risk-taking incentives decreased again. In comparison to the empirical studies for industrial firms, Coles et al. (2006) report that the average vega for executives is $79,586 between 1992 to 2002. This is close to the average vega for executives in the European banking industry before the start of the financial crisis (about £66,200 by the end of 2006).

4.3 Banks CDS use

Figure 4.3 highlights the amount of CDS use for trading by European banks as measured using the notional amount of CDS scaled by total assets.

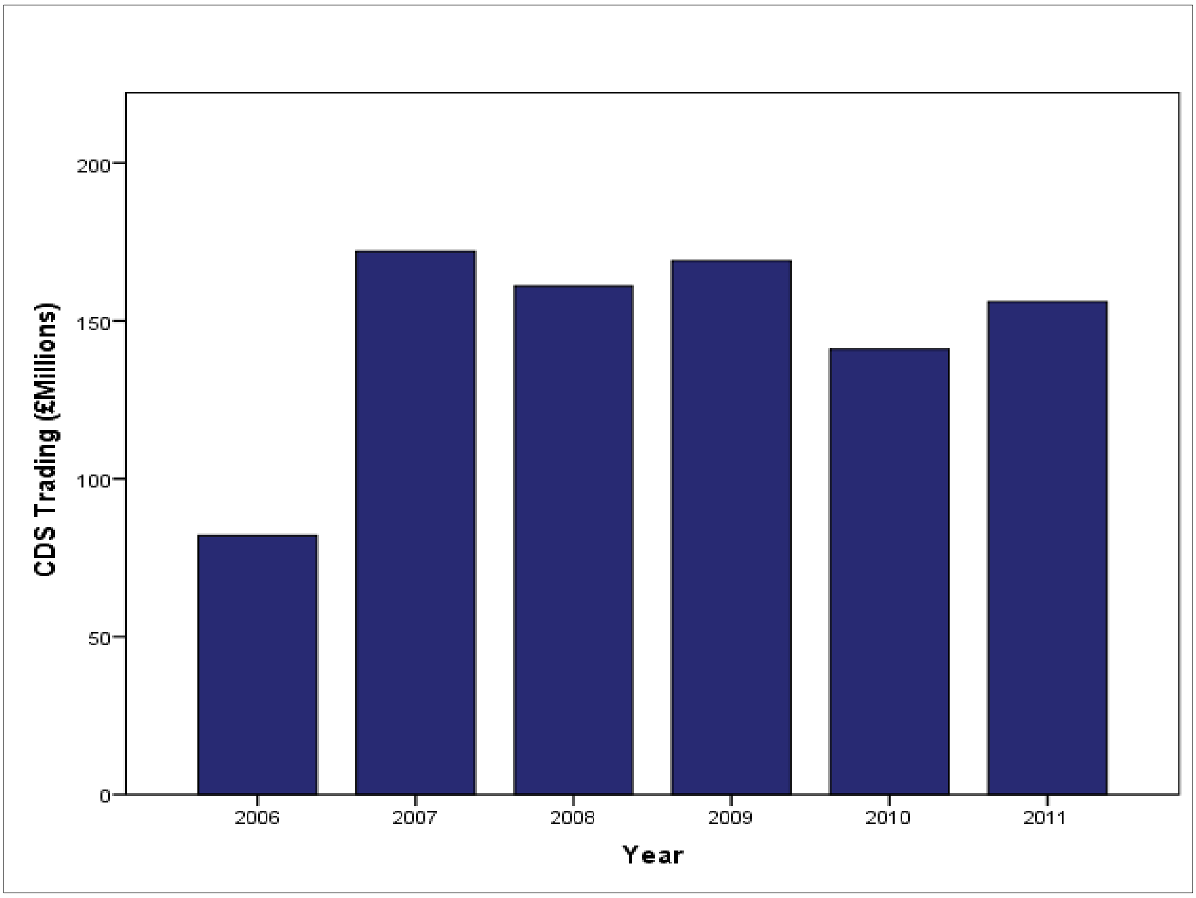


Figure 4.3: Average CDS use for trading purposes by European banks

The notional amount of CDS use for trading increased exponentially in the run up to the financial crisis, from £81.7 million in 2006 to £171.6 million in 2007.

This shows how CDS use for trading purposes in European banks is doubled before the financial crisis period. The total notional amount of CDS use for trading remains high even during and after the years of the financial crisis. In 2008 and 2009 the average total notional amount was almost £161 million and £169 million, respectively. This is consistent with empirical studies that provide evidence that firms do not reduce their derivatives use even during the financial crisis (e.g., Norden et al., 2011; Corsi et al., 2011; Bedendo and Bruno, 2012). In the subsequent year the notional amount of CDS trading decreased slightly by £28 million in 2010 (from £169 million to £141 million), but rises again in 2011.

Figure 4.4 below illustrates the changes in CDS use for hedging purposes during the sample period (2006-2011).

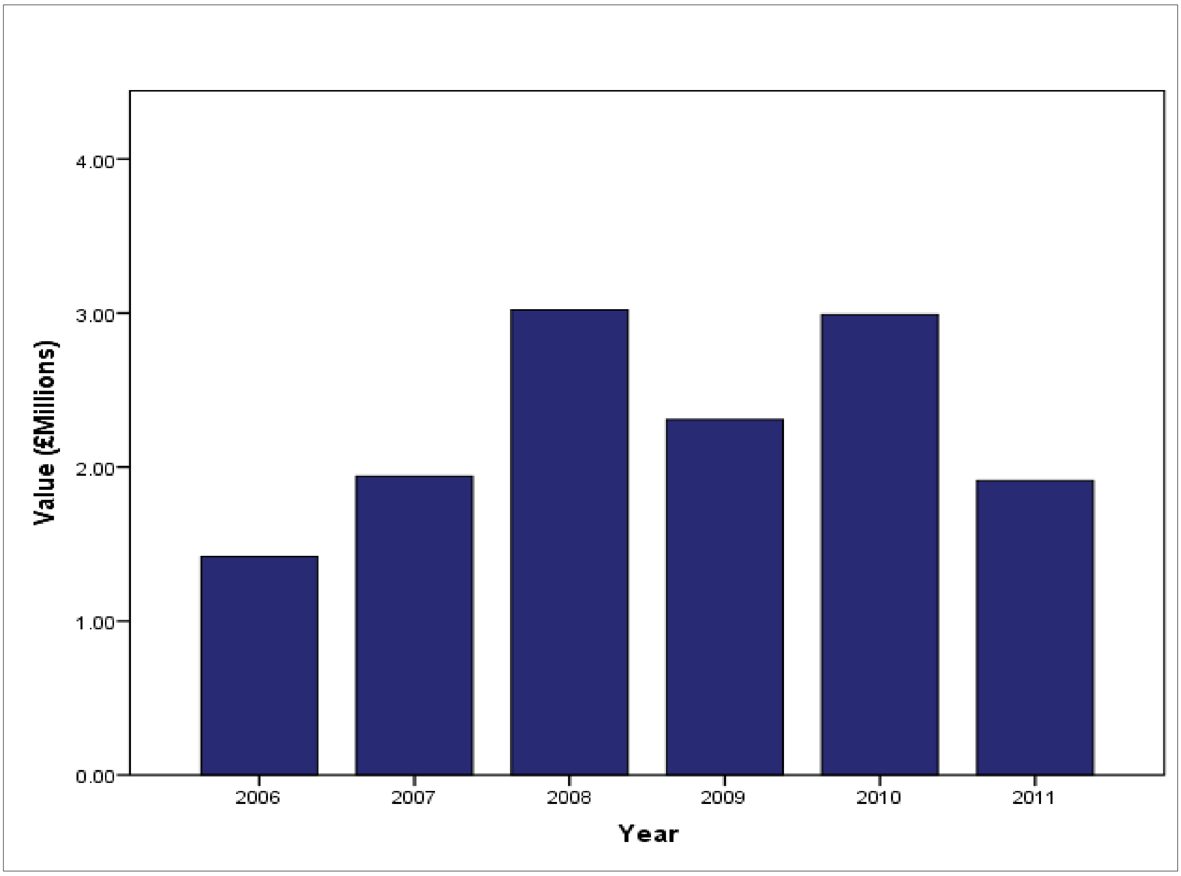


Figure 4.4: CDS use for hedging purposes by European banks.

European banks use CDS for trading purposes much more than using CDS for hedging purposes. The notional value of CDS use for hedging purposes increased steadily between 2006 and 2008. The average CDS use for hedging purposes in 2006 was £1.42 million and £1.94 million in 2007. The notional of CDS use for hedging reached a peak in 2008 at around £3 million. This suggests that banks were trying to use more CDS for hedging purposes during the financial crisis period in order to reduce their credit risk exposure. However, the average notional use of CDS for hedging purposes is still very limited compare with CDS use for trading.

After the end of the financial crisis period banks reduced their CDS use for hedging purposes. The average notional CDS use for hedging decreased by 28% in 2009 (from £3.2 million to £2.3 million). In 2010 the average notional value increased again to almost £3 million and declined in 2011 to £1.9 million.

4.4 CEO cash compensation (salary and bonuses)

Salaries and cash bonuses are two of the basic components in an executive compensation packages. The executive compensation package most often contains both types of cash compensation. Salary is the fixed contractual amount of compensation that does not vary explicitly. However, it can be affected by banks financial results, as good financial results can lead to higher salary and bad financial results can lead to lower salary in the future period (Balsam, 2002). Figure 4.5 displays the relative importance of the cash compensation package of CEOs in European banks between 2006 and 2011.

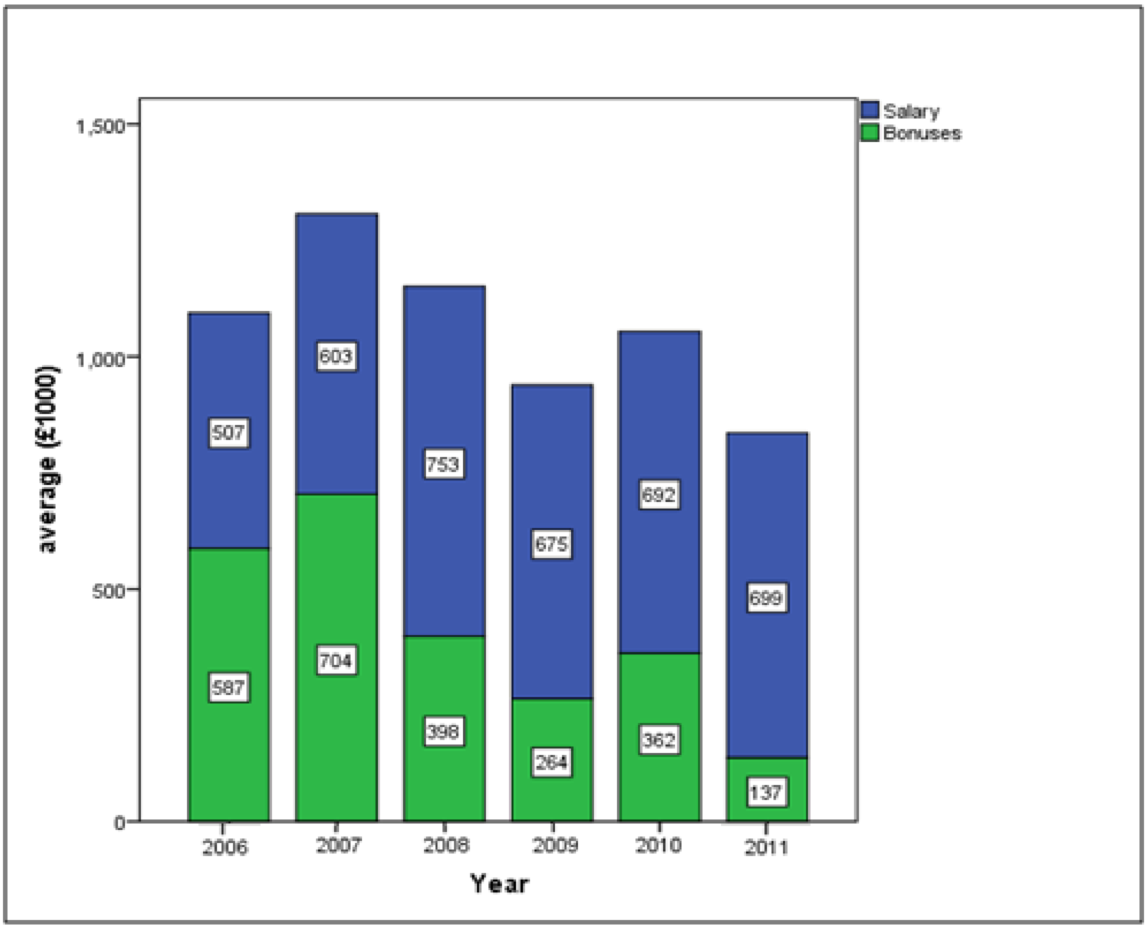


Figure 4.5: CEOs' salary and cash bonuses 2006 and 2011.

As illustrated in Figure 4.5 salaries face less variation compared with cash bonuses. The average salary increased from £507 thousand in 2006 to £603 thousand in 2007. However, after the financial crisis the average executive salary declines by 10 %, from £753 thousand in 2008 to £675 thousand in 2009. After the financial crisis period the average executive salaries faces a steady increase by 3% in 2010 (from £675 thousand to £692 thousand), and by 1% in 2011 (from £692 thousand to £699 thousand).

In contrast, executive annual cash bonuses face a substantial variation between 2006 and 2011. Cash bonuses ranged from a low of £137 thousand to a high of £704 thousand. In 2007 the average cash bonuses increase by 20% (from £587 in thousand in 2006 to £704 thousand in 2007). As a consequence of the financial crisis, cash bonuses decreased by 43% in 2008 (from £704 thousand to £398 thousand). In 2009, the average cash bonuses also decreased to reach £264 thousand. This may be related to the public concern about executive pay arrangements aftermath the financial crisis.

Even after the financial crisis executive cash bonuses face more fluctuation. The average cash bonuses increased by 37% in 2010 (from £264 thousand to £362 thousand), then decreased in 2011 to £137 thousand which indicate that CEO are less compensated with cash bonuses.

4.5 CEO stock-based compensation

Stock grants and stock options are among the major and most common components of executive compensation. Stock grants occur when the firm give shares to their executives. The main difference between stock grants and stock options is that stock grants have no exercise price. Whereas a stock option only has value if the firms share price is above the exercise price.

Stock-based compensation represents an important component of executive compensation plans. These components (stock grant and stock options) have different effects on executive incentives, as well as different costs for the corporation. A well-constructed executive compensation package normally makes trade-offs between these form of compensation to maximize the benefit to both the shareholders and the executives.

Executive stock grants can be restricted or unrestricted. For example a restriction imposed upon stock grants might be that the executive cannot sell the shares until a predetermined period of time. Stock options can be extremely valuable when the firm's share price rises, but can be expired worthless if the share price declines. Figure 4.6 illustrates how the values of executive stock-based compensation (shares and stock options) changes between 2006 and 2011.

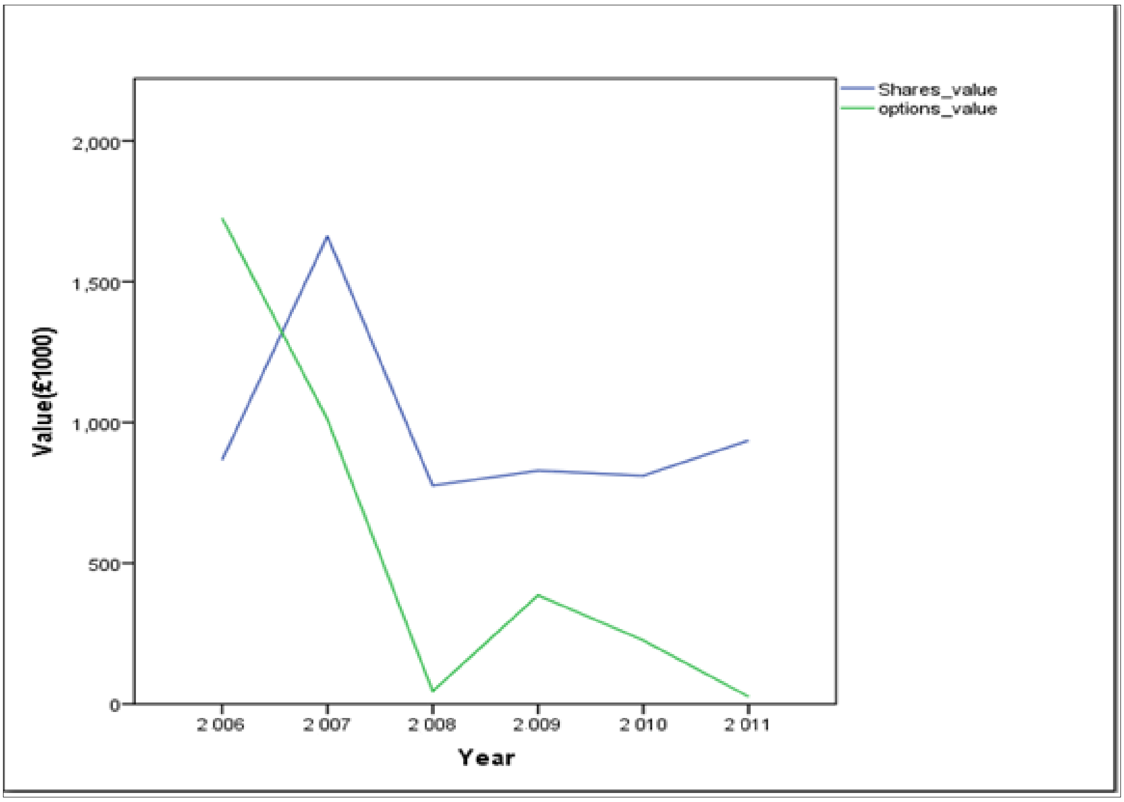


Figure 4.6: The value of CEOs' stock-based compensation (shares and stock options).

The value of executive share rises dramatically for the period before the start of the financial crisis and reaches the highest value in 2007. However, executives' share value has witnessed a sharp decrease during the financial crisis which can be explained by the large declines in stock prices (Chaudhury, 2014).

After 2009 the share values face less fluctuations and seems to increase and decrease in a small percentage compared with the period before and during the financial crisis.

The figure above also shows that CEOs suffered large losses on their stock option portfolios during the financial crisis. This was probably due to the uncertainty and the decline of share prices during the period of the financial recession, where the exercise price can be much higher than the share price (Fahlenbrach and Stulz, 2011). In other words, as the share price goes down the executive merely lose a potential profit opportunity because the value of stock option depends on the underlying share price (Carpenter and Yermack, 1999). As shown in figure 4.6, the value of stock options were higher than the value of stock grants in 2006, but the value of stock options face a substantial decline during the financial crisis period. Executive stock options bring more reward with the rising share prices, and bring more losses with the falling of share prices. After the financial crisis the value of stock options increases in 2009, but decline again in 2010 and 2011.

4.6 Banks' risk (beta)

Figure 4.7 shows how the systematic risk (beta) evolves over the sample period. Beta for European banks has an inverted U-shape during the financial crisis period, peaking in 2008. In 2009 and 2010 the banks beta declined which can be explained by the end of the financial crisis period. However, banks seem to take more risk again as the banks beta start to increase in 2011.

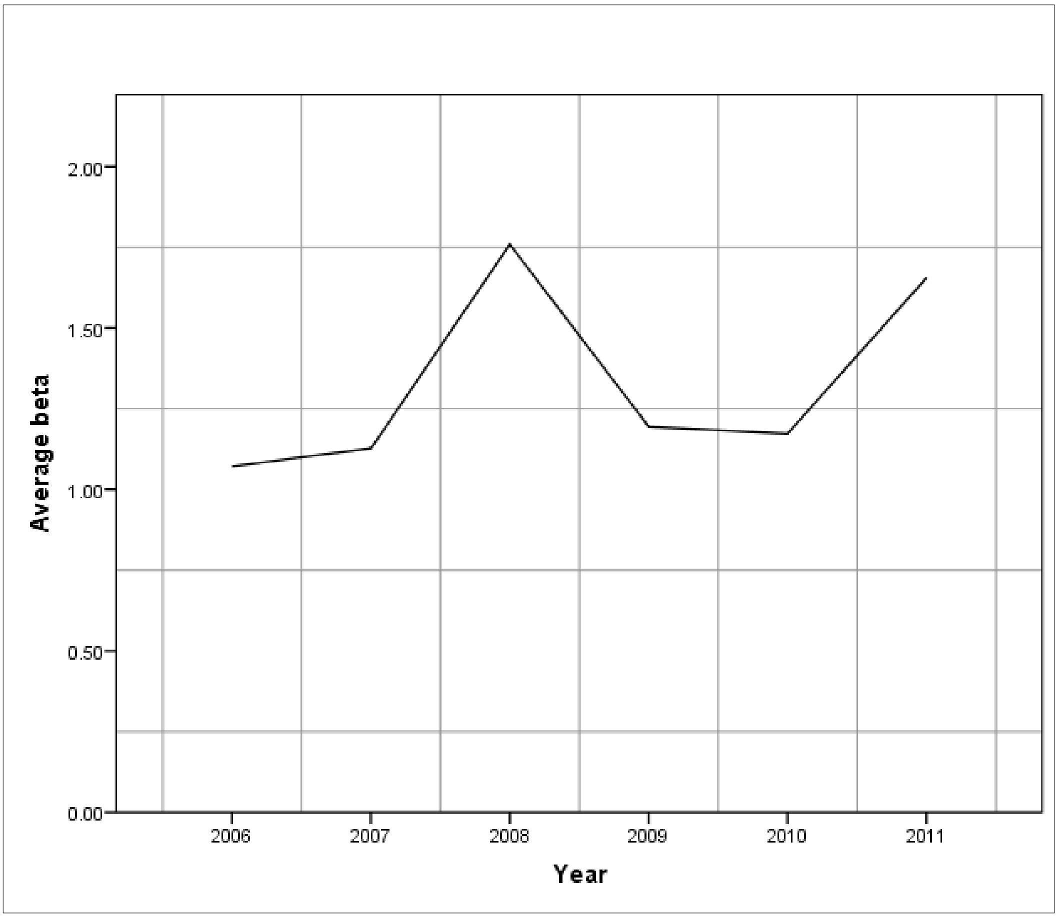


Figure 4.7: European banks' risk (beta) between 2006 and 2011.

Stângă (2014) documents evidence that the stabilization effects of bank bailouts on banking sector in the aftermath of the crisis are temporarily and limited across the European countries. She shows that bank bailouts lead to a temporarily improve in the creditworthiness of the European banking sector after the financial crisis and thereafter the banks' risk increase again.

4.7 CEO age

Prior studies suggest that old CEOs may have less incentive to increase the firm's risk as they approach their expected retirement dates (e.g., Yermack, 1995). Adkins et al. (2007) report that the average age of CEO in US bank holding companies in 1996–2000 was 56 years, the average age of the CEO in this European banks sample is 54 years.

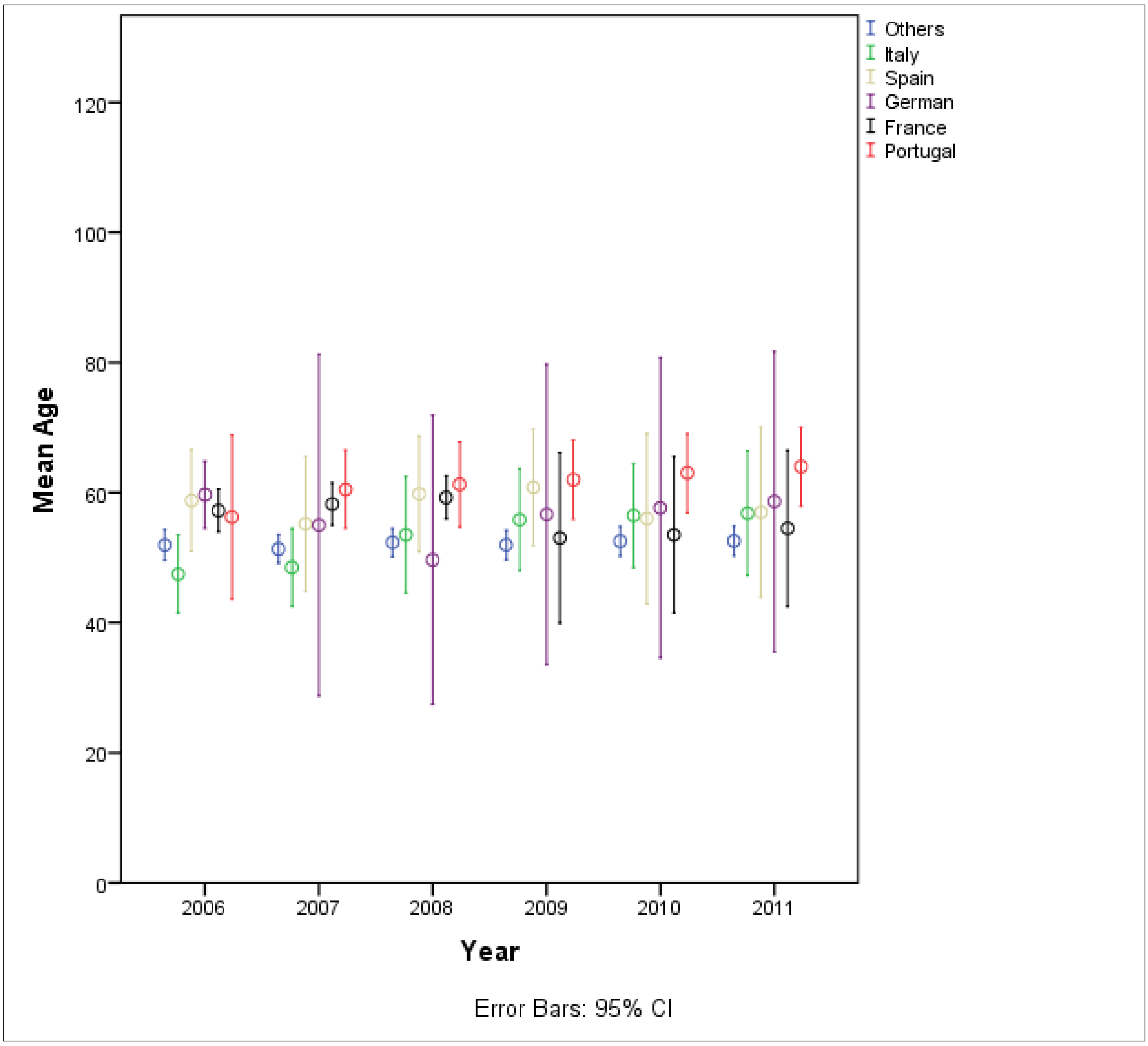


Figure 4.8 Executives' characteristics: The average age for CEO by country

Figure 4.8 summarizes the difference between CEO's age based on the country during the 2006-2011 sample period. In 2006 CEOs' in Italian banks are the youngest with an average age of 48 years, while the CEOs of Spanish and German banks are the oldest with an average age of 59 and 60 years, respectively. For CEOs in French and Portuguese banks the average age is 57 and 56, respectively. The average age of CEOs in other countries including UK banks is 52 years. Figure 4.8 indicates that in 2006 CEOs in Spanish and German banks are near to retirement and can be more sensitive to risk-taking as they approach retirement.

In 2007 CEOs' in Italian banks are still the youngest compared to other countries with an average age of 49 years, while the average age of Spanish and German banks CEOs is 55 years. This means that some Spanish and German banks changed their CEOs in 2007 as some of them retired or left their job. CEOs in French and Portuguese banks are the oldest in 2007 with an average age 57 and 56 respectively. The average CEOs age for other countries is 51 years. In 2008 the average age for CEOs in Portuguese banks is the highest with an average age of 61 years, while the lowest average age is for CEOs in Germans banks with 50 years. In 2009 , 2010, and 2011the figure shows that CEOs in Portuguese banks are still the closest to the retirement age with an average age of 62, 63, and 64 years, respectively, while CEOs in other countries are the youngest with an average age of 52 and 53 and 53 years, respectively.

4.8 Leverage

Earlier empirical studies discuss the effect of leverage and argue that higher leverage is associated with higher firm risk (Tufano, 1996; Coles et al., 1996). Figure 4.9 summarizes the difference between banks based on leverage ratio (Book value of debt / book value of asset).

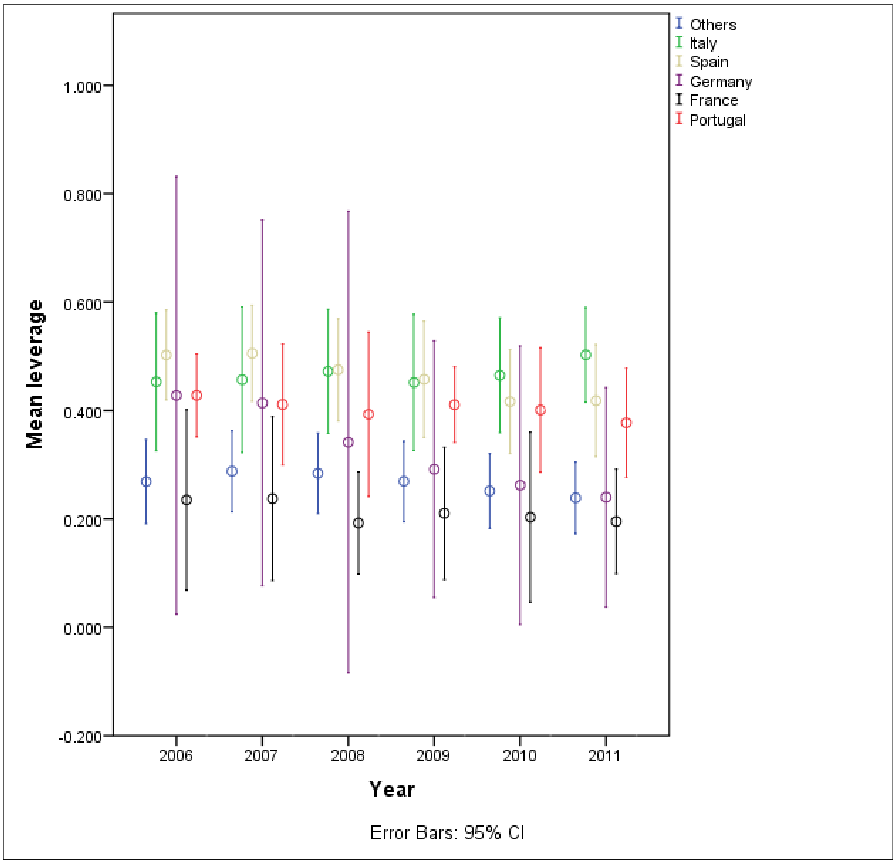


Figure 4.9 European banks' leverage by countries

The figure illustrates that in 2006 the average leverage ratio for Spanish banks is the highest (with average ratio of 0.502), while the lowest average leverage ratio is for French banks (with average ratio of 0.235). The average leverage ratio for Italian, German, Portuguese and other countries banks is 0.453, 0.427, 0.428 and 0.268, respectively.

During the financial crisis period the leverage ratio for Spanish banks is still the highest (with average ratio of 0.505 and 0.475 in 2007 and 2008, respectively), while the average leverage ratio for French banks is the lowest (0.237 and 0.192 in 2007 and 2008, respectively).

The average leverage ratio for Spanish banks decreased in 2009 but was still the highest, while the average leverage ratio in French banks are the lowest. In 2010 and 2011 the average leverage ratio for Italian banks is the highest (0.4652 and 0.5030, respectively), while the leverage ratio for French banks is still the lowest (0.2032 and 0.1954, respectively).

4.9 Diversification

Literature suggests that executives can use different strategies and tools to reduce bank's risk. For example, corporate diversification contributes to bank risk reduction. Hedging derivatives is also considered as an alternative way to diversify firms' risk. For example, executives can achieve risk reduction by using interest rate derivatives, currency exchange derivatives, and equity derivatives.

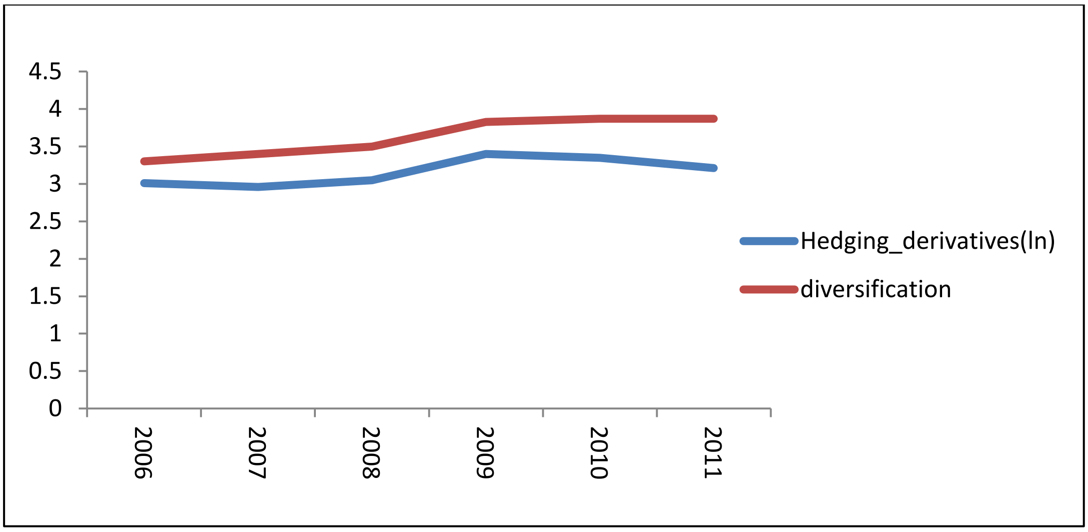


Figure 4.10 Hedging derivatives and diversification

Figure 4.10 presents the changes in banks diversification (measured by the number of geographical segments) and the use of hedging derivatives over the period of 2006 through 2011. The two variables are moving in a similar pattern, banks increase the use of hedging derivatives and diversification during and after the financial crisis compares with the period before the crisis. This indicates that banks were trying to reduce banks' risk by using more derivatives and by increasing the level of diversification.

4.10 CDS trading in large banks

Figure 4.11 presents how banks CDS use for trading differs during the sample period for the main countries in the sample. Italian banks increase their use of CDS for trading largely after the financial crisis compare with the period before and during the financial crisis. For example the average notional value for CDS trading is £63 million between 2006 and 2008, but this usage increased to £118 and £480 million in 2010 and 2011, respectively.

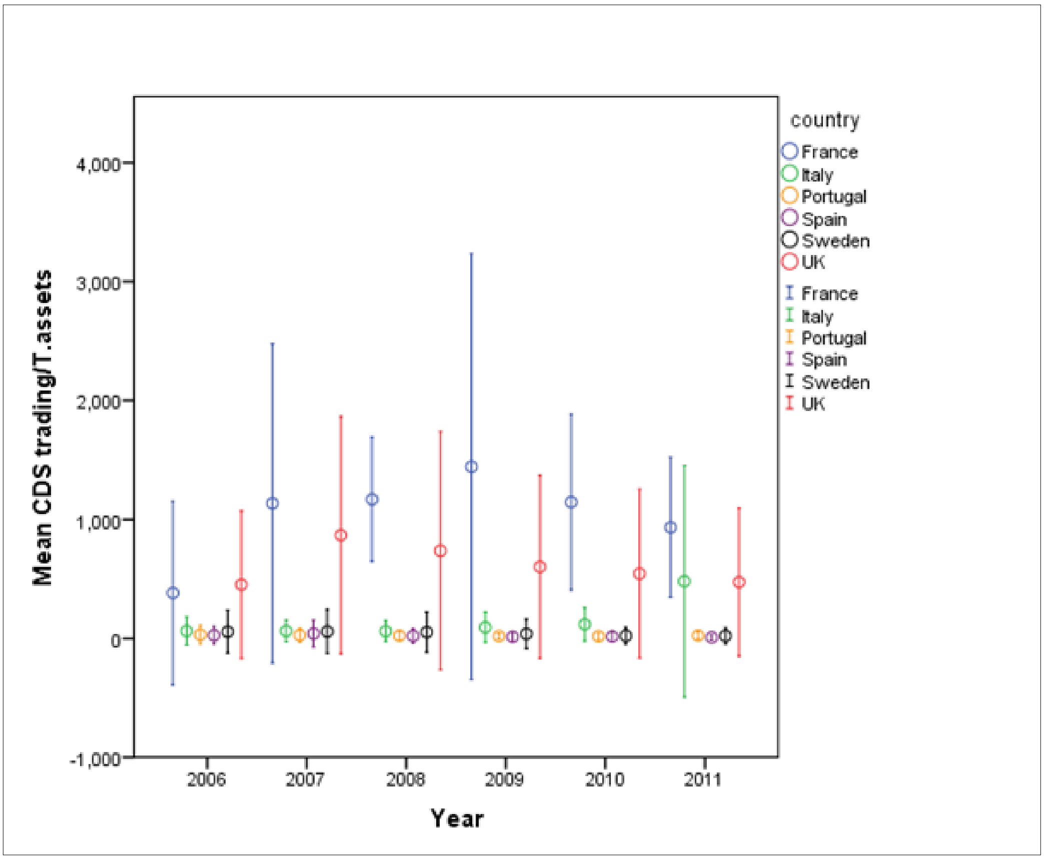


Figure 4.11: CDS trading for large European countries (countries with more than 3 banks in the sample)

French banks also increased their CDS use for trading for the period following the financial crisis. For example, in 2006 the average notional value for CDS trading increased from £1163 million in 2007 to £1444 million in 2009.

In contrast, CDS trading declines after the financial crisis in other countries like Spain, Portugal, Sweden and the UK. For example, UK banks decrease their CDS trading after the financial crisis from £868 million and £737 million in 2007 and 2008 to £545 million and £473 million in 2010 and 2011, respectively. Spanish banks also decrease their CDS trading from £27 million in 2006 to £8 million in 2011.

Chapter 5: Empirical tests and results for banks using CDS for trading purposes

5.1 Introduction

This chapter reports the results of empirical tests carried out to investigate the two aspects of this thesis: 1) The relationship between the risk-taking incentives generated by stock options and CDS use; 2) The impact of CDS use on a firm's risk. The results are based on data collected from the annual reports and Datastream for 60 European banks over a period of 6 years (2006-2011).

The results are displayed in accordance with the purpose of CDS use (i.e., trading purposes). The first part of this chapter is organised as follows. 1) The results of the relationship between CEOs' risk-taking incentives and CDS use for trading purposes are reported. 2) The results of the relationship between firm risk and CDS use for trading purposes are reported. Moreover, the results for the control variable are also discussed.

5.2 Empirical tests

The analysis is conducted entirely in a multivariate framework. OLS model is used to examine the relationship between the extent of CDS use for trading purposes and CEO risk-taking incentives in the European banking sector. Moreover, a two stage regressions model is used to address the endogeneity issues and to eliminate the possible simultaneity bias of modelling risk-taking incentives of stock option compensation as an exogenous variable (e.g., Rajgopal and Shevlin, 2002; Rogers, 2002; Coles et al., 2006). The analysis is based on the research method outlined in Chapter 3.

In the first stage model CEOs' risk-taking incentives (vega) are assumed as an exogenous variable. In the second stage, CEOs' risk-taking incentives (vega) are used as an endogenous explanatory variable. The risk-taking incentives are estimated using specifications very similar to those used by previous studies (e.g., Guay, 1999b; Rogers, 2002; Rajgopal and Shevlin, 2002; Coles et al., 2006).[41] The predicted value of vega is then incorporated as an explanatory variable in the CDS use model. Table 5.1 shows the descriptive statistics for the variables (mean, standard deviation, minimum, and maximum).

The relationship between firm risk and CDS use for trading purposes is conducted using OLS and panel data random effects models. In order to address the potential endogeneity of CDS use with respect to firm risk, the predicted value of CDS is used as an explanatory variable in the firm risk model. Regressions are expanded to broaden the scope of the investigation by using different sets of subsamples. More details for the subsamples used in the analysis are presented in Appendix (E).

Table 5.1: Descriptive statistics, mean, standard deviation, minimum, and maximum

Variables	Mean	Std.Dev	Min	Max
Age	53.978	7.271	35	70
Tenure	4.833	4.057	1	28
Ownership (%)	0.004	0.019	0	0.190
Salary(ln)	5.988	1.240	1.609	8.154
Bonus(ln)	2.774	3.141	-0.843	8.697
Sharevalue(ln)	1.852	3.241	0	10.622
Optionvega(ln)	2.397	4.411	-9.269	14.163
Delta(ln)	3.943	4.860	-9.436	13.488
Trading CDS (ln)	1.607	2.619	-3.72	8.03
Hedging CDS (ln)	0.211	0.926	-4.52	4.74
Trading derivatives(ln)	5.350	3.485	-1.129	11.106
Hedging derivatives(ln)	3.162	2.746	-2.416	10.476
Leverage	0.317	0.194	0	0.932
Investment opportunities(ln)	0.058	0.728	-2.04	1.848
Diversification (number of geographical segments)	3.639	2.485	1	10
Beta (ln)	0.123	0.732	-4.086	1.596
Distance to default	7.260	6.780	2.544	62.172
Size(ln)	9.103	3.395	2.639	18.189

Number of observations =360

[41] These specifications include regress vega with the following variables: CEO's cash compensation (salary and bonuses), delta, bank size, growth opportunities, leverage, and risk.

5.3 Risk-taking incentives and CDS use for trading purposes

5.3.1 First stage analysis

In this subsection, the relationship between vega (as a proxy for CEOs' risk-taking incentives generated by stock option compensation) and CDS use for trading purposes is examined in first stage regressions. The analysis is conducted mainly using OLS regressions. Tobit, probit, and panel data random effects models are also used to further examine the robustness of the results.

The models employed in this subsection assume that CEO risk-taking incentives of stock options are an exogenous variable. Tables 5.2 and 5.3 report the results of the first stage OLS regressions. The dependent variable is the extent of CDS use for trading purposes as measured using the notional value of a CDS contract scaled by total assets (e.g., Knopf et al., 2002; Rogers, 2002). The dependent variable is expressed in the natural logarithm of its value.

The independent variable in the first stage analysis is the CEO risk-taking incentives provided by stock option compensation. The risk incentive feature of managerial stock option compensation is measured as vega. Vega represents a measure of the extent of change in the value of a CEO's stock options in response to changes in the bank stock return volatility. Similar to several other studies, the vega of the stock option compensation is used to calculate the vega of a CEO's total stock-based compensation (Gao, 2010; Fahlenbrach and Stulz, 2011; Hagendorff and Vallascas, 2011; Bai and Elyasiani, 2013). The reason is that stock option vega is many times higher than stock vega, and the risk-taking incentives of CEOs' stock-based compensation to volatility is driven primarily by stock options, where the risk-taking incentive of stock compensation is negligible (Guay, 1999b; Bai and Elyasiani, 2013). Vega is expressed in the natural logarithm of its value.

Table 5.2, column (1) shows the results from the first stage risk-taking incentives (vega) model incorporating different independent variables. This study also controls for time and countries differences through the inclusion of countries and years dummy variables in column (2). The country dummy variable used in column (2) is based on the number of banks operating in each country. The countries divided into tow categories, dummy variable equals one if the country has more than 3 banks, and zero otherwise.

Table 5.2: First stage OLS regressions of the extent of CDS use for trading purposes and the risk-taking incentives (vega)

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Vega	0.113***	0.026	0.000	0.086***	0.025	0.001
Salary	-0.265**	0.117	0.025	-0.596***	0.122	0.000
Bonus	0.076*	0.039	0.055	0.034	0.037	0.361
Shares	0.059	0.038	0.119	-0.006	0.036	0.878
Ownership	-0.018	0.053	0.728	0.032	0.050	0.525
Derivatives (hedging)	0.004	0.051	0.941	-0.076	0.049	0.119
Derivatives (trading)	0.319***	0.042	0.000	0.290***	0.040	0.000
Investment opportunities	-0.846***	0.156	0.000	-0.642***	0.190	0.001
Leverage	-1.301**	0.558	0.020	-2.159***	0.533	0.000
Size	0.136***	0.040	0.001	0.481***	0.090	0.000
Diversification	0.150***	0.049	0.002	0.060	0.047	0.205
Bank dummy				-1.329***	0.237	0.000
Year1				0.437	0.429	0.308
Year2				-2.744***	0.753	0.000
Year3				0.292	0.338	0.388
Year4				0.344	0.345	0.319
Year5				0.139	0.338	0.681
Adjusted R^2	0.446			0.530		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results reported in Table 5.2 show that the coefficient of vega is positive and statistically significant to the extent of CDS for trading purposes (at the 1% level). This indicates a positive association between the risk-taking incentives generated by stock option compensation and the extent of CDS use for trading purposes. This relationship is still positive and statistically significant after controlling for year and countries differences in column (2).

This finding is consistent with the implication of theoretical arguments, which state that stock option compensation increases the risk-taking incentives of the CEOs (Smith and Stulz, 1985). Accordingly, the results suggest that CEO risk-taking incentive generated by stock option compensation is an important determinant of bank CDS use for trading.

This finding is consistent with the hypothesis that a higher incentive to take risk is associated with greater CDS use for trading purposes, and suggests that CDS use for trading purposes is positively related to risk-taking incentives (Fung et al., 2012; Nijskens and Wagner, 2011; Rossi, 2011). Higher vega can align the interests of executives with their shareholders who typically prefer more risk-taking and would like firm managers to undertake risky projects.

Similar results are found in previous empirical studies. For example, Chen et al. (2006) find that stock options can make managers select projects that increase firm risk. Guay (1999b) and Rajgopal and Shevlin (2002) find that the use of stock options reduces the CEOs' risk-related incentives problem and motivates them to take in risky projects.

Similar results are obtained in Table 5.3 after using different sets of country dummies. In column (1), country dummy variables are used based on the use of CDS. Dummy variables equal one is used for countries that have the highest number of CDS observations (Germany, Italy, Spain, Denmark, France, and Portugal, zero otherwise). In column (2), year and country dummies are used for the countries that have the largest number of banks included in the sample (dummy variable equals one if the bank operates in one of the following countries: the UK, France, Italy, Portugal, Spain and Sweden, zero otherwise).[42]

[42] The number of banks: 5 in the UK, 4 in France, 6 in Italy, 4 in Portugal, 5 in Spain and 4 in Sweden.

Table 5.3: First stage OLS regressions of the extent of CDS use for trading purposes and the risk-taking incentives (vega) including country dummies

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Vega	0.102***	0.026	0.000	0.049**	0.024	0.041
Salary	-0.233*	0.119	0.051	-0.425***	0.117	0.000
Bonus	0.033	0.039	0.401	0.038	0.036	0.293
Shares	-0.126***	0.038	0.001	-0.086**	0.042	0.040
Ownership	-0.020	0.052	0.705	0.068	0.048	0.162
Derivatives (hedging)	0.005	0.049	0.913	-0.023	0.046	0.618
Derivatives (trading)	0.278***	0.045	0.000	0.201***	0.040	0.000
Investment opportunities	-0.650***	0.156	0.000	-0.479**	0.188	0.011
Leverage	-0.634	0.586	0.280	-0.425	0.541	0.432
Size	0.098**	0.038	0.011	0.393***	0.086	0.000
Diversification	0.105**	0.051	0.041	0.050	0.049	0.309
Country dummy1	1.633***	0.568	0.004	-3.662***	0.458	0.000
Country dummy2	1.894***	0.663	0.005	-3.283***	0.557	0.000
Country dummy3	2.063***	0.684	0.003	-2.876***	0.559	0.000
Country dummy4	1.320*	0.728	0.070	-0.404	0.566	0.477
Country dummy5	4.504***	0.696	0.000	-2.533***	0.579	0.000
Country dummy6	2.264***	0.679	0.001	-3.384***	0.531	0.000
Year1				0.230	0.401	0.566
Year2				-2.286***	0.717	0.002
Year3				0.174	0.312	0.576
Year4				0.237	0.318	0.457
Year5				0.073	0.311	0.813
Adjusted R^2	0.515			0.604		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Vega coefficient in column (1) is positive and statistically significant to the notional value of CDS use for trading (at the 1% level). This shows a positive relationship between the risk-taking incentives (vega) and the extent of CDS use for trading purposes. In column (2) the relationship between risk-taking incentives (vega) and the extent of CDS use for trading purposes is also positive and significant (at the 5% level). This finding is consistent with the results presented in Table 5.2.

The results reported in Tables 5.2 and 5.3 of the OLS regressions show that adjusted R^2 ranges from 0.446 to 0.604. This indicates that the models fit the data and 44.6% to 60.4% of the variation in the dependent variable is explained by variations in the independent variables.

5.3.2 The results for the control variables (firs stage regressions)

Independent control variables are used as proxies for the determinants of CDS use. These variables are selected based on the previous literature (e.g., Rajgopal and Shevlin, 2002; Rogers, 2002). Cash compensation variables (salary and cash bonuses) are included in the analysis as a control variable for managerial risk aversion. A negative association is expected between cash compensation (salary and cash bonuses) and CDS use for trading purposes. In general, the results reported for the OLS models in the first stage regressions reveal significant negative relationship between CEOs' salaries and CDS use for trading. This negative linkage indicates that as CEOs' salaries increase, the CDS use for trading purposes decreases because managers prefer to reduce firm risk as a result of their risk aversion. The results in Table 5.2 show that cash compensation variables are positively related to CDS use for trading. This finding is consistent with pervious empirical studies that find cash bonuses are linked to less risk management and more risk-taking (e.g., Ertugrul et al., 2008; Supanvanij and Strauss, 2010).

The value of stock grants is also used as a proxy for managerial risk aversion. Stock grants increase the risk aversion of non-diversified managers and provide the managers with incentive to reduce firm risk (Smith and Stulz, 1985). The results show a negative relationship between the value of managers' stock grants and CDS use for trading purposes in Table 5.3. This negative relationship between CDS use for trading purposes and the value of stock grants implies that as the value of share compensation increases, the managers tend to use less CDS for trading purposes.

The use of other types of derivatives for trading purposes (e.g., interest rates derivatives, exchange rate derivatives, commodity derivatives) is found to be positively and significantly associated with CDS use for trading purposes (at the 1% level). This is consistent with the finding of Minton et al. (2009), that banks which use credit derivatives are more likely to use other derivatives.

The results displayed in the first stage regressions indicate that there is a significant negative association between investment opportunities and CDS use for trading purposes. This is consistent with existing literature that finds a positive association between investment opportunities and the incentives to reduce firm risk by using more derivatives for hedging (Tufano, 1996; Géczy et al., 1997; Coles et al., 2006; Supanvanij and Strauss, 2010). Banks with greater investment opportunities use less CDS for trading purposes.

Leverage as a proxy for financial distress is negatively association with CDS use for trading purposes. This result is consistent with theoretical and empirical studies that point out that firms facing higher expected costs of financial distress have larger incentives to reduce firm risk and are more likely to use more derivatives for hedging (Smith and Stulz, 1985; Rogers, 2002; Géczy et al., 2007).

The relationship between CDS use for trading purposes and bank diversification is positive and significant. This is consistent with prior empirical studies that document a negative relationship between the degree of diversification and derivatives use for hedging to reduce firm risk (e.g., Tufano, 1996; Géczy et al., 2007; Fung et al., 2012). Similarly, the results presented in the tables for the first stage regression above show a positive and significant linkage between bank size and CDS use for trading purposes. Large banks are found to use more CDS for trading purposes. This finding is consistent with previous empirical studies that find evidence that large companies are more likely to speculate in the derivatives market (e.g., Géczy et al., 2007). This suggests that economies of scale in costs are important determinants of CDS use for trading purposes.

5.4 Second stage analysis

This subsection presents the results of the second stage regression on the relationship between CDS use for trading purposes and vega as a proxy for CEOs risk-taking incentives generated by stock option compensation when vega is modelled as an endogenous variable.

The risk-taking incentives (vega) are estimated using specifications very similar to those used by previous studies (e.g., Rogers, 2002; Rajgopal and Shevlin, 2002; Coles et al., 2006).[43] The predicted value of vega is then incorporated as an explanatory variable in the CDS use model. Similar to the first stage analysis, Table 5.4 shows the results of the second stage OLS regressions after including year and country dummy variables based on the number of banks operating in each country (dummy variable equals one if the country has more than 3 banks, and zero otherwise).

[43] These specifications include regress vega with the following variables: CEO's cash compensation (salary and bonuses), delta, bank size, growth opportunities, leverage, and risk.

Table 5.4: Second stage OLS regressions of the extent of CDS use for trading purposes and the risk-taking incentives (vega)

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Predicted vega	0.051***	0.016	0.002	0.033**	0.016	0.034
Salary	-0.191	0.129	0.140	-0.556***	0.137	0.000
Bonus	0.079**	0.040	0.049	0.037	0.038	0.329
Shares	-0.016	0.048	0.743	-0.052	0.045	0.251
Ownership	-0.035	0.053	0.506	0.021	0.051	0.674
Derivatives (hedging)	-0.012	0.051	0.813	-0.092*	0.049	0.062
Derivatives (trading)	0.336***	0.042	0.000	0.307***	0.039	0.000
Investment opportunities	-0.764***	0.159	0.000	-0.643***	0.192	0.001
Leverage	-1.355**	0.565	0.017	-2.232***	0.538	0.000
Size	0.129***	0.041	0.002	0.479***	0.095	0.000
Diversification	0.169***	0.049	0.001	0.073	0.048	0.129
Bank dummy				-1.344***	0.241	0.000
Year1				0.669	0.426	0.117
Year2				-2.585***	0.782	0.001
Year3				0.372	0.341	0.276
Year4				0.483	0.346	0.164
Year5				0.252	0.340	0.459
Adjusted R^2	0.432			0.520		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results reported in Table 5.4 show that vega is positive and statistically significant to the extent of CDS for trading purposes. This finding is consistent with the results presented in the first stage analysis. The results support the hypothesis that higher incentive to take risk is associated with greater CDS use for trading purposes.

Table 5.5 below shows the results of the second stage regressions after including dummy variables in column 1 for countries that have the highest number of CDS observations (Germany, Italy, Spain, Denmark, France, and Portugal, zero otherwise), and dummy variables in column 2 for year and the countries that have the largest number of banks included in the sample (dummy equals one if the bank operates in one of the following countries: the UK, France, Italy, Portugal, Spain and Sweden, zero otherwise).

Table 5.5: Second stage OLS regressions of the extent of CDS use for trading purposes and the risk-taking incentives (vega) including country dummies

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Predicted vega	0.032**	0.016	0.046	0.030**	0.014	0.041
Salary	-0.185	0.130	0.156	-0.145	0.115	0.207
Bonus	0.051	0.040	0.199	0.053	0.037	0.149
Shares	-0.089***	0.049	0.072	-0.103**	0.051	0.044
Ownership	-0.031	0.052	0.554	0.025	0.048	0.601
Derivatives (hedging)	-0.007	0.049	0.881	0.023	0.045	0.601
Derivatives (trading)	0.282***	0.045	0.000	0.223***	0.041	0.000
Investment opportunities	-0.581***	0.158	0.000	-0.507***	0.192	0.009
Leverage	-0.594	0.596	0.319	-0.330	0.555	0.552
Size	0.100***	0.040	0.012	0.001**	0.000	0.015
Diversification	0.121***	0.052	0.020	0.132***	0.048	0.006
Country dummy1	1.517***	0.576	0.009	-4.043***	0.461	0.000
Country dummy2	1.838***	0.674	0.007	-3.341***	0.573	0.000
Country dummy3	1.668**	0.684	0.015	-2.982***	0.565	0.000
Country dummy4	0.918	0.729	0.209	-0.356	0.585	0.543
Country dummy5	4.475***	0.709	0.000	-3.030***	0.578	0.000
Country dummy6	1.971***	0.685	0.004	-3.560***	0.541	0.000
Year1				0.348	0.408	0.394
Year2				0.128	0.427	0.764
Year3				0.318	0.318	0.319
Year4				0.370	0.324	0.254
Year5				0.156	0.318	0.623
Adjusted R^2	0.499			0.584		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results reported are consistent with the finding of OLS model in the first stage regression. The columns show that the coefficients of vega are consistently positive and statistically significant. The results confirm the finding of the first stage OLS regression, vega is linked to higher extent of CDS use for trading purposes.

The results reported in Tables 5.4 and 5.5 of the second stage OLS regressions show that adjusted R^2 rang from (0.432 to 0.584). This indicates that the models fit the data and 43.2%

to 58.4% of the variation in the dependent variable is explained by variations in the independent variables.

As stated before, in addition to OLS regressions, the panel data random effects model is used to control for the presence of unobserved firm heterogeneity in the sample.

Table 5.6: Panel data random effect model of CDS use for trading purposes and the predicted risk-taking incentives (vega)

Independent variables	Coefficients	Standard error	P value
Predicted vega	0.002	0.009	0.868
Salary	0.051	0.110	0.639
Bonus	-0.007	0.018	0.710
Shares	0.010	0.030	0.730
Ownership	-0.022	0.030	0.459
Derivatives (hedging)	0.102	0.036	0.004
Derivatives (trading)	0.198	0.033	0.000
Investment opportunities	-0.164	0.098	0.095
Leverage	-0.305	0.712	0.669
Size	0.026	0.016	0.115
Diversification	0.120	0.051	0.019
Year	-0.031	0.034	0.363
R^2 within	0.122		
R^2 between	0.381		
R^2 overall	0.362		

The results reported in Table 5.6 are consistent with the results reported for OLS models. The risk-taking incentive generated from stock option compensation (vega) is positively related to CDS use for trading purpose; however, this relationship is not statistically significant.

5.4.1 The results for the control variables (second stage regressions)

The results for the second stage analysis (displayed in Tables 5.4 and 5.5) show a negative association between CEO's salaries and CDS use for trading. This negative relationship is statistically significant in column 2 of Table 5.4. Cash bonus variable is positively associated with CDS use for trading in column (1). However, previous studies had difficulties documenting the relationship between cash compensation (salary or cash bonuses) and derivatives use (Adkins et al., 2007; Knopf et al., 2002).

The value of the stock grants is also associated with less CDS use for trading purposes in Table 5.5. These results are consistent with prior studies that show negative relationship between stock grants and the risk-taking strategies (e.g., Tufano, 1996; Rogers, 2002).

The use of trading derivatives is found to be positively and significantly associated with CDS use for trading. While hedging derivatives variable is negatively related to the extent of CDS use for trading. This finding is consistent with the results of Minton et al. (2009), that banks which use credit derivatives are more likely to use other derivatives.

The results from the second stage regressions confirm the finding shown in the first stage regression for each of the investment opportunities, leverage, diversification and size. A significant and negative association is found between investment opportunities and CDS use for trading. Consistent with prior studies, banks with greater investment opportunities are less likely to use CDS for trading purposes (e.g., Tufano, 1996; Géczy et al., 2007; Supanvanij and Strauss, 2010). Leverage in the second stage regression is also negatively associated with CDS use for trading. Diversification and size are positive and significant with CDS use for trading.

Overall, the results reported for the control variables of the first stage regressions (Tables 5.2 and 5.3) and the second stage regressions (Tables 5.4 and 5.5) in the CDS use model suggest that investment opportunities, bank size, other derivatives use, and diversification are important determinants for CDS use.

This thesis also controls for delta (CEO pay-performance sensitivity). Few previous empirical studies tend to control for delta because the effect of delta in the risk-taking incentives is less important compare with vega (e.g., Rogers, 2002; Coles et al., 2006). However, in the present thesis delta is used as an additional control variable. The results are largely unchanged after the inclusion of delta as an explanatory variable. The results of the main variables when delta used as a control variable are summarised in Appendix F (Panel B).

5.4.2 Robustness checks

As mentioned before, tobit and probit models are included to further examine the robustness of the results from the OLS model. A tobit model is used to examine the relationship between the extent of CDS use for trading purposes and CEO risk-taking incentives. The dependent variable in tobit model is the extent of CDS use for trading purposes (the notional value of a CDS contract scaled by total assets), while the independent variable is CEOs' risk-taking incentives (predicted vega).

Probit model is also used in an effort to disentangle the decision to use CDS from the extent of using CDS (e.g., Haushalter, 2000; Graham and Rogers, 2002; Ertugrul et al., 2008). The dependent variable in probit model is a dummy variable equals to one if the bank uses CDS for trading and zero otherwise, while the independent variable is CEO risk-taking incentives generated by stock options as an endogenous variable. Table 5.7 reports the results of tobit and probit models. Dummy variables equal one is used for countries that have the highest number of CDS observations (Germany, Italy, Spain, Denmark, France, and Portugal, zero otherwise).

The results reported for tobit model show that the coefficient of vega is positive and statistically significant to CDS use for trading. This finding is consistent with the hypothesis that a higher incentive to take risk is associated with greater CDS use for trading purposes, and suggests that the extent of CDS use for trading purposes is positively related with risk-taking (Fung et al., 2012; Nijskens and Wagner, 2011; Rossi, 2011).

Table 5.7: Second stage tobit and probit regressions of CDS use for trading purposes and the risk-taking incentives (vega)

	Tobit model		*Probit model*	
Independent variables	**Coefficients**	**P value**	**Coefficients**	**P value**
Predicted vega	0.095***	0.003	0.044***	0.009
Salary	0.295	0.454	0.188	0.327
Bonus	0.093	0.238	0.010	0.780
Shares	0.066	0.479	-0.035	0.440
Ownership	0.030	0.810	-0.005	0.927
Derivatives (hedging)	0.163	0.158	0.040	0.423
Derivatives (trading)	0.928***	0.000	0.353***	0.000
Investment opportunities	-1.758***	0.000	-0.685***	0.000
Leverage	-0.939	0.630	-1.866**	0.037
Size	0.339***	0.000	0.131***	0.002
Diversification	0.333***	0.004	0.169***	0.003
Country dummy1	-1.955**	0.027	-1.445*	0.089
Country dummy2	0.240	0.838	0.619	0.490
Country dummy3	-1.983	0.192	-0.934	0.339
Country dummy4	-1.554	0.248	-0.480	0.606
Country dummy5	0.663	0.575	0.255	0.778
Country dummy6	-1.079	0.416	0.587	0.512
Pseudo R- squared	0.286		0.574	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results for probit model also show positive and significant relationship between the decision to use CDS for trading purposes and CEO risk-taking incentives generated by stock options. Similar results are found in previous empirical studies. For example, Chen et al. (2006) find that stock options can make managers select projects that increase firm risk. Guay (1999) and Rajgopal and Shevlin (2002) find that the use of stock options reduces the CEOs' risk-related incentives problem and motivates them to take in risky projects.

These findings are consistent with the results presented for the first and second stage OLS regressions. The results support the hypothesis that higher incentive to take risk is associated with greater CDS use for trading purposes. These results are consistent with the implications of the theoretical arguments that the risk-taking incentives of stock option compensation (vega) can align the interests of executives with their shareholders and induce them to take more risk (Smith and Stulz, 1985).

5.5 CDS use for trading purposes and firm risk

5.5.1 Distance to default

The literature has largely focused on investigating the purposes of corporate derivatives use and has tried to find whether executives are using derivatives to hedge or to speculate. However, the relationship between the purposes of derivative use and a firm's risk has gained less attention. Prior studies assume that firms that engage in derivatives use for hedging purposes seek mainly to minimize risk, where firms that use derivatives for trading purposes do so to take more risk.

This section explores the influence of CDS use on a firm's risk and reports the results of the firm risk model based on OLS and panel random effects regressions. The analysis is conducted in a setting in which CDS use for trading purposes is modelled as an endogenous variable.

In this section, the relationship between CDS use and banks' risk is examined using the same subsamples used in previous section. Four different subsamples are used: The first column is based on the full sample. In the second column a dummy variable is allocated to the number of banks operating in each country which equals 1 if the country has more than three banks and 0 otherwise. In the third column a country dummies are added for countries that have the highest number of CDS observations: Germany, Italy, Spain, Denmark, France, and Portugal. In the fourth subsample country dummies are used for the following countries: the UK, France, Italy, Portugal, Spain and Sweden. The list of the four subsamples and classification criteria are presented in Appendix E.

Table 5.8 shows the results of the relationship between the independent variable, which is CDS use for trading purposes, and the dependent variable, which is firm risk as measured using Merton distance to default model.

Table 5.8: OLS regressions of firm risk (distance to default) and CDS use for trading purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	-0.267***	0.003	-0.356***	0.000	-0.255**	0.016	-0.438***	0.000
Salary	-0.175	0.616	-0.727*	0.061	-0.550	0.143	-0.526	0.180
Bonus	-0.074	0.542	-0.158	0.193	-0.328***	0.007	-0.216*	0.083
Leverage	4.807***	0.005	5.413***	0.002	4.335**	0.014	5.202***	0.006
Investment opportunities	-4.166***	0.000	-4.241***	0.000	-3.494***	0.000	-4.173***	0.000
Size (sales log)	0.510***	0.000	1.510***	0.000	1.168***	0.000	1.939***	0.000
Tenure	-0.045	0.607	0.002	0.978	0.090	0.287	0.019	0.822
Age	0.061	0.221	0.062	0.202	-0.020	0.672	-0.002	0.976
Diversification	0.280*	0.077	0.138	0.393	-0.089	0.586	-0.051	0.771
Bank dummy			1.797**	0.022				
Country dummy1					-1.450	0.287	-2.792**	0.021
Country dummy2					-1.964	0.232	-3.476**	0.014
Country dummy3					-1.404	0.464	-1.589	0.293
Country dummy4					8.588***	0.000	3.920***	0.005
Country dummy5					4.177**	0.019	-3.827***	0.007
Country dummy6					-1.857	0.393	-3.344**	0.013
Year1			0.870	0.528			0.679	0.623
Year2			-8.444***	0.000			-11.48***	0.000
Year3			-0.320	0.772			-0.568	0.600
Year4			-2.134*	0.059			-2.331**	0.035
Year5			-1.584	0.153			-1.631	0.132
Adjusted R^2	0.195		0.236		0.340		0.279	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results reported in all columns show that the coefficients of CDS trading are consistently negative and statistically significant (below the 10% level).

These findings are consistent with the hypothesis that the increase in CDS use for trading purposes is associated with higher firm risk. The results indicate that CDS use for trading purposes lowers the distance to default (i.e., increase the default risk). This empirical finding is consistent with previous empirical findings of Fung et al. (2012), which state that CDS use for trading purposes is positively associated with firm risk. Table 5.9 shows the results of the firm risk (distance to default) using a random effects regression.

Table 5.9: Random effects regressions of firm risk (distance to default) and CDS use for trading purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	-0.267***	0.003	-0.250***	0.006	-0.302***	0.001	-0.300***	0.003
Salary	-0.175	0.616	-0.101	0.776	0.200	0.571	0.246	0.510
Bonus	-0.074	0.542	-0.063	0.603	-0.185	0.129	-0.098	0.434
Leverage	4.807***	0.005	5.444***	0.002	5.919***	0.001	5.988***	0.002
Investment opportunities	-4.166***	0.000	-4.189***	0.000	-3.730***	0.000	-4.240***	0.000
Size (sales log)	0.510***	0.000	0.521***	0.000	0.452***	0.000	0.571***	0.000
Tenure	-0.045	0.607	-0.064	0.462	0.030	0.730	-0.064	0.461
Age	0.061	0.221	0.068	0.175	0.001	0.988	0.025	0.626
Diversification	0.280*	0.076	0.306*	0.053	0.010	0.950	0.199	0.250
Bank dummy			1.138	0.147				
Country dummy1					-6.097***	0.000	-2.792**	0.035
Country dummy2					-6.614***	0.000	-3.476**	0.003
Country dummy3					-6.605***	0.000	-1.589	0.004
Country dummy4					-1.081	0.495	3.920***	0.126
Country dummy5					-6.546***	0.002	-3.827***	0.001
Country dummy6					-1.643	0.180	-3.344**	0.013
Year1			0.870	(0.528)			0.543	0.659
Year2			-8.444***	(0.000)			-7.049**	0.039
Year3			-0.320	(0.772)			-0.401	0.640
Year4			-2.134	(0.059)*			-2.301***	0.009
Year5			-1.584	(0.153)			-1.608*	0.057
R2 within	0.200		0.207		0.288		0.243	
R2 between	0.579		0.569		0.600		0.540	
R2 overall	0.213		0.217		0.301		0.249	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results are consistent with the regression coefficients reported in Table 5.8. All columns show that the coefficients of CDS trading are consistently negative and statistically significant (below the 1% level). The results indicate that CDS use for trading purposes lower the distance to default (i.e., increase the default risk).

In summary, the results reported in Tables 5.8 and 5.9 show consistent results. CDS use for trading purposes is negatively related to firm risk. Greater CDS use for trading leads to an increase in bank risk (lowering the distance to default).

5.5.2 Beta

This subsection reports the results of the firm risk model based on OLS and random effects regressions using beta as a proxy for firm risk (e.g., Chen et al. 2006; Nijskens and Wagner, 2011; Bartram et al., 2011). The analysis is conducted in a setting in which CDS use for trading purposes is modelled as an endogenous variable. Table 5.10 shows the results of the relationship between CDS use for trading purposes and firm risk (beta). The results reported generally show that the coefficients of CDS trading are positive and statistically significant (below the 5% level).

Table 5.10: OLS regressions of firm risk (beta) and CDS use for trading purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	0.035***	0.000	0.026***	0.008	0.031***	0.006	0.024**	0.035
Salary	0.127***	0.001	0.062	0.131	0.148***	0.000	0.071*	0.098
Bonus	-0.012	0.336	-0.021*	0.099	-0.009	0.524	-0.024**	0.080
Leverage	0.026	0.887	0.040	0.828	0.071	0.730	-0.029	0.888
Investment opportunities	-0.089	0.117	-0.069	0.314	-0.120	0.480	-0.082	0.246
Size (sales log)	0.001	0.981	0.096***	0.002	0.005	0.729	0.125***	0.000
Tenure	0.004	0.651	0.009	0.329	0.002	0.913	0.011	0.241
Age	-0.004	0.468	-0.004	0.454	-0.005	0.361	-0.008	0.129
Diversification	0.017	0.323	0.004	0.832	0.003	0.860	-0.014	0.454
Bank dummy			0.101	0.225				
Country dummy1					-0.047	0.764	-0.215	0.100
Country dummy2					-0.218	0.257	-0.173	0.256
Country dummy3					-0.147	0.504	-0.135	0.410
Country dummy4					-0.210	0.341	0.273*	0.073
Country dummy5					0.158	0.435	-0.100	0.513
Country dummy6					0.068	0.786	-0.262*	0.073
Year1			0.066	0.652			0.082	0.581
Year2			-0.787***	0.002			-0.974***	0.000
Year3			0.196*	0.095			0.187	0.112
Year4			-0.156	0.191			-0.156	0.192
Year5			-0.142	0.227			-0.138	0.239
Adjusted R^2	0.218		0.261		0.217		0.270	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

These findings are consistent with the hypothesis that more CDS use for trading purposes will increase firm risk (beta). Accordingly, this positive association between CDS use for trading purposes and beta confirms the results for distance to default and shows that CDS use for trading increases a bank’s risk.

The results of the random effects regression are consistent with those reported in the OLS regressions. Table 5.11 shows the coefficients of CDS use for trading purposes are positive and statistically significant (at the 1% level).

Table 5.11: Random effects regressions of firm risk (beta) and CDS use for trading purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	0.035***	0.002	0.036***	0.002	0.032**	0.013	0.034***	0.008
Salary	0.134***	0.002	0.136***	0.002	0.153***	0.001	0.153***	0.001
Bonus	-0.015	0.262	-0.015	0.269	-0.013	0.359	-0.015	0.274
Leverage	0.082	0.707	0.094	0.677	0.120	0.614	0.130	0.598
Investment opportunities	-0.072	0.236	-0.072	0.234	-0.095	0.134	-0.083	0.181
Size (sales log)	-0.007	0.607	-0.007	0.617	-0.003	0.834	-0.005	0.733
Tenure	0.005	0.604	0.005	0.634	0.004	0.711	0.005	0.601
Age	-0.006	0.339	-0.005	0.354	-0.007	0.274	-0.007	0.234
Diversification	0.018	0.364	0.019	0.353	0.005	0.812	0.007	0.754
Bank dummy			0.023	0.822				
Country dummy1					-0.089	0.630	-0.202	0.215
Country dummy2					-0.243	0.289	-0.170	0.363
Country dummy3					-0.171	0.507	-0.110	0.590
Country dummy4					-0.210	0.422	0.277	0.140
Country dummy5					0.128	0.594	-0.116	0.543
Country dummy6					0.020	0.947	-0.247	0.175
Year1			0.092	0.379			0.054	0.723
Year2			0.044	0.767			-0.980***	0.001
Year3			-0.801***	0.006			0.182	0.109
Year4			0.192*	0.088			-0.168	0.147
Year5			-0.166	0.149			-0.145	0.199
R2 within	0.029		0.028		0.029		0.030	
R2 between	0.545		0.547		0.576		0.568	
R2 overall	0.326		0.236		0.247		0.246	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

In summary, the results reported in Tables 5.8-5.11 show consistent results in the OLS and random effects models. CDS use for trading purposes is positively related to firm risk. Furthermore, this finding is confirmed using different risk measures (i.e., distance to default and beta). The results are in line with the finding of Fung et al. (2012) that CDS use for trading leads to an increase in bank risk. The conclusion derived from these results shows that CDS use for trading purposes leads to an increase in bank risk.

5.5.3 The results for the control variables

The purpose of this subsection is to discuss the results for the control variables in the firm risk model. These variables are selected based on previous literature (e.g., Coles et al., 2006; Bai and Elyasiani, 2013). The control variables are as follows: investment opportunities, leverage, size, tenure, age, diversification, and the cash compensation component (CEO's salary and CEO's bonus).

Prior studies show that firm risk is expected to be positively associated with investment opportunities (Smith and Watts, 1992; Bartram et al., 2011). The results presented for distance to default show that greater investment opportunities are associated with lower distance to default risk (i.e., increase the default risk). The coefficients are negative and significant in all columns in the OLS and random effects models (below the 1% level). This finding is consistent with prior empirical studies that document a positive association between investment opportunities and firm risk (Guay, 1999; Rajgopal and Shevlin; 2002). However, the results when using beta as a risk measure show no association between investment opportunities and firm risk.

Contrary to the expected sign of the relationship between bank risk and leverage, the results that are reported in Tables 5.8 and 5.9 show that the coefficients of leverage are positive and significant (below the 5% level). This indicates that leverage increases bank distance to default (i.e., reduce the default risk). This finding is inconsistent with previous empirical studies that show a positive relationship between leverage and firm risk (e.g., Guay, 1999a; Coles at al., 2006). However, this negative association between leverage and firm risk is in line with the empirical finding of Rajgopal and Shevlin (2002), who find a positive association between leverage and the incentives to undertake riskier projects.

The explanation for such a positive association is that managers in high leverage firms (banks) have an incentive to accept risky projects because shareholders will enjoy a significant part of the benefits of these risky projects and debt holders will bear more risk (Leland; 1998; Aretz and Bartram, 2010). The coefficients of leverage when firm risk is measured by beta in Tables 5.10 and 5.11 are not significant.

The results of the regression analysis for bank size are significant and positive with distance to default (below the 1 % level). This shows that large banks have a lower risk level as the distance to default increase (i.e., reduce bank default risk). These results are consistent with prior empirical studies that show a negative relationship between bank size and firm risk (e.g., Chen et al., 2006; Coles et al., 2006; Bai and Elyasiani, 2013). However, the results in beta regressions show a positive or no relationship with bank size. These positive results are consistent with the result of Bartram, Brown, and Conrad (2011) who find firm size to be positively related to beta and cash flow volatility but not related to firm total risk.

In term of the relationship between bank risk (distance to default) and the variable of bank diversification, the findings are consistent with previous literature, which finds that diversification reduces bank risk (e.g., Chen et al. 2006; Bartram, Brown, and Conrad, 2011). The results in beta regressions are generally not significant for bank diversification.

The results displayed in this section indicate that there is no significant association between the firm risk variables (distance to default and beta) and each of the CEOs' age, tenure, and cash bonuses. However, the results show that the CEOs' salaries are positively related to beta. This is inconsistent with previous studies that show that high CEO salaries will result in less firm risk because of managerial risk aversion (Whidbee and Wohar, 1999; Coles et al., 2006; Adkins et al., 2007) and is consistent with the argument that higher salaries will give the managers the chance to build wealth that is not tied to firm value, thus make the CEOs better diversified (Knopf et al., 2002; Ertugrul et al., 2008).

Overall, the results for the control variables in the risk model suggest that financial distress (leverage), investment opportunities, bank size, and diversification are important determinants for firm risk. Delta is included as an additional control variable (Coles et al., 2006). The results for the regression after controlling for delta show consistent results to those reported in this chapter. Appendix F (Panel C) presents the results of the key measures for firm risk and using the OLS and random effects models.

5.6 CDS use for trading purposes and the financial crisis

This section reports on the results of empirical analyses that investigate the influence of CDS use for trading purposes on banks risk in relation to the financial crisis of 2007–2008. The results are discussed and explained according to the time period of the sample, which is divided into three subsamples: before, during, and after the financial crisis.

The first subsample is the year 2006, which represents the period before the onset of the crisis. The second subsample covers the period between 2007-2009, which is considered the period of the crisis (e.g., Calice et al., 2012; Bai and Elyasiani, 2013). The third subsample is the period after the financial crisis and covers the last two years of the sample period 2010 and 2011. To keep consistency with previous sections, two different measures are used to examine the influence of CDS use for trading purposes on bank risk. These are distance to default and beta.

This section is organised as follows. Firstly, the influence of CDS use for trading purposes on banks' risk before the financial crisis is reported in section 5.6.1. Secondly, section 5.6.2 presents the results of the relationship between CDS use for trading purposes and banks risk during the financial crisis. Thirdly, section 5.6.3 displays the regression analysis of the influence of CDS use for trading purposes on banks' risk after the financial crisis.

5.6.1 CDS use for trading purposes and firm risk before the financial crisis

As mentioned above the analysis is based on the time period of the sample. This sub-section presents the results of how CDS use for trading purposes influences banks' risk before the financial crisis (i.e., 2006). Table 5.12 shows the results of the relationship between CDS use for trading purposes and bank risk using Merton distance to default.

Table 5.12: OLS regressions of firm risk (distance to default) and CDS use for trading purposes (before the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	-0.342***	0.006	-0.331***	0.007	-0.247*	0.058	-0.427***	0.002
Salary	-0.202	0.684	-0.169	0.729	-0.136	0.767	-0.035	0.948
Bonus	-0.023	0.903	-0.036	0.848	-0.190	0.309	-0.017	0.936
Leverage	1.856	0.375	2.675	0.211	2.549	0.194	3.233	0.168
Investment opportunities	-1.889*	0.075	-1.874*	0.074	-0.984	0.308	-1.657	0.129
Size (sales log)	0.869**	0.027	0.977**	0.014	0.743**	0.048	1.057**	0.017
Tenure	0.063	0.543	0.019	0.858	0.101	0.463	0.014	0.895
Age	0.070	0.264	0.072	0.241	0.031	0.615	0.103	0.141
Diversification	0.033	0.886	0.082	0.719	0.008	0.971	0.069	0.789
Bank dummy			1.512	0.127				
Country dummy1					-1.162	0.476	-0.663	0.681
Country dummy2					-1.043	0.612	-3.869**	0.031
Country dummy3					-2.553	0.247	-0.208	0.918
Country dummy4					6.205	0.012	-1.072	0.559
Country dummy5					-0.682	0.752	-1.835	0.320
Country dummy6					-2.242	0.513	-1.106	0.533
Adjusted R^2	0.138		0.162		0.336		0.127	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results reported in table 5.12 shows that CDS use for trading purposes is negatively associated with bank distance to default. The coefficients are statistically significant in columns 1, 2 and 4 (at the 1% level) and significant in column 5 (at the 10 % level). The results imply that CDS use for trading purposes lower bank distance to default in the period before the financial crisis (i.e. higher bank risk).

Table 5.13 reports the results of the relationship between banks risk as measured by beta and CDS use for trading purposes as measured using the notional value scaled by total assets.

The results show no association between CDS use for trading purposes and beta. The coefficients are consistently insignificant in all columns in table 5.13. This can be explained by the small sample size before the financial crisis.

Table 5.13: OLS regressions of firm risk (beta) and CDS use for trading purposes (before the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	0.017	0.398	0.016	0.419	0.009	0.720	0.006	0.802
Salary	-0.139*	0.092	-0.141*	0.092	-0.136	0.124	-0.135	0.125
Bonus	-0.017	0.586	-0.016	0.603	-0.016	0.644	-0.014	0.699
Leverage	0.234	0.495	0.193	0.589	0.126	0.734	0.146	0.703
Investment opportunities	-0.080	0.640	-0.081	0.640	-0.032	0.859	-0.052	0.771
Size (sales log)	0.055	0.387	0.049	0.446	0.053	0.449	0.072	0.311
Tenure	-0.004	0.803	-0.002	0.909	-0.000	0.996	-0.004	0.838
Age	-0.005	0.600	-0.005	0.594	-0.004	0.741	-0.003	0.815
Diversification	0.029	0.434	0.027	0.481	0.030	0.484	0.035	0.415
Bank dummy			-0.076	0.646				
Country dummy1					-0.384	0.218	0.332	0.217
Country dummy2					0.018	0.963	-0.104	0.718
Country dummy3					-0.380	0.364	0.261	0.434
Country dummy4					-0.204	0.654	0.167	0.582
Country dummy5					-0.137	0.738	-0.165	0.586
Country dummy6					-0.382	0.558	-0.204	0.486
Adjusted R^2	0.122		0.126		0.203		0.211	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

5.6.2 CDS use for trading purposes and bank risk during the financial crisis

This sub-section presents the results of the influence of CDS use for trading purposes on bank's risk during the financial crisis period (2007-2009). The results using Merton distance to default as a measure for bank's risk are displayed in Table 5.14.

Table 5.14: OLS regressions of firm risk (distance to default) and CDS use for trading purposes (during the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	-0.335***	0.005	-0.303***	0.010	-0.349***	0.005	-0.343**	0.013
Salary	-0.201	0.672	-0.020	0.966	0.146	0.761	0.137	0.792
Bonus	-0.108	0.501	-0.081	0.610	-0.156	0.335	-0.087	0.613
Leverage	3.711	0.103	4.701**	0.041	6.063***	0.010	5.902**	0.023
Investment opportunities	-6.185***	0.000	-6.244***	0.000	-5.262***	0.000	-6.400***	0.000
Size (sales log)	0.776***	0.000	0.793***	0.000	0.628***	0.000	0.812***	0.000
Tenure	-0.019	0.864	-0.058	0.601	-0.000	0.998	-0.059	0.600
Age	0.004	0.949	0.020	0.761	-0.029	0.673	-0.003	0.966
Diversification	0.169	0.422	0.210	0.315	-0.086	0.691	0.097	0.672
Bank dummy			2.196**	0.034	-7.014***	0.000	-3.867**	0.020
Country dummy1								
Country dummy2					-8.768***	0.000	-2.566	0.198
Country dummy3					-7.719***	0.001	-0.523	0.799
Country dummy4					-5.170**	0.017	-0.365	0.854
Country dummy5					-6.157**	0.031	-3.423*	0.077
Country dummy6					6.178	0.229	-1.265	0.482
Adjusted R^2	0.262		0.277		0.352		0.271	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results displayed in table 5.14 show that the relationship between CDS use for trading purposes and banks risk is negative and statistically significant. This findings suggest that CDS use for trading purposes increases the bank risk during the financial crisis period and lowers bank distance to default (i.e. higher bank risk).

The results reported for bank risk as measured by beta in Table 5.15 are similar to those reported in the above table. A positive association is found in Table 5.15 between the dependent variable (beta) and the independent variable (CDS use for trading purposes during the financial crisis).

The coefficients for beta are positive and significant. This finding suggests that CDS use for trading purposes increases banks' risk during the financial crisis period (2007-2009).

Table 5.15: OLS regressions of firm risk (beta) and CDS use for trading purposes (during the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	0.035***	0.005	0.022*	0.067	0.043***	0.003	0.045***	0.002
Salary	0.162***	0.001	0.077	0.134	0.160***	0.004	0.169***	0.002
Bonus	-0.008	0.628	-0.011	0.483	-0.003	0.885	-0.005	0.799
Leverage	-0.388	0.102	-0.269	0.225	-0.383	0.146	-0.409	0.127
Investment opportunities	-0.167*	0.058	-0.031	0.711	-0.195*	0.042	-0.221**	0.016
Size (sales log)	0.003	0.865	0.144***	0.000	0.003	0.882	0.009	0.601
Tenure	0.009	0.416	0.012	0.284	0.002	0.859	0.007	0.558
Age	-0.001	0.903	0.001	0.915	-0.001	0.938	-0.001	0.931
Diversification	0.007	0.763	-0.003	0.901	-0.009	0.723	-0.003	0.884
Bank dummy			0.302***	0.003				
Country dummy1					0.278	0.179	-0.397**	0.022
Country dummy2					-0.054	0.829	-0.128	0.538
Country dummy3					0.208	0.481	-0.399	0.064
Country dummy4					0.372	0.193	-0.091	0.658
Country dummy5					0.259	0.335	-0.001	0.998
Country dummy6					0.591*	0.083	-0.276	0.142
Adjusted R^2	0.278		0.393		0.284		0.289	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

5.6.3 CDS use for trading purposes and bank risk after the financial crisis

Tables 5.16 and 5.17 reports the results of the relationship between CDS use for trading purposes and banks' risk after the financial crisis period (2007-2009)using Merton distance to default and beta respectively.

The dependent variable in Table 5.16 is bank risk as measured by Merton distance to default, and the independent variable is CDS use for trading purposes as measured using the notional value of CDS scaled by total assets. The coefficients are negative in all columns. However, the coefficients are statistically significant in columns 3 and 4. This finding implies that CDS use for trading purposes increases bank risk after the financial crisis (i.e., lowers the bank distance to default).

Table 5.16: OLS regressions of firm risk (distance to default) and CDS use for trading purposes (after the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	-0.257	0.224	-0.252	0.236	-0.416**	0.060	-0.381*	0.089
Salary	-0.858	0.317	-0.863	0.317	-0.410	0.614	-0.607	0.453
Bonus	-0.154	0.573	-0.155	0.572	-0.177	0.506	-0.201	0.448
Leverage	7.336*	0.071	7.668*	0.074	5.642	0.197	4.277	0.304
Investment opportunities	-3.613***	0.006	-3.634***	0.006	-2.650**	0.041	-2.550**	0.044
Size (sales log)	1.160	0.087	1.207*	0.088	1.420**	0.038	2.054	0.002
Tenure	0.079	0.736	0.082	0.729	0.028	0.903	-0.044	0.842
Age	0.120	0.267	0.121	0.264	-0.014	0.894	-0.059	0.575
Diversification	0.125	0.737	0.123	0.742	-0.116	0.763	0.022	0.954
Bank dummy			0.448	0.805				
Country dummy1					-3.879	0.114	-2.148	0.449
Country dummy2					-2.976	0.364	-1.935	0.543
Country dummy3					-4.377	0.206	13.012***	0.000
Country dummy4					10.235***	0.005	-5.081	0.110
Country dummy5					-5.864	0.174	-5.253**	0.062
Country dummy6					-0.118	0.809	-1.263	0.682
Adjusted R^2	0.107		0.175		0.248		0.263	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Table 5.17 shows the results of the relationship between CDS use for trading purposes and beta as a proxy for banks risk after the financial crisis. The results show that beta is positively associated with CDS use for trading purposes after the financial crisis. The coefficients are positive and significant in columns 1 and 2 at the 5% level and at the 10% level respectively. This finding suggests that CDS use for trading purposes increased bank riskiness after the last credit crisis.

Table 5.17: OLS regressions of firm risk (beta) and CDS use for trading purposes (after the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Trading CDS (predicted)	0.042**	0.046	0.040*	0.059	0.010	0.669	0.031	0.208
Salary	0.153*	0.072	0.148*	0.084	0.171**	0.045	0.172*	0.051
Bonus	-0.022	0.420	-0.018	0.507	-0.003	0.916	-0.019	0.499
Leverage	0.429	0.280	0.440	0.297	0.674	0.140	0.614	0.204
Investment opportunities	-0.144	0.259	-0.120	0.364	-0.250*	0.062	-0.155	0.266
Size (sales log)	0.061	0.360	0.062	0.374	0.157**	0.028	0.096	0.186
Tenure	0.020	0.395	0.019	0.412	0.021	0.381	0.024	0.312
Age	-0.011	0.307	-0.011	0.320	-0.009	0.429	-0.014	0.232
Diversification	-0.013	0.729	-0.012	0.748	-0.050	0.206	-0.045	0.290
Bank dummy			-0.026	0.883			-0.311	0.297
Country dummy1					-0.046	0.883	-0.210	0.507
Country dummy2					-0.517	0.190	0.202	0.563
Country dummy3					-0.527	0.232	0.529	0.106
Country dummy4					-1.053	0.015	0.011	0.975
Country dummy5					0.374	0.370	0.013	0.966
Country dummy6					-0.118	0.809		
Adjusted R^2	0.265		0.256		0.319		0.263	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

In summary, this section displays the results of the how CDS use for trading purposes influence banks risk. The sample is divided into three subsamples that cover the period before, during, and after the financial crisis. The results reported in Tables 5.12 to 5.17 show a positive association between banks' risk and CDS use for trading purposes before, during, and after the financial crisis.

5.7 Summary

This chapter focuses on the examination of the relationship between the risk-taking incentives generated by stock option compensation and CDS use for trading purposes. The results of the first and the second stage of the analysis suggest a positive and significant association between CEOs' risk-taking incentives provided by stock option compensation and CDS use for trading.

This chapter also investigates how CDS use for trading purposes influence banks risk. The results for distance to default and beta show a positive and statistically significant relationship between banks riskiness and CDS use for trading.

The chapter also show the influence of CDS use for trading purposes on banks risk in relation to the financial crisis. The results suggest that CDS use for trading purposes increase banks risk before, during, and after the financial crisis. This positive association between CDS use for trading and banks risk is statistically significant using different subsamples and different risk measures. Table 5.18 summarises the main results in this chapter.

Table 5.18: A summary of the main results in chapter 5

	(1)	(2)	(3)	(4)
CDS	The dependent variable is CDS for trading and the independent variable is vega			
OLS model (First stage)	0.113***	0.086***	0.102***	0.049**
	(0.000)	(0.001)	(0.000)	(0.041)
OLS model (second stage)	0.051***	0.033**	0.032**	0.030**
	(0.002)	(0.034)	(0.046)	(0.041)
Random effects	0.002			
	(0.868)			
Tobit model	0.095***			
	(0.003)			
Probit model	0.044***			
	(0.009)			
Firm risk model	The dependent variable is firm risk and the independent variable is CDS trading			
Distance to default (OLS)	-0.267***	-0.356***	-0.255**	-0.438***
	(0.003)	(0.000)	(0.016)	(0.000)
Beta (OLS)	0.035***	0.026***	0.031***	0.024**
	(0.000)	(0.008)	(0.006)	(0.035)
Distance to default (random effects)	-0.267***	-0.250***	-0.302***	-0.300***
	(0.003)	(0.006)	(0.001)	(0.003)
Beta (random effects)	0.035***	0.036***	0.032**	0.034***
	(0.002)	(0.002)	(0.013)	(0.008)

Chapter 6: Empirical tests and results for banks using CDS for trading purposes

6.1 Introduction

This chapter of the thesis reports the results for the analysis conducted when CDS use for hedging purposes. The chapter is organised as follows. The first two sections (6.2 and 6.3) reports the results of the relationship between CEOs' risk-taking incentives and CDS use for hedging purposes. Section 6.2 presents the results for first stage analysis. Section 6.3 reports the results for the second stage analysis.

The results of the relationship between firm risk and CDS use for hedging are discussed in Sections 6.4. Subsection 6.4.1 discusses the results when bank risk is measured using Merton distance to default. Subsection 6.4.2 reports the results when bank risk is measured using beta. Similar to the CDS use for trading purposes in the previous chapter, the relationship between CDS use for hedging and CEOs' risk-taking incentives of stock option compensation is analysed using first and second stage regression OLS regressions. In the first stage regressions the risk-taking incentives are considered as an exogenous variable. In the second stage regressions the risk-taking incentives are modelled as an endogenous variable.

The OLS model is used to examine the relationship between the extent of CDS use for hedging and CEOs' risk-taking incentives using a continuous measure of CDS use for hedging purposes (i.e., notional value of a CDS contract). In this chapter tobit, probit, and panel data random effects models are also used to further examine the robustness of the results from the OLS model. Tobit model is employed to examine the linkage between the extent of CDS use for hedging and risk-taking incentives, while probit model is used to investigate the linkage between the decision to use CDS for hedging and risk-taking incentives. The influence of CDS use for hedging on firms' risk is also tested using the OLS and the random effects models. Consistent with previous chapter, predicted value of CDS is used as an explanatory variable in the firm risk model to control for endogeneity issues between CDS use for hedging and firm risk.

6.2 Risk-taking incentives and CDS use for hedging purposes

6.2.1 First stage analysis

The main objective of the first stage analysis is to examine the relationship between vega (as a proxy for CEOs' risk-taking incentives) and CDS use for hedging purposes assuming that CEO risk-taking incentives generated by stock options are an exogenous variable.

Table 6.1 presents the results from first stage OLS regressions on the relationship between risk-taking incentives (vega) and CDS use for hedging purposes. The dependent variable is the extent of CDS use for hedging which is measured using the notional value of a CDS contract scaled by total assets (e.g., Knopf et al., 2002; Rogers, 2002).

Table 6.1: First stage OLS regressions of the extent of CDS use for hedging purposes and the risk-taking incentives (vega)

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Vega	-0.012	0.012	0.997	-0.001	0.012	0.964
Salary	0.013	0.053	0.807	0.036	0.059	0.544
Bonus	0.016	0.018	0.351	0.017	0.018	0.340
Shares	0.062***	0.017	0.000	0.067***	0.018	0.000
Ownership	0.025	0.024	0.283	0.024	0.025	0.330
Derivatives (hedging)	0.115***	0.023	0.000	0.118***	0.024	0.000
Derivatives (trading)	-0.047**	0.019	0.013	-0.044**	0.019	0.022
Investment opportunities	0.041	0.070	0.558	-0.001	0.093	0.994
Leverage	0.443*	0.249	0.077	0.501*	0.260	0.055
Size	-0.006	0.018	0.742	-0.024	0.044	0.583
Diversification	-0.044**	0.022	0.043	-0.041*	0.023	0.080
Bank dummy				0.095	0.116	0.413
Year1				0.067	0.209	0.747
Year2				0.197	0.367	0.593
Year3				-0.091	0.165	0.579
Year4				-0.016	0.168	0.922
Year5				0.076	0.165	0.647
Adjusted R^2	0.113			0.104		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The independent variable is the CEO risk-taking incentives which are measured as vega. Years and dummies are similar to those included in the previous chapter (see Section 5.3 of Chapter 5). The results reported in Table 6.1 show that the coefficients of vega are negative and statistically insignificant. This indicates that the extent of CDS use for hedging is negatively related to risk-taking incentives generated by stock option compensation when extent of CDS use is measured using the continuous variable (notional value).

Consistent results are found in Table 6.2, after including year and country dummies.

Table 6.2: First stage OLS regressions of the extent of CDS use for hedging purposes and the risk-taking incentives (vega) including country dummies

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Vega	-0.002	0.011	0.889	-0.007	0.012	0.593
Salary	-0.093**	0.051	0.069	-0.024	0.060	0.688
Bonus	-0.005	0.017	0.743	0.001	0.018	0.993
Shares	0.074***	0.016	0.000	0.119***	0.022	0.000
Ownership	0.034	0.022	0.129	0.003	0.025	0.901
Derivatives (hedging)	0.085***	0.021	0.000	0.106***	0.024	0.000
Derivatives (trading)	0.013	0.019	0.510	-0.005	0.021	0.795
Investment opportunities	0.084	0.067	0.208	0.002	0.097	0.980
Leverage	-0.046	0.251	0.854	0.178	0.279	0.523
Size	-0.013	0.016	0.413	-0.038	0.045	0.396
Diversification	-0.051**	0.022	0.021	-0.018	0.025	0.491
Country dummy1	-1.941***	0.243	0.000	0.973***	0.236	0.000
Country dummy2	-1.364***	0.284	0.000	1.248***	0.287	0.000
Country dummy3	-1.077***	0.293	0.000	1.316***	0.288	0.000
Country dummy4	-0.860***	0.311	0.006	0.825***	0.292	0.005
Country dummy5	-1.697***	0.298	0.000	0.737**	0.299	0.014
Country dummy6	-1.772***	0.291	0.000	0.620**	0.274	0.024
Year1				0.110	0.207	0.595
Year2				0.320	0.370	0.387
Year3				-0.028	0.161	0.863
Year4				0.011	0.164	0.945
Year5				0.110	0.160	0.491
Adjusted R^2	0.288			0.157		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The negative sign is consistent with the theoretical arguments that stock option compensation provides managers with incentives to use less hedging derivatives (Smith and Stulz, 1985). However, the results of the regressions that are reported in Table 6.1 and 6.2 fail to capture any significant coefficient for vega of the stock option compensation. These results are consistent with Knopf et al. (2002) and Géczy et al. (1997), but inconsistent with Rajgopal and Shevlin (2002), Ertugrul et al. (2008).

Knopf et al. (2002) find negative and insignificant association between derivatives use for hedging and the sensitivity of the CEO's option portfolio to stock return volatility as a measure for risk-taking incentives. Géczy et al. (1997) find an insignificant relationship between derivatives use and managerial risk-taking as measured by the value of managerial options derivatives use. Rogers (2002) also report a negative and insignificant association between predicted risk-taking incentives and derivatives use.

The results reported for OLS models in Tables 6.1 and 6.2 show weak associations between the CEO risk-taking incentives generated by stock options and the extent of CDS use for hedging purpose. In general, the results show that the use of stock options can reduce the CEOs' risk-related incentives problem and motivates them to use less CDS for hedging purposes.

The results reported in Tables 6.1 and 6.2 of the OLS regressions show that adjusted R^2 range from (0.104 to 0.288). This indicates that the models fit the data and 10.4% to 28.8% of the variation in the dependent variable is explained by variations in the independent variables.

6.2.2 The results for the control variables (firs stage regressions)

This subsection discusses the result for the control variables used in CEOs' risk-taking incentives. Control variables are selected based on the previous literature (e.g., Guay, 1999a; Rajgopal and Shevlin, 2002; Rogers, 2002). Cash compensation (salary and cash bonuses) as a proxy for managerial risk aversion is expected to be positively related to CDS use for hedging purposes. In general, the results reported for OLS model reveal no relationship between cash compensation variables (salary and bonuses) and CDS use for hedging. Many empirical studies also find no relationship between cash compensation and derivatives use (e.g., Adkins et al., 2007; Knopf et al., 2002).

The value of stock grants is also used as a proxy for managerial risk aversion in the CDS model. Smith and Stulz (1985) predict a positive association between stock grants and derivatives use. The results reported for the first stage regressions in Tables 6.1 and 6.2 show that the relationship between the value of managers' stock compensation and CDS use for hedging is positive and significant. The results indicate that stock grants increase executive risk aversion and associated with more CDS use for hedging purposes. This positive relationship between the CEO's stock compensation and CDS use for hedging is consistent with the results documented in previous studies (e.g., Tufano, 1996; Rogers, 2002; Supanvanij and Strauss, 2010).

Other derivatives use for hedging is positively related to CDS use for hedging. The results also show significant positive association between leverage and CDS use for hedging. This suggests that as financial distress increases, banks tend to use more CDS for hedging. This finding is consistent with theoretical and empirical studies that predict a positive relationship between the expected costs of financial distress and the incentives to reduce firm risk using more derivatives for hedging (Smith and Stulz, 1985; Rogers, 2002; Géczy et al., 2007).

Diversification is negatively association with CDS use for hedging. This finding is consistent with prior empirical studies that document a negative relationship between the degree of diversification and derivatives use for hedging purposes (e.g., Tufano, 1996; Géczy et al., 2007; Fung et al., 2012).

6.3 *Second stage analysis*

Tables 6.3 and 6.4 report the results of the second stage OLS model of relationship between vega as a proxy for CEOs risk-taking incentives generated by stock option compensation (when vega is modelled as an endogenous variable) and CDS use for hedging purposes.

The risk-taking incentive (vega) is predicted using variables very similar to those used in earlier empirical studies (e.g., Guay, 1999b; Rajgopal and Shevlin, 2002; Coles et al., 2006). The predicted value of vega is then incorporated as an independent variable in the CDS use model. The results reported in table 6.3 show that the coefficients of vega are negative and statistically insignificant. The negative sign of the relationship between vega and CDS use for hedging purposes is consistent with the theoretical prediction of Smith and Stulz (1985).

Table 6.3: Second stage OLS regressions of the extent of CDS use for hedging purposes and the risk-taking incentives (vega)

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Predicted vega	0.003	0.007	0.662	0.005	0.008	0.550
Salary	0.024	0.057	0.679	0.055	0.066	0.407
Bonus	0.015	0.018	0.412	0.015	0.018	0.401
Shares	0.056***	0.021	0.008	0.059***	0.022	0.007
Ownership	0.026	0.024	0.272	0.023	0.024	0.339
Derivatives (hedging)	0.116***	0.022	0.000	0.120***	0.024	0.000
Derivatives (trading)	-0.048**	0.019	0.011	-0.045**	0.019	0.018
Investment opportunities	0.044	0.070	0.529	0.002	0.093	0.981
Leverage	0.444*	0.249	0.076	0.500*	0.260	0.055
Size	-0.008	0.018	0.660	-0.034	0.046	0.462
Diversification	-0.045**	0.022	0.041	-0.040*	0.023	0.087
Bank dummy				0.088	0.116	0.452
Year1				0.064	0.206	0.757
Year2				0.252	0.377	0.505
Year3				-0.091	0.164	0.582
Year4				-0.017	0.167	0.917
Year5				0.079	0.164	0.629
Adjusted R^2	0.113			0.105		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Table 6.4 below shows the results of the second stage regressions after including the same countries and year dummy variables used in the first stage analysis.

Table 6.4: Second stage OLS regressions of the extent of CDS use for hedging purposes and the risk-taking incentives (vega) including country dummies

	Column (1)			*Column (2)*		
Independent variables	**Coefficients**	**Standard error**	**P value**	**Coefficients**	**Standard error**	**P value**
Predicted vega	-0.002	0.007	0.803	-0.003	0.007	0.832
Salary	-0.089	0.055	0.107	-0.044	0.058	0.448
Bonus	-0.006	0.017	0.724	0.000	0.019	0.997
Shares	0.071***	0.021	0.001	0.114***	0.026	0.000
Ownership	0.033	0.022	0.131	0.006	0.024	0.802
Derivatives (hedging)	0.085***	0.021	0.000	0.100***	0.022	0.000
Derivatives (trading)	0.013	0.019	0.513	-0.007	0.021	0.734
Investment opportunities	0.086	0.067	0.198	0.006	0.097	0.950
Leverage	-0.048	0.251	0.848	0.170	0.280	0.543
Size	-0.014	0.017	0.399	0.000	0.000	0.509
Diversification	-0.050**	0.022	0.021	-0.023	0.024	0.329
Country dummy1	-1.940***	0.243	0.000	0.977***	0.232	0.000
Country dummy2	-1.363***	0.284	0.000	1.226***	0.289	0.000
Country dummy3	-1.079***	0.288	0.000	1.275***	0.284	0.000
Country dummy4	-0.859***	0.307	0.005	0.799***	0.295	0.007
Country dummy5	-1.702***	0.299	0.000	0.738**	0.291	0.012
Country dummy6	-1.770***	0.288	0.000	0.611**	0.272	0.026
Year1				0.124	0.205	0.546
Year2				0.118	0.215	0.585
Year3				-0.034	0.160	0.832
Year4				0.015	0.163	0.929
Year5				0.115	0.160	0.474
Adjusted R^2	0.280			0.156		

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results are consistent with the finding of OLS model in the first stage regression. Vega coefficients are negatively related to CDS hedging. The results reported in Tables 6.3 and 6.4 of the second stage OLS regressions show that adjusted R^2 range from (0.105 to 0.280).

Panel data random effects regression is used to control for the presence of unobserved firm heterogeneity in the sample. Table 6.5 shows the results of random effects regressions.

Table 6.5: Panel data random effect model of CDS use for hedging purposes and the predicted risk-taking incentives (vega)

Independent variables	Coefficients	Standard error	P value
Predicted vega	-0.004	0.007	0.625
salary	-0.076	0.074	0.305
bonus	0.013	0.015	0.369
shares	0.060***	0.023	0.008
ownership	-0.028	0.023	0.223
Derivatives (hedging)	0.080***	0.026	0.002
Derivatives (trading)	-0.038	0.023	0.100
Investment opportunities	0.048	0.078	0.542
Leverage	-0.212	0.420	0.614
Size	0.001	0.013	0.924
Diversification	-0.013	0.033	0.696
Year	0.009	0.028	0.747
R^2 within	0.053		
R^2 between	0.105		
R^2 overall	0.087		

The results reported in Table 6.5 are consistent with results of OLS model (firs and second stage analysis). The risk-taking incentive generated from stock option compensation (vega) is negatively associated with CDS use for hedging.

6.3.1 The results for the control variables (second stage regressions)

The results for the control variables in the second stage regression are consistent with those reported in the first stage regressions. The coefficients for the value of stock compensation in the second stage regressions are positively related to CDS use for hedging. The positive relationship between the CEO's stock compensation and CDS use for hedging purposes is consistent with corporate hedging literature (e.g., Tufano, 1996; Rogers, 2002).

Tables 6.3and 6.4 show that the coefficients for derivatives use for hedging (e.g, interest rates derivatives, exchange rate derivatives, commodity derivatives) is positively related to CDS use for hedging. This finding is consistent with the argument that banks use credit derivatives are more likely to use other derivatives (Minton et al., 2009).

In general, diversification is negatively related to CDS use for hedging purposes. These results are consistent with the results reported for the first stage regression and prior empirical studies (e.g., Tufano, 1996; Géczy et al., 2007; Fung et al., 2012).

Overall, the results reported for the control variables in the CDS model for both the first and the second stage regression are consistent with the findings of many previous empirical studies. The analysis is also conducted using delta as an additional control variable in the CDS model for hedging. The results are largely consistent with those reported in this chapter. The results of the key variables after including delta are summarised in Appendix G (Panel B).

6.3.2 Robustness checks

This subsection reports the results for tobit and probit models that are used to further examine the robustness of the results from the OLS model. A tobit model is used to investigate the relationship between the extent of CDS use for hedging and CEO risk-taking incentives. Probit model is used to examine the relationship between the decision to use CDS and CEO risk-taking incentives. Table 6.6 reports the results of tobit and probit models after including countries dummy variables for countries that have the highest number of CDS observations (Germany, Italy, Spain, Denmark, France, and Portugal).

The results reported for probit model show that the coefficient of vega is negative but statistically insignificant to CDS use for hedging. This finding is consistent with the results reported for OLS model, and suggests that decision using CDS use for hedging is negatively related to risk-taking incentives (Nijskens and Wagner, 2011; Rossi, 2011).

Table 6.6: Second-stage tobit and probit regressions of CDS use for hedging purposes and the risk-taking incentives (vega)

	Tobit model		*Probit model*	
Independent variables	**Coefficients**	**P value**	**Coefficients**	**P value**
Predicted vega	0.011	0.640	-0.014	0.501
Salary	-0.186	0.599	-0.056	0.841
Bonus	-0.005	0.938	0.020	0.716
Shares	0.312***	0.001	0.099	0.153
Ownership	-0.082	0.526	0.005	0.954
Derivatives (hedging)	0.511***	0.000	0.896***	0.000
Derivatives (trading)	0.317***	0.001	0.212*	0.057
Investment opportunities	-0.141	0.677	-0.257	0.325
Leverage	6.197***	0.007	3.596*	0.051
Size	0.038	0.598	0.137**	0.022
Diversification	0.142	0.179	0.078	0.432
Country dummy1	-3.863***	0.001	-1.333*	0.070
Country dummy2	1.468	0.127	1.573*	0.061
Country dummy3	1.711	0.133	1.147	0.231
Country dummy4	2.933***	0.002	5.830***	0.001
Country dummy5	0.124	0.888	1.652**	0.038
Country dummy6	4.034***	0.000	8.065***	0.000
Pseudo R- squared	0.430		0.666	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The negative association between the risk-taking incentives generated by CEOs' stock options and the decision to use CDS for hedging is consistent with the theoretical predictions of Smith and Stulz (1985), who expect a negative relationship between derivatives use and the risk-taking incentives of the CEO's stock option compensation.

Overall, the results reported in this chapter for the OLS, tobit, probit, and random effects models show that the risk-taking incentives of stock options (vega) are negatively related to CDS use for hedging when such incentives are modelled as an endogenous variable. These findings are consistent with the theoretical and empirical literature (Smith and Stulz, 1985; Tufano, 1996; Knopf et al., 2002; Rogers, 2002).

The conclusion derived from these results shows that CEOs' stock option compensation reduces the risk-related incentives problem by providing a disincentive to use CDS for hedging. This thesis also uses the value of CEOs stock options as an additional proxy for the risk-taking incentives, and to check the robustness of the results of the relationship between the risk-taking incentives and CDS use for hedging. The inference of the results is no different compared to the results reported using vega. The results are presented in Appendix G (Panel A).

6.4 CDS use for hedging purposes and firm risk

6.4.1 Distance to default

In this thesis OLS and panel data random effects regressions are primarily employed to test how CDS use influences firm risk. Previous empirical studies have focused essentially on the reason of derivatives use, while the influence of derivatives use on firm risk has received less attention.

The analysis is conducted in a setting in which CDS use for hedging purposes is modelled as an endogenous variable. Table 6.7 shows the results of the relationship between the independent variable, which is CDS use for hedging purpose, and the dependent variable which is firm risk.

CDS use for hedging is measured using the notional value of a CDS contract and firm risk is measured using Merton distance to default. The results show that the coefficients of CDS use for hedging are consistently negative. This negative relationship is statistically significant in columns 3 and 4 (below the 10% level).

Table 6.7: OLS regressions of firm risk (distance to default) and CDS use for hedging purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	-0.113	0.581	-0.215	0.309	-0.381*	0.060	-0.404*	0.058
Salary	-0.410	0.244	-0.809***	0.041	-0.662*	0.075	-0.846**	0.034
Bonus	-0.145	0.264	-0.211	0.106	-0.339***	0.006	-0.281**	0.035
Leverage	5.538***	0.008	6.805***	0.001	5.811***	0.004	5.311**	0.015
Investment opportunities	-3.579***	0.000	-3.742***	0.000	-3.295***	0.000	-3.565***	0.000
Size (sales log)	0.363***	0.003	1.115***	0.000	0.984***	0.000	1.524***	0.000
Tenure	-0.043	0.627	-0.008	0.925	0.102	0.234	0.020	0.820
Age	0.061	0.226	0.067	0.183	-0.027	0.584	-0.009	0.856
Diversification	0.164	0.290	0.041	0.804	-0.144	0.385	-0.030	0.864
Bank dummy			1.944**	0.015				
Country dummy1					-0.923	0.496	-0.681	0.603
Country dummy2					-1.106	0.505	-2.601*	0.082
Country dummy3					0.464	0.788	4.160***	0.004
Country dummy4					10.496***	0.000	-3.441**	0.017
Country dummy5					4.963***	0.006	-3.557***	0.008
Country dummy6					-1.051	0.625	1.155	0.407
Year1			1.238	0.377			-0.086	0.938
Year2			-6.282***	0.009			-1.923*	0.089
Year3			-0.020	0.986			-1.360	0.221
Year4			-1.830	0.111			-9.194***	0.000
Year5			-1.374	0.224			-1.120	0.305
Adjusted R^2	0.172		0.206		0.335		0.234	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results suggest that CDS use for hedging purposes lowers bank distance to default (i.e., increases bank default risk). This finding contrasts with the argument established in the theoretical literature of derivatives use for hedging purposes (Smith and Stulz, 1985). The results show that CDS use for hedging increases bank riskiness. However, this finding is consistent with previous empirical studies that provide evidence that CDS for hedging increase firms' risk (e.g., Nijskens and Wagner, 2011; Fung et al., 2012).

Table 6.8 shows the results of the relationship between CDS use for hedging purposes and firm risk (distance to default) using the random effects model. The results are consistent with the regression coefficients of the OLS model reported in Table 6.7.

Table 6.8: Random effects regressions of firm risk (distance to default) and CDS use for hedging purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	-0.113	0.581	-0.069	0.736	-0.245	0.204	-0.069	0.742
Salary	-0.410	0.243	-0.314	0.375	-0.200	0.549	-0.100	0.785
Bonus	-0.145	0.264	-0.136	0.296	-0.277**	0.023	-0.196	0.139
Leverage	5.538***	0.007	6.072***	0.003	5.605***	0.006	5.796***	0.009
Investment opportunities	-3.579***	0.000	-3.627***	0.000	-3.218***	0.000	-3.708***	0.000
Size (sales log)	0.363***	0.003	0.384***	0.002	0.334***	0.003	0.436***	0.000
Tenure	-0.043	0.626	-0.069	0.440	0.047	0.584	-0.074	0.406
Age	0.061	0.226	0.069	0.174	-0.019	0.704	0.014	0.788
Diversification	0.164	0.289	0.206	0.187	0.010	0.949	0.125	0.470
Bank dummy			1.392**	0.079				
Country dummy1					-1.863	0.162	-2.775*	0.058
Country dummy2					-1.883	0.257	-5.349***	0.002
Country dummy3					-0.367	0.831	-3.757**	0.035
Country dummy4					10.063***	0.000	-3.931**	0.037
Country dummy5					3.440**	0.047	-6.049***	0.001
Country dummy6					-1.894	0.380	-5.159***	0.005
Year1							1.582	0.256
Year2							-9.267***	0.000
Year3							-0.071	0.948
Year4							-1.807	0.106
Year5							-1.264	0.250
R2 within	0.178		0.188		0.331		0.223	
R2 between	0.619		0.605		0.627		0.576	
R2 overall	0.194		0.201		0.342		0.231	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

All columns show that the coefficients of CDS use for hedging are consistently negative but statistically insignificant, indicating that CDS use for hedging lower the distance to default (i.e., increase the default risk).

In summary, the results reported in Tables 6.7 and 6.8 suggest that CDS use for hedging purposes is negatively related to firm risk. More CDS use for hedging leads to an increase in bank risk (lower distance to default).

6.4.2 Beta

Tables 6.9 and 6.10 report the results of the firm risk model for OLS and random effects models when firm risk is measured using beta (e.g., Chen et al. 2006; Nijskens and Wagner, 2011; Bartram et al., 2011). CDS use for hedging is modelled as an endogenous variable to avoid potential issues of endogeneity between CDS use and firm risk. Table 6.9 presents the results of the relationship between CDS use for hedging and firm risk (beta) using the OLS model. The results reported show that the coefficients of CDS for hedging are positive and statistically significant in all columns (at the 5% level).

Table 6.9: OLS regressions of firm risk (beta) and CDS use for hedging purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	0.047**	0.031	0.049**	0.025	0.049**	0.029	0.047**	0.037
Salary	0.145***	0.000	0.132***	0.001	0.170***	0.000	0.155***	0.000
Bonus	-0.012	0.399	-0.018	0.185	-0.007	0.604	-0.018	0.216
Leverage	-0.246	0.262	-0.287	0.190	-0.125	0.596	-0.199	0.401
Investment opportunities	-0.141***	0.010	-0.187***	0.004	-0.158***	0.006	-0.196***	0.004
Size (sales log)	0.015	0.250	0.032*	0.055	0.017	0.209	0.034*	0.054
Tenure	0.003	0.781	0.004	0.655	0.000	0.981	0.006	0.558
Age	-0.004	0.405	-0.004	0.408	-0.004	0.439	-0.006	0.272
Diversification	0.032*	0.053	0.031*	0.063	0.012	0.493	0.012	0.511
Bank dummy			0.040	0.632			-0.192	0.157
Country dummy1					-0.119	0.443	-0.193	0.182
Country dummy2					-0.334*	0.084	0.100	0.533
Country dummy3					-0.376*	0.061	0.212	0.174
Country dummy4					-0.447**	0.032	-0.010	0.947
Country dummy5					0.045	0.823	-0.051	0.723
Country dummy6					-0.038	0.879	0.274*	0.051
Year1			0.263	0.054			0.319***	0.005
Year2			0.323***	0.005			-0.021	0.855
Year3			-0.029	0.798			-0.022	0.846
Year4			-0.031	0.786			-0.025	0.827
Year5			-0.142	0.227				
Adjusted R²	0.198		0.223		0.211		0.227	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results suggest that CDS use for hedging purposes increases banks risk. This finding is consistent with the results reported for distance to default and previous empirical literature (e.g., Nijskens and Wagner, 2011).

The results of the random effects model are also consistent with those reported for OLS regressions. Table 6.10 shows the coefficients of CDS use for hedging purposes are positive and statistically significant.

Table 6.10: Random effects regressions of firm risk (beta) and CDS use for hedging purposes

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	0.048*	0.055	0.048*	0.058	0.050**	0.048	0.045*	0.077
Salary	0.151***	0.001	0.151***	0.001	0.174***	0.000	0.174***	0.000
Bonus	-0.015	0.284	-0.015	0.285	-0.012	0.395	-0.015	0.298
Leverage	-0.191	0.473	-0.192	0.477	-0.088	0.747	-0.054	0.851
Investment opportunities	-0.124**	0.030	-0.124**	0.031	-0.137**	0.018	-0.124**	0.034
Size (sales log)	0.007	0.603	0.007	0.606	0.009	0.493	0.006	0.638
Tenure	0.004	0.671	0.004	0.674	0.002	0.828	0.005	0.616
Age	-0.006	0.279	-0.006	0.281	-0.006	0.314	-0.007	0.244
Diversification	0.033*	0.090	0.033**	0.096	0.015	0.474	0.016	0.476
Bank dummy			-0.002	0.986	-0.164	0.373	-0.151	0.369
Country dummy1					-0.359	0.119	-0.194	0.282
Country dummy2					-0.397*	0.094	0.217	0.268
Country dummy3					-0.449	0.071	0.217	0.265
Country dummy4					0.016	0.946	-0.006	0.977
Country dummy5					-0.092	0.757	0.028	0.874
Country dummy6							0.018	0.907
Year1			0.082	0.447			-1.062***	0.001
Year2			0.022	0.882			0.162	0.152
Year3			-0.900***	0.002			-0.194*	0.093
Year4			0.177	0.115			-0.161	0.152
Year5			-0.190*	0.098			0.018	0.907
R2 within	0.029		0.0292		0.027		0.031	
R2 between	0.496		0.4959		0.565		0.532	
R2 overall	0.217		0.2165		0.242		0.233	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

In summary, the results reported in this section show consistent results of OLS and random effects models. CDS use for hedging is positively related to bank risk. Furthermore, this empirical finding is robust using different risk measures (i.e., distance to default and beta).

The results contrast the theoretical argument that derivatives use for hedging are regularly used to reduce firm risk (Smith and Stulz, 1985), and show that CDS use for hedging can lead to an increase in the bank risk. This finding is consistent with prior empirical studies that document a positive association between CDS use for hedging and firms risk.

6.4.3 The results for the control variables

This subsection discusses the results for the control variables that are included in the firm risk model. Previous empirical studies expect a positive relationship between firm risk and investment opportunities (e.g., Smith and Watts, 1992; Bartram et al., 2011). The results reported for distance to default show that greater investment opportunities are associated with lower distance to default risk (i.e., increase the default risk). This finding is consistent with prior empirical studies that show a positive association between investment opportunities and firm risk (e.g., Guay, 1999a; Rajgopal and Shevlin; 2002).

The results reported for distance to default in Tables 6.7 and 6.8 show that the coefficients of leverage are positive and significant (below the 5% level). This suggest that leverage increases the bank distance to default (i.e., reduces the default risk). This finding contrasts with previous empirical studies that show a positive relationship between leverage and firm risk (e.g., Guay; 1999a; Coles at al., 2006). However, this negative association between leverage and firm risk is consistent with the empirical findings of Rajgopal and Shevlin (2002); they show a positive association between leverage and the incentives to undertake riskier projects.

This positive relationship between leverage and bank risk can be related to the attitude of managers in high leverage firms (banks) who have an incentive to accept risky projects because shareholders will enjoy a significant part of the benefits of these risky projects and debt holders will bear more risk (Leland; 1998; Aretz and Bartram, 2010). The coefficients of beta as a proxy for bank risk show no association between bank risk and leverage as reported in Tables 6.9 and 6.10.

Bank size is significant and positive to the distance to default in the OLS model and in the random effects model. This finding indicates that large banks have a lower risk level as the distance to default increases (i.e., reduced bank default risk). This finding is consistent with a wider literature that reports a negative relationship between bank size and firm risk (e.g., Coles et al., 2006; Bai and Elyasiani, 2013).

Bank diversification is positively related to the bank risk (beta). For the OLS and random effects models, the coefficients are generally positive and significant. This finding is consistent with Hagendorff and Vallascas (2011), and inconsistent with previous literature that expects diversification to reduce bank risk (Chen et al. 2006; Bartram, Brown, and Conrad, 2011).

The results also show that cash compensation increases a bank's risk. In Table 6.7 the coefficients for cash compensation (salary and bonuses) are generally negative and significantly related to distance to default. The results for beta in Tables 6.9 and 6.10 also show that cash compensation (salary) is associated with a higher bank risk. This finding is inconsistent with the argument that suggests higher salaries will increase managerial risk aversion and result in less firm risk (Whidbee and Wohar, 1999; Coles et al., 2006; Adkins et al., 2007). However, this finding is consistent with the results of many empirical studies that argue that a higher salary will make the CEO's better diversified and encourage them to take more risk (Knopf et al., 2002; Ertugrul et al., 2008).

Overall, the results for the control variables suggest that financial distress (leverage), investment opportunities, bank size, diversification and salary are important determinants for firm risk.

In line with Chapter 5, delta is also included as an additional control variable. The results using delta as a control variables are largely the same. Appendix G (Panel C) presents the results of the main measures for firm risk and using the OLS and random effects models.

6.5 CDS use for hedging purposes and the financial crisis

This section will discuss and report the results of regression analysis for the relationship between CDS use for hedging purposes and banks' risk in relation to the financial crisis. Consistent with the results reported in the previous chapter, the sample is split into three subsamples. The first represents a period before the financial crisis 2006, the second is the period of the financial crisis 2007-2009, and the third is the period after the financial crisis (2010-2011).

This section is organised as follows. Section 6.5.1 reports the results for the relationship between CDS use for hedging and banks risk before the financial crisis. Section 6.5.2 presents the results of the relationship between CDS use for hedging and banks risk during the financial crisis. The influence of CDS use on banks risk after the financial crisis is reported in section 6.5.3.

6.5.1 CDS use for hedging purposes and bank risk before the financial crisis

Table 6.11 displays the results for the time period preceding the financial crisis. The dependent variable is bank risk (distance to default) and the independent variable is CDS use for hedging purposes (notional value of CDS scaled by total assets).

Table 6.11: OLS regressions of firm risk (distance to default) and CDS use for hedging purposes (before the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	-0.327	0.195	-0.327	0.188	-0.575***	0.008	-0.374	0.165
Salary	-0.345	0.513	-0.298	0.566	-0.151	0.729	-0.321	0.569
Bonus	-0.057	0.783	-0.066	0.744	-0.189	0.279	-0.099	0.673
Leverage	4.842*	0.053	5.699**	0.025	5.477**	0.011	6.023**	0.034
Investment opportunities	-1.122	0.295	-1.138	0.280	-0.569	0.523	-1.039	0.368
Size (sales log)	0.573	0.143	0.707*	0.074	0.696	0.044	0.818*	0.080
Tenure	0.059	0.592	0.011	0.922	0.113	0.394	0.007	0.955
Age	0.063	0.341	0.066	0.311	-0.002	0.971	0.077	0.304
Diversification	-0.038	0.875	0.018	0.941	-0.073	0.732	0.011	0.969
Bank dummy			1.684	0.108				
Country dummy1					-0.567	0.714	-1.217	0.486
Country dummy2					-0.124	0.950	-2.506	0.175
Country dummy3					-0.798	0.678	-2.000	0.353
Country dummy4					9.264***	0.000	-0.948	0.636
Country dummy5					0.837	0.687	-2.255	0.263
Country dummy6					-1.005	0.755	-1.832	0.343
Adjusted R^2	0.177		0.220		0.386		0.231	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results reported in table 6.11 indicate that CDS use for hedging is negatively associated with banks' distance to default. The coefficients are negative in all columns and statistically significant in column 3 (at the 1% level). The results suggest that CDS use for hedging purposes lowers banks' distance to default (i.e. increased bank risk).

Table 6.12 presents the results using beta as a dependent variable. Similar to the results reported in Table 5.13 for the relationship between CDS use for trading and beta in Chapter five, no association is found between CDS use for hedging and bank risk (beta). This also can be explained by the small sample size before the financial crisis.

Table 6.12: OLS regressions of firm risk (beta) and CDS use for hedging purposes (before the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	0.006	0.868	0.006	0.869	-0.009	0.834	-0.127	0.143
Salary	-0.128	0.124	-0.130	0.120	-0.125	0.151	-0.010	0.789
Bonus	-0.013	0.696	-0.012	0.709	-0.010	0.766	0.170	0.686
Leverage	0.134	0.727	0.091	0.818	0.147	0.719	-0.063	0.717
Investment opportunities	-0.121	0.467	-0.120	0.473	-0.052	0.768	0.081	0.252
Size (sales log)	0.072	0.238	0.065	0.299	0.065	0.334	-0.003	0.871
Tenure	-0.003	0.839	-0.001	0.951	0.002	0.950	-0.002	0.833
Age	-0.005	0.615	-0.005	0.607	-0.003	0.781	0.034	0.421
Diversification	0.032	0.402	0.029	0.453	0.030	0.487	0.349	0.192
Bank dummy			-0.084	0.611				
Country dummy1					-0.397	0.199	-0.131	0.638
Country dummy2					0.023	0.953	0.273	0.402
Country dummy3					-0.441	0.249	0.176	0.564
Country dummy4					-0.257	0.539	-0.168	0.582
Country dummy5					-0.149	0.716	-0.202	0.491
Country dummy6					-0.428	0.504	-0.165	0.364
Adjusted R^2	0.110		0.115		0.202		0.211	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

6.5.2 CDS use for hedging purposes and bank risk during the financial crisis

Table 6.13 and Table 6.14 display the results of the relationship between CDS use for hedging and banks' risk during the financial crisis (2007-2009). In table 6.13 the dependent variable is bank risk as measured by Merton distance to default, and the independent variable is CDS use for hedging purposes as measured using the notional value of CDS scaled by total assets.

Table 6.13: OLS regressions of firm risk (distance to default) and CDS use for hedging purposes (during the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	P value	Coefficients	P value	Coefficients	P value	Coefficients	P value
Hedging CDS (predicted)	-0.444*	0.099	-0.379	0.155	-0.594**	0.014	-0.340	0.217
Salary	-0.390	0.412	-0.183	0.702	-0.283	0.507	-0.191	0.705
Bonus	-0.120	0.482	-0.095	0.574	-0.188	0.217	-0.151	0.392
Leverage	6.071	0.028	6.792**	0.014	6.998***	0.006	6.653**	0.026
Investment opportunities	-5.719***	0.000	-5.811***	0.000	-5.073***	0.000	-6.163***	0.000
Size (sales log)	0.634***	0.000	0.664***	0.000	0.553***	0.000	0.711***	0.000
Tenure	-0.016	0.885	-0.060	0.596	0.073	0.504	-0.058	0.617
Age	0.011	0.870	0.028	0.684	-0.024	0.706	-0.011	0.877
Diversification	0.033	0.872	0.091	0.659	-0.057	0.775	0.016	0.946
Bank dummy			2.371**	0.024				
Country dummy1					-1.463	0.390	-3.962**	0.020
Country dummy2					-2.195	0.293	-0.958	0.611
Country dummy3					0.054	0.981	-2.040	0.307
Country dummy4					13.083***	0.000	-0.381	0.850
Country dummy5					0.720	0.746	-3.761*	0.055
Country dummy6					-1.021	0.713	-2.200	0.216
Adjusted R^2	0.239		0.257		0.443		0.251	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results reported in Table 6.13 show that the relationship between CDS use for hedging and bank risk is negative and statistically significant in columns 1 and 3. This finding suggests that CDS use for hedging increases the bank risk and lowers bank distance to default (i.e. increased bank risk) during the financial crisis period.

The results reported in table 6.14 show the relationship between CDS use for hedging and banks' risk using beta as a second proxy for banks risk.

Table 6.14: OLS regressions of firm risk (beta) and CDS use for hedging purposes (during the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	0.041	0.146	0.046*	0.098	0.051*	0.084	0.048*	0.099
Salary	0.184***	0.000	0.202***	0.000	0.204***	0.000	0.212***	0.000
Bonus	-0.005	0.761	-0.003	0.854	0.005	0.796	0.003	0.888
Leverage	-0.604**	0.036	-0.542*	0.060	-0.522*	0.092	-0.515*	0.095
Investment opportunities	-0.221**	0.012	-0.229***	0.009	-0.244**	0.011	-0.249***	0.008
Size (sales log)	0.018	0.253	0.021	0.190	0.019	0.271	0.022	0.197
Tenure	0.010	0.423	0.006	0.631	0.001	0.953	0.006	0.608
Age	-0.002	0.831	-0.000	0.988	0.000	0.952	0.000	0.968
Diversification	0.021	0.334	0.026	0.233	0.003	0.885	0.008	0.728
Bank dummy			0.204*	0.063				
Country dummy1					0.166	0.423	-0.394**	0.025
Country dummy2					-0.220	0.386	-0.342*	0.080
Country dummy3					-0.153	0.572	-0.209	0.312
Country dummy4					0.037	0.892	-0.099	0.634
Country dummy5					0.095	0.726	-0.165	0.364
Country dummy6					0.418	0.216	-0.202	0.491
Adjusted R^2	0.252		0.263		0.259		0.263	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

The results for beta are consistent with the results of the analysis using distance to default. A positive and significant relationship is found between CDS use for hedging purposes and beta as reported in Table 6.14. The coefficients are positive and significant for beta in columns 2, 3, and 4. This finding shows that CDS use for hedging purposes increased banks' risk during the financial crisis period (2007-2009).

6.5.3 CDS use for hedging purposes and bank risk after the financial crisis

This subsection displays the results of the influence of CDS use for hedging on banks' risk after the crisis. Table 6.15 reports the results using Merton distance to default as a risk measure, and 6.16 reports the results using beta as a proxy for banks' risk. The results reported in table 6.15 show that there is no association between CDS use for hedging and banks' distance to default after the financial crisis.

Table 6.15: OLS regressions of firm risk (distance to default) and CDS use for hedging purposes (after the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	0.363	0.466	0.395	0.434	0.313	0.514	0.318	0.507
Salary	-0.959	0.267	-0.970	0.264	-0.780	0.341	-0.939	0.251
Bonus	-0.289	0.325	-0.296	0.315	-0.409	0.148	-0.385	0.182
Leverage	5.079	0.305	5.526	0.275	2.315	0.647	2.316	0.648
Investment opportunities	-2.978**	0.022	-3.013**	0.021	-1.996	0.116	-2.160*	0.099
Size (sales log)	0.620	0.334	0.705	0.293	0.711	0.257	1.542**	0.019
Tenure	0.085	0.720	0.088	0.710	0.029	0.899	-0.036	0.873
Age	0.095	0.389	0.096	0.385	-0.062	0.568	-0.077	0.476
Diversification	0.085	0.818	0.087	0.814	-0.081	0.834	-0.050	0.901
Bank dummy			0.838	0.647				
Country dummy1					-0.854	0.777	-2.119	0.453
Country dummy2					-0.270	0.944	-0.535	0.847
Country dummy3					1.596	0.680	-3.732	0.239
Country dummy4					7.508*	0.056	11.660***	0.000
Country dummy5					12.747***	0.002	-5.298	0.102
Country dummy6					-1.799	0.701	-6.424**	0.025
Adjusted R^2	0.168		0.169		0.340		0.338	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Table 6.16 shows the results of the relationship between CDS use for hedging and banks risk after the financial crisis. The dependent variable is bank risk as measured by beta. The independent variable is CDS use for hedging purposes. The coefficients are positive and statistically significant in columns 3 and 4. This finding suggests that CDS use for hedging increased bank riskiness after the last credit crisis.

Table 6.16: OLS regressions of firm risk (beta) and CDS use for hedging purposes (after the financial crisis)

Independent variables	*Column (1)*		*Column (2)*		*Column (3)*		*Column (4)*	
	Coefficients	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**	**Coefficients**	**P value**
Hedging CDS (predicted)	0.066	0.179	0.066	0.189	0.083 *	0.087	0.092 *	0.064
Salary	0.151*	0.078	0.145*	0.094	0.264***	0.001	0.241***	0.002
Bonus	-0.028	0.342	-0.024	0.423	-0.004	0.904	-0.018	0.564
Leverage	0.081	0.869	0.102	0.838	0.257	0.625	0.140	0.793
Investment opportunities	-0.174	0.172	-0.141	0.285	-0.267*	0.052	-0.218	0.129
Size (sales log)	0.093	0.145	0.092	0.168	0.001	0.672	0.006	0.639
Tenure	0.016	0.498	0.015	0.514	0.004	0.867	0.008	0.745
Age	-0.013	0.252	-0.012	0.263	-0.010	0.377	-0.016	0.183
Diversification	0.005	0.883	0.006	0.876	0.003	0.930	0.012	0.746
Bank dummy			-0.025	0.892				
Country dummy1					-0.202	0.517	-0.296	0.323
Country dummy2					-0.619	0.126	-0.283	0.339
Country dummy3					-0.628	0.123	0.444	0.175
Country dummy4					-1.079***	0.010	-0.074	0.829
Country dummy5					0.133	0.784	0.130	0.639
Country dummy6					-0.372	0.438	-0.269	0.756
Adjusted R^2	0.250		0.243		0.288		0.240	

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Overall, this section shows the results of the how CDS use for hedging purposes influenced banks' risk in relationship to the last credit crisis using different risk measures. The analysis and the results that are presented in Tables 6.11 to 6.16 reveal a positive association between banks' risk and CDS use for hedging purposes before, during, and after the financial crisis.

6.6 Summary

This chapter examined the relationship between the risk-taking incentives generated by stock option compensation and CDS use for hedging purposes. The results presented in this chapter show a negative and weak statistical significant association between CEOs' risk-taking incentives provided by stock option compensation and CDS use for hedging. Tobit model is also used to examine the relationship between the risk-taking incentives of stock option compensation and the extent of CDS use for hedging purposes. While probit model is used to investigate the association between the risk-taking incentives of stock option compensation and the decision of using CDS use for hedging. The results for tobit and probit models are consistent with the results from OLS model.

This chapter also investigates how CDS use for hedging purposes influence banks risk. The results that are reported in this chapter show a positive and statistically significant relationship between bank risk and CDS use for hedging purposes. Table number 5.17 below provides a summary of the main results in this chapter.

Table 6.17: A summary of the main results in chapter 6

	(1)	(2)	(3)	(4)
CDS	The dependent variable is CDS for hedging and the independent variable is vega			
OLS model (First stage)	-0.012	-0.001	-0.002	-0.007
	(0.997)	(0.964)	(0.889)	(0.593)
OLS model (second stage)	0.003	0.005	-0.002	-0.003
	(0.662)	(0.550)	(0.803)	(0.832)
Random effects	-0.004			
	(0.625)			
Tobit model	0.011			
	(0.640)			
Probit model	-0.014			
	(0.501)			
Firm risk model	The dependent variable is firm risk and the independent variable is CDS hedging			
Distance to default (OLS)	-0.113	-0.215	-0.381*	-0.404*
	(0.581)	(0.309)	(0.060)	(0.058)
Beta (OLS)	0.047**	0.049**	0.049**	0.047**
	(0.031)	(0.025)	(0.029)	(0.037)
Distance to default (random effects)	-0.113	-0.069	-0.245	-0.069
	(0.581)	(0.736)	(0.204)	(0.742)
Beta (random effects)	0.048*	0.048*	0.050**	0.045*
	(0.055)	(0.058)	(0.048)	(0.077)

Chapter 7: Summary, conclusions and suggestions for future research

7.1 Introduction

The main purpose of this thesis is to investigate two different issues related to CDS use by banks. The first one is to examine the relationship between the CEOs' risk-taking incentives of stock option compensation and CDS use by banks for both hedging and trading (speculating) purposes. The second is to investigate how CDS use influences bank risk by decomposing CDS use into hedging and trading (speculating) purposes. This decomposition enables the estimation of the effect of CDS use which is expected to influence firm risk differently.

Many earlier empirical research on the relationship between the risk-taking incentives of stock option compensation and derivatives use almost exclusively focuses on derivatives use without distinguishing between the motives of the use (e.g., Tufano, 1996; Geczy et al., 1997; Gay and Nam, 1998; Whidbee and Wohar, 1999; Haushalter, 2000). Previous research has paid little attention to the effect of derivatives use on firm risk (Allayannis and Ofek, 2001; Hentschel and Kothari, 2001; Bartram, Brown and Conrad, 2011; Fung et al., 2012). Furthermore, the different effects of derivatives use have often been ignored in previous studies.

A significant body of empirical studies in risk management has been trying to explain why firms use derivatives and what motivates firms to use derivatives. This study has a primary advantage over previous studies due to the improvements in derivatives disclosure requirements, particularly the disclosure requirements by IFRS 9 Financial Instruments (replacement of IAS 39), which requires firms to report the purpose of CDS use.

This enables examining the influence of each purpose of CDS use separately instead of examining whether CDS are used for hedging or for trading. Accordingly, the current thesis addresses directly the linkage CEOs' risk-taking incentives and CDS use for hedging and trading. It also examines directly how CDS that are used for hedging and trading influence bank risk.

The aim of this chapter is to bring together and highlight the primary conclusions related to the key aspects of this research. Moreover, this chapter summarises the main findings of the present research and the contributions to the literature. Furthermore, key limitations of this study and some areas that could potentially be explored in future research are identified.

7.2 Overview

The present thesis has explored the CEOs' risk-taking incentives generated by stock option compensation in relation to CDS use in European banks, and examined how risk-taking incentives influence the extent and the decisions to use CDS. The rationale was to examine whether the purpose of CDS use is related to the risk-taking incentives provided by stock options. Jensen and Meckling (1976) show that shareholders can use stock options to mitigate the effects of managerial risk aversion and to increase managers' risk-taking incentives in order to adopt rather than avoid risky projects. Smith and Stulz (1985) illustrate that stock options can influence CEOs' derivatives use decisions and can be used to reduce the risk-related agency problem by providing CEOs with incentives to increase firm risk on behalf of risk-neutral shareholders.

CDS can be used as risk reduction strategy (hedging) or as risk taking activity (trading) based on the purpose of CDS use. Therefore, it is important to consider the motive of CDS use when examining the relationship between the risk-taking incentives of stock options and CDS use, because the use of CDS for trading purposes can result in completely different results in firm risk.

Previous theoretical and empirical studies have explored the relationship between the risk-taking incentives and derivatives use assuming that the presence of derivatives is an indication for hedging firm risk. Moreover, there is little research of the relationship between the risk-taking incentives of stock option compensation and CDS use which represent the major category of credit derivatives market.

In order to fill the existing gap in the literature, this thesis provides an investigation of the relationship between the risk-taking incentives of stock options and CDS use for hedging or trading.

In addition, the present research investigates how CDS use influences firm risk and distinguishes between the possible effects of the different purposes of CDS. This can offer a more complete picture of the relationship between CDS use which is expected to be determined by the CEOs' risk-taking incentives. Stulz (1984) discuss corporate derivatives use as a risk reduction strategy in the presence of market imperfections such as financial distress, transactions costs, or agency conflicts. Guay (1999a) point out that derivatives use for hedging purposes are expected to be negatively associated with firm risk, and derivatives use for trading (speculating) purposes are anticipated to be positively associated with firm risk.

A few studies have examined the relationship between derivatives use and firm risk. However, the empirical studies for the effects of derivatives use on firms' risk have produced mixed results (e.g., Hentschel and Kothari, 2001; Fung et al., 2012). Moreover, most of the earlier empirical studies focus on derivatives use without distinguishing between the different effects of the purpose of derivatives use on the risk profile.

This thesis uses CDS data collected from the annual reports of European publicly-listed banks and distinguishes between CDS use for hedging purposes and CDS use for trading purposes to investigate the influence of CDS use on firm risk. Thus, based on the previous discussion, the research questions are formulated as follows:

Research Question 1: Do the CEOs' risk-taking incentives generated by stock option compensation influence the use of CDS? This question is extended to include the following sub-questions:

- Do the CEOs' risk-taking incentives of stock option compensation influence the use of CDS for hedging purposes?
- Do the CEOs' risk-taking incentives of stock option compensation influence the use of CDS for trading purposes?

These questions are investigated based on hypotheses H1 (a) and H2 (a) formulated in Chapter 2:

H_1 (a): higher risk-taking incentives of stock option compensations are associated with less CDS use for hedging purposes.

H_2 (a): higher risk-taking incentives of stock option compensations are associated with greater CDS use for trading purposes.

Research Question 2: Does CDS use influence bank risk? This question is extended to include the following sub-questions:

- Does CDS use for hedging purposes influence bank risk?
- Does CDS use for trading purposes influence bank risk?

These questions are investigated based on hypotheses H1 (b) and H2 (b) formulated in Chapter 2:

H1 (b): there is a negative association between CDS use for hedging purposes and bank risk.

H2 (b): there is a positive association between CDS use for trading purposes and bank risk.

7.3 Research Design

7.3.1 Vega as the CEOs' risk-taking incentives proxy

Different approaches have been used in the literature to measure executives' risk-taking incentives such as the number of stock options granted to the CEO, the value of stock options at the end of the year, or the presence of stock option plans (e.g., Tufano, 1996; Conyon and Murphy, 2000; Chen et al., 2006). These measures are considered noisy proxies for risk-taking incentives because they do not take into consideration the time-to-maturity, volatility, or exercise price of stock options (Core and Guay, 2002; Knopf et al., 2002). Instead of these simple proxies, this thesis uses CEO stock options sensitivity to stock return volatility (vega) as a proxy for the risk-taking incentives. This method was developed by Core and Guay (2002) to measure managerial incentives to increase risk from CEO stock option compensation. Vega has been used in some empirical studies (e.g., Rajgopal and Shevlin, 2002; Coles et al. 2006; Hagendorff and Hagendorff, 2011) and is considered a better measure to capture the risk-taking incentives provided by stock option compensation compared to simple proxies such as the number or the value of stock options.

7.3.2 Measuring CDS use

The present thesis uses the notional value of a CDS contract as a proxy for the extent of CDS use. This measure is widely adopted in previous derivatives literature (e.g., Gay and Nam, 1998; Hentschel and Kothari, 2001; Knopf et al., 2002; Rogers, 2002; Supanvanij and Strauss, 2010).

In contrast to using binary variables to test whether or not banks have used CDS, the notional value of a CDS contract represents a continuous variable for the amount of CDS use. This thesis also uses binary variables to test the relationship between the decision to use and CEOs' risk-taking incentives generated by stock options.

7.3.3 Measuring firm risk

This thesis investigates how CDS use influences bank risk using two different measures for bank risk. The first measure is Merton distance to default which is adopted by many empirical studies and considered as a suitable indicator for bank risk (Gropp et al., 2006; Hagendorff and Vallascas, 2011; Bai and Elyasiani, 2013). Following prior empirical studies (e.g., Chen et al., 2006; Nijskens and Wagner, 2011; Fung et al., 2012), this thesis also uses beta as a second measure for bank risk. Beta measures the volatility of the banks stock return in relation to the volatility of the market's return index (Bessis, 1998).

7.4 Conclusion

This section of the thesis presents the conclusion and summarises the results of the analyses. Subsection 6.4.1 presents the summary for Chapter 4 which aims to investigate the relationship between the risk-taking incentives and CDS use for trading purposes, and how CDS use for trading purposes influence bank risk. Subsection 6.4.2 is the summary for Chapter 5 that reports the results for the relationship between the risk-taking incentives and CDS use for hedging purposes, and how CDS use for hedging purposes influences bank risk.

7.4.1 CDS use for trading purposes

Risk-taking incentives and CDS use for trading purposes

The findings of the present research confirmed that the risk-taking incentives generated by stock option compensation induce CEOs in the banking industry to use more CDS for trading purposes. The uses of stock options can mitigate the risk-related incentives problem and align the interests of the managers with their shareholder by encouraging the adoption of riskier strategies through using more CDS for trading purposes. The risk-taking incentives of CEOs' stock option compensation are found to be an important determinant of bank CDS use for trading purposes.

The findings show a positive and strong association between the risk-taking incentives generated from stock options and both the extent and the decision of CDS use for trading purposes. The findings are robust across different regression specifications and when an alternative measures is used (i.e., stock options value). Moreover, this research corrects for the possible endogeneity problem between vega and CDS use. A positive and significant association between vega and CDS use for trading purposes is found using one-stage analysis (i.e., vega is exogenous). This positive relationship remains significant when the analysis is conducted using a two stage regression (i.e., vega is treated as an endogenous variable).

The results reported are consistent with the theoretical literature that posits that stock option compensation aligns the interests of risk-averse managers with those of shareholders by encouraging managers to take on more risk (Jensen and Meckling, 1976; Smith and Stulz, 1985).

CDS use for trading purposes and firm risk

With regard to the effect of CDS use for trading purposes on firm risk, the findings show that CDS use for trading purposes increases a bank's risk. This research uses Merton distance to default as a bank risk measure. Merton distance to default measures how far the bank is from the default point (the probability that the bank fails to repay the debt). The findings show that CDS use for trading purposes significantly lowers the distance to default (i.e., increases the default risk).

This research has also employed beta as an additional measure for bank risk. Beta measures the volatility of the bank's stock return in relation to the volatility of the market's index return. The results, in the aggregate, show a positive and significant association between CDS use for trading purposes and banks' beta. This finding confirms the results that are found using distance to default and suggests that CDS use for trading purposes contributed to a higher bank beta.

Baseline results from the analysis of the relationship between CDS use for trading purposes and firm risk hold even when performing various robustness checks, in particular, when building several sub-samples and when using the random effects model.

Combining these findings, this research concludes that CDS use for trading purposes influences banks' risk. CDS use for trading purposes is associated with a bank's higher risk (lower distance to default and higher beta). These findings have catered for the endogeneity problem related to CDS use and firms' risk. The results are consistent with empirical evidence provided in some of the previous empirical studies (e.g., Minton et al., 2009; Fung et al., 2012).

7.4.2 CDS use for hedging purposes

Risk-taking incentives and CDS use for hedging purposes

The results, in the aggregate, show that the risk-taking incentives generated by stock option compensation encourage CEOs to use less CDS for hedging purposes. The use of stock options compensation is likely to mitigate managers' risk aversion and align their interests with the interests of the shareholders. The risk-taking incentives of CEOs' stock option compensation (vega) are found to be negative but weakly related to CDS use for hedging purposes.

This negative insignificant association between CDS use for hedging purposes and the risk-taking incentives generated by stock options is consistent with the findings of previous empirical studies on derivatives (e.g., Géczy et al., 1997; Knopf et al., 2002). However, the results suggest that CDS use for hedging purposes is negatively related to the risk-taking incentives of stock options.

Similar to the analysis of the relationship between risk-taking incentives and CDS use for trading purposes, the findings for CDS use for hedging purposes are robust across different regression models and use an alternative measure of managerial risk-taking incentives (i.e., stock options value). Moreover, the analysis of the relationship between CDS use for hedging purposes and risk-taking incentives (vega) corrects for the possible endogeneity problem. In the aggregate, a negative and insignificant association between vega and CDS use for hedging purposes is found using one stage analysis (i.e., vega is exogenous). Moreover, the relationship remains negative insignificant when the analysis is conducted using a two stage regression (i.e., vega is treated as endogenous variable).

The results reported are consistent with the theoretical literature that stock option compensation is expected to reduce managers derivatives use for hedging purposes and align the interests of risk-averse managers with those of shareholders (Smith and Stulz, 1985).

CDS use for hedging purposes and firm risk

This thesis finds a fairly strong positive association between CDS use for hedging purposes and firm risk. The effect of CDS use for hedging purposes on bank distance to default is found to be negative in four models, and significant in two models of OLS regression. However, the empirical findings show a positive and statistically significant association, which is robust across all models, for the relationship between CDS use for hedging purposes and firm risk when measured by beta.

The findings show that CDS use for hedging purposes increases a bank's risk. CDS use for hedging purposes leads to lower banks' distance to default (i.e., increase the default risk) and increases a bank's beta (i.e., higher banks' risk). The results of the relationship between banks risk and CDS use for hedging purposes have controlled for the endogeneity problem between CDS use and firms risk.

The positive association between CDS use for hedging purposes and bank risk is inconsistent with the theoretical literature that expects firms to use derivatives to hedge firm risk (e.g., Smith and Stulz, 1985; Froot et al., 1993). Nevertheless, the finding of a positive association between CDS use for hedging purposes and firm risk is in line with empirical evidence presented in previous studies (e.g., Fung et al., 2012; Nijskens and Wagner, 2011). Fung et al. (2012) find that CDS use for hedging purposes is associated with higher firm risk in insurance companies.

This positive relationship between CDS use for hedging purposes and firm risk can be explained by the event of the credit crisis that started in 2007. Despite the explosive growth in the derivatives market, there was a general debate about the benefits of derivatives and an expressed concern regarding the expected effect of using derivatives on the stability of the financial system. This negative view for the role of CDS use may amplify the concern of market participants on the expected outcome of using this financial instrument under crisis conditions.

The event of the financial crisis can negatively influence the attitude and the behaviour of the investors (Shiller, Konya, and Tsutsui, 1988). An interpretation of the results of CDS use for hedging purposes and firm risk can also be related to the event of the last financial crisis. Eichengreen et al. (2012) show that investors were primarily worried during the financial crisis period (abnormal period) and this made them wary of the risks in the banking portfolios for reasons that are independent of the evolution of the real economy and this makes all banks to look riskier than in normal circumstances. Nevertheless, Nijskens and Wagner (2011) point out that the market considered banks that use CDS to be substantially riskier even before the onset of the crisis.

7.4.3 Contributions

This research contributes to the literature in several ways. First, although the relationship between the risk-taking incentives generated from stock options has been investigated in previous literature, the focus of the literature was mainly on derivatives without differentiating between hedging and speculative motivations for using derivatives. Thus, the present research fills the gap in the literature by examining the relationship between the risk-taking incentives generated from stock option compensation and the extent of CDS use for hedging purposes. This research also investigates the relationship between risk-taking incentives of stock option compensation and CDS use for trading purposes.

Second, in the empirical method, this research adopted an effective approach to capture the risk-taking incentives generated from stock options by using vega which accounts for the differences in stock option plans such as: the time to maturity, exercise price, and volatility. A wide range of previous empirical studies in the literature on risk-taking incentives and derivatives rely on simple proxies for risk-taking incentives. Moreover, this thesis controls for panel data individual effects by using a random effects model. Few studies appear to control for panel data individual effects (e.g., Supanvanij and Strauss, 2010).

Third, the empirical analysis controls for the problem of endogeneity between the risk-taking incentives and CDS use by applying a two-stage regression which represents one of the principal approaches of resolving endogeneity.

Fourth, the present thesis contributes to the existing literature by analysing how CDS use influences firm risk. Earlier empirical studies have tried to improve the understanding of how firms use derivatives. The assumption in nearly all of this literature has been that derivatives are used for hedging purposes. Thus, the findings in this literature are predominately interpreted based on this assumption. This research fills this gap by exploring how the different purposes of using CDS (i.e., hedging purposes or trading purposes) influence firm risk. Furthermore, this research control for the problem of endogeneity that could arise between CDS use and firm risk.

Fifth, this research sheds more light on the relationship between CDS use for trading purposes and firms' risk, and investigates the link between the risk-taking incentives and CDS use for trading purposes. The theoretical literature in derivatives use for trading purposes is nonetheless somewhat limited. The theoretical studies lay the groundwork for examining the association between derivatives use for hedging purposes and executive compensation (Stulz; 1984; Smith and Stulz, 1985). This thesis tries to empirically investigate the nature of the relationship between executive stock options and CDS use for trading purposes.

In conclusion, this thesis contributes to improve the knowledge of different relationships between the risk-taking incentives of stock options and the purpose of using CDS. Furthermore, this research contributes to the growing debate on the effects of CDS use on firm risk.

7.4.4 Implications

Examining the relationship between risk-taking incentives of stock option compensation and CDS use can make clear to regulators, policy makers and bank shareholders the potential effect of the risk-taking incentives generated from stock options. This thesis shows that the executive stock option compensation programme induces managers to take more risk. CEOs' compensation, in the form of stock options is sensitive to stock return volatility and gives an incentive to implement riskier choices, such as using more CDS for trading purposes and reducing the incentives to use CDS for hedging purposes.

Regulators may benefit from improving transparency of executive remuneration, so that what executives are paid is clear and easy to understand. A number of changes can be considered to the way that executive compensation is reported, for example, more details about the main purpose of providing these compensation components, any relevant financial targets and information about a time period for the compensation plan. These changes can provide greater clarity to executives' remuneration report and can develop clear guidance on the level of detail and type of information that should be reported by public companies.

Regulators in European countries may think about adopting a range of regulatory activities regarding the compensation of executives in European listed companies. For instance, by encouraging the implementation of appropriate compensation practices across European Union members, providing more detailed disclosure rules and higher levels of control over different types of executive compensation that induce risk-taking, in order to curb excessive risk-taking incentives. These changes should ensure some consistency between different remuneration reports.

This research also confirms the view that the incentive structure of CEO stock option compensation has implications for financial stability. Compensation patterns in the European banking sector are consistent with the implications of agency theory. Shareholders in European banks appear to provide high CEO risk-taking incentives through stock options. Stock options increase executives' risk-taking incentives and increase their desire to use more CDS for trading purposes. While this is an important indication that stock option compensation is an essential component of executive compensation which motivates executives to take more risk, regulators and shareholders may think about the costs and the benefits of relying on stock options.

Moreover, the results suggest that increasing shareholder involvement in setting executive compensation is somewhat concerning. For example, giving shareholders a vote on CEOs compensation is unlikely to mitigate risk-taking in the European banking industry. Shareholders prefer to offer CEOs compensation components that increase the risk-taking incentives to engage in risk-taking choices. Consequently, using executive stock option compensation to align the interests of shareholders and management in the banking sector is expected to lead to excessive risk-taking.

Regulating CEO compensation could take the form of introducing limits on the amount of the risk-inducing components. Alternatively, they could encourage banks to use more deferred compensation (e.g., defined-benefit pensions). The latter could remedy incentives for CEOs to shift risk by making executives unsecured bondholders with a financial interest in the liquidation value of a firm. Moreover, European regulators should pay particular attention to executive compensation packages in bailed-out financial institutions to prevent executives from taking unnecessary and excessive risks.

This thesis also shows that the effects of CDS use on firm risk are also important to policy makers. CDS are used mainly for trading purposes and this is associated with a higher bank risk. Moreover, the results illustrate that high risk-taking incentives increase CDS use for trading, which increases the default risk. Since financial stability considerations are one of the essential rationales for regulating the banking sector, the results support the case for regulating executives' stock option compensation in European banks.

CDS transactions for hedging purposes do not reduce bank risk, but instead contribute to a higher bank risk. An effective regulatory policy that focuses on the costs and benefits of CDS use for hedging purposes would be beneficial.

Overall, the results affirm the importance of further control on the executives' stock option compensation as a "variable component" of executives' compensation, to reduce excessive risk taking as recommended by Capital Requirements Directive IV (CRD IV). Undoubtedly, the executive risk-taking incentives of the compensation contract will continue to be a hotly debated subject for years to come (Core and Guay, 2010). This thesis highlights the importance of stock options compensation in providing executives with incentives to take actions to increase risk in the banking industry.

7.4.5 Limitations and areas for further research

This thesis extends the empirical knowledge and adds to the literature on both executive compensation and derivatives. The present research, however, has its own limitations that have to be considered when interpreting the results.

The first limitation of this thesis is in its sample size and selection. The sample was chosen from European stock market indices and premier indices of the European Union countries (EU-27). Therefore, the results are limited to the largest banks. The findings may not be generalisable to small banks. This limitation opens an interesting avenue for future research by using a sample consisting of small and large banks.

The second limitation of the present research arises from the examination of a single industry (i.e., the banking industry). The results may not be generalised for other industries. Future research can examine different industries or focus on nonfinancial firms.

The third limitation of this thesis can be related to the use of the notional value to measure the extent of CDS use. While the notional value is considered to be a good proxy for the extent of CDS use and is used in many previous empirical studies, it does not take into account the effect of holding both long (sell) and short (buy) positions. CDS users can take multiple CDS transactions within a year by taking different CDS buy or sale positions. The net position of CDS was not used due to data limitations in the CDS reporting[44] and the inconsistency in the pattern of disclosures between the European banks.

The fourth limitation is the potential of measurement error from using the Black-Scholes model to estimate the risk-taking incentives of stock options (vega). Previous empirical studies point out that the risk incentives (vega) could be overstated when it is calculated using

[44] The need for data on the date of opening position, date of termination date, date of maturity, amount received or paid, and transaction descriptions for CDS .

the partial derivatives from the Black-Scholes model (Core and Guay, 2002; Rajgopal and Shelvin, 2002).

A further limitation of the present research arises from the other source of the endogeneity problem. While this research has catered for the endogeneity problem related to simultaneity of CDS use and risk-taking incentives, there are other sources of endogeneity in some control variables, such as leverage and derivatives use. A better model should deal with multiple endogeneities for all of endogenously determined variables. However, it is beyond the scope of this thesis to consider all of the endogenous control variables. This could be a potential area of future research.

Further research can extend this study in several ways, such as to examine longer time period, using different measures for the extent of CDS use, using different proxies for firm risk, or to improve the model to control for the multiple endogeneity of the determinants of CDS use.

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Appendix A: Summary of the empirical literature (risk-taking and derivatives use)

Derivatives use and risk-taking incentives induced by stock option compensation

Authors	Main Risk-taking incentives variable	How derivatives are measured	Sample (size & Country)	Finding
Tufano (1996)	Number of options	Survey (Private data provided by Ted Reeve)	48 North American gold and mining firms	Negatively related to derivatives use
Géczy , Minton, and Schrand (1997)	MV of stock options	Keyword search	372 US nonfinancial firms	Positively related to derivatives use
Nam and Gay (1998)	Number of options	Notional value	325 US nonfinancial firms	Positively related to derivatives use
Knopf, Nam and Thornton (2002)	Vega	Notional value	260 US nonfinancial firms	Negatively related to derivatives use
Rajgopal and Shevlin (2002)	Vega	Reserves hedged	117 US oil and gas firms	Negatively related to derivatives use
Rogers (2002)	Vega-to-Delta	Net notional value	569 US firms from various industries	Negatively related to derivatives use
Adkins, Carter, and Simpson (2007)	Value of stock options	Notional value	252 US financial firms (banks)	Negatively related to derivatives use
Ertugrul, Sezer, and Sirmans (2008)	Vega	Notional value	112 US real estate investment trust industry	Negatively related to derivatives use
Supanvanij and Strauss (2010)	Vega-to-Delta	Notional value	198 US nonfinancial firms	Negatively related to derivatives use

Risk-taking incentives induced by stock option compensation and managerial choices

Authors	Main Risk-taking incentives variable	How derivatives are measured	Sample (size & Country)	Finding
Chen, Steiner, and Whyte (2006)	Value of stock options	-	591 US financial firms (banks)	Positively related to firm's risk measures
Coles, Daniel and Naveen (2006)	Vega	-	10,687 US nonfinancial firms	Positively related to firm's risky policy
Acrey, McCumber, and Nguyen (2011)	value of stock options	-	84 US financial firms (banks)	Positively relted to bank default risk and risky activities
Hagendorff and Vallascas (2011)	Vega	-	172 US financial firms (banks)	Positively related to risky investment choices (M&A)
Bai and Elyasiani (2013)	Vega	-	132 US financial firms (banks)	Positively related to firm's risky policies

Appendix B: Summary of the empirical literature (derivatives use and firm's risk)

Derivatives use and firms' risk			
Authors	**Dependent variable**	**Finding**	**Sample (size & Country)**
Guay (1999a)	Firm's risk	Negatively related to derivative use	254 US nonfinancial firms
Allayannis and Ofek (2001)	Firm's foreign exchange-rate exposure	Negatively related to derivatives use	378 US nonfinancial firms
Hentschel and Kothari (2001)	Firm's risk	Insignificant affect of derivatives usage on firm's risk	425 US firms from various industries
Faulkender (2005)	Firm-specific interest rate exposure	Positively related to derivatives use	133 US chemical firms
Géczy, Minton, and Schrand (2007)	Managerial risk taking incentive	Positively related to derivatives use in speculating firms	341 US nonfinancial firms
Adam and Guettler (2010)	Firm's risk	Positively related to derivatives use	100 US mutual fund industry
Bartram, Brown and Conrad (2011)	Firm's risk	Negatively related to derivative use	6888 nonfinancial from 47 countries
Nijskens and Wagner (2011)	Firm's risk	Positively related to CDS use	38 financial firms from various countries (banks)
Rossi (2011)	Foreign exchange exposure	Positively related to derivatives use	200 Brazilian nonfinancial firms
Fung, Wen, and Zhang (2012)	Firm's risk	Positively related to derivatives use	191 US financial firms (Insurance)

Appendix C: the complete list of the banks in the sample:

Classified as CDS user and CDS non-user, and their market capitalisation

CDS users	market capitalisation (£m)	Symbol	Country	CDS non-users	market capitalisation (£m)	Symbol	Country
Intesa Sanpaolo SpA	28,398	I:ISP	Italy	Banca Popolare di Milano	1,965	I:PMI	Italy
Mediobanca di credito	6,424	I:MB	Italy	Banco Popular Espanol SA	7,259	E:POP	Spain
Banco Popolare	3,672	I:BP	Italy	Banco Sabadell	5,002	E:BSAB	Spain
Banca Monte dei Paschi	5,871	I: BMPS	Italy	Bankinter	2,642	E:BKT	Spain
Banca Popolare Romagna	2,337	I:BPE	Italy	Bank of Valletta	578	MT:BOV	Malta
Banco Santander SA	60,453	E:SCH	Spain	FIMBAnk	92	MT:FIM	Malta
BBVA	36,668	E:BBVA	Spain	Lombard	89	MT:LOM	Malta
Commerzbank	7,921	D:CBK	Germany	BRE bank	2,089	PO:BRE	Poland
Deutsche Bank AG	5,080	D:DBK	Germany	Bank Pekao SA	8,788	PO:PKA	Poland
Deutsche bank	27,813	D:DPB	Germany	Bank Handlowy	2,069	PO:PHY	Poland
BNP Paribas	44,355	F:BNP	France	Nova Kreditna banka	313	SV:NOE	Slovenia
Credit Agricole SA	21,963	F:CRDA	France	Abanka Vipa dd	276	SV:ABV	Slovenia
Societe Generale	27,181	F:SGE	France	Probanka	9	SV:PPI	Slovenia
Natixis	9,275	F:KN@F	France	BRD Group	2,170	RM:BRD	Romania
Banco Comercial Portugues	4,157	P:BCP	Portugal	Banca Transilvania SA	623	RM:TLV	Romania
Banco Espirito Santo	3,766	P:BES	Portugal	CB First Investment Bank	171	BL:CBF	Bulgaria
BPI	1,784	P:BPI	Portugal	Corporate Commercial Bank	187	BL:CBO	Bulgaria
Banif financial group	521	P:BNF	Portugal	CB Central Cooperative Bank	112	BL:CBC	Bulgaria
Marfin popular Bank Public	1,949	CP:CPB	Cyprus	Bank Of Cyprus Public	2,608	CP:BCH	Cyprus
Sydbank	1,160	DK:SYD	Denmark	Siauliu Bankas AB	60	LT:SUB	Lithuania
Danske Bank	10,550	DK:DAB	Denmark	Ukio Bankas AB	80	LT:UKI	Lithuania
KBC	12,629	B:KB	Belgium	FHB Mortgage Bank	217	HN:FHB	Hungary
Dexia	7,667	B:DEX	Belgium	OTP Bank	4,731	SK:INV	Hungary
Nordea	21,433	W:NDA	Sweden	Skandinaviska Enskild	8,486	W:SEA	Sweden
Svenska Handelsbanken AB	10,045	W:SVK	Sweden	Swedbank AB	6,876	W:SWED	Sweden
Erste Group Bank AG	8,856	O:ERS	Austria	Julius Baer Gruppe AG	5,310	S:BAER	Switzerland
Barclays PLC	29,781	BARC	UK	Bank of Ireland	4,113	BKIR	Ireland
Lloyds Banking Group plc	27,417	LLOY	UK	DNB NOR ASA	9,902	N:DNB	Norway
RBS	29,658	RBS	UK	KB Komerční banka	4,411	CZ:KOM	Czech Rep.
Standard Chartered PLC	28,187	STAN	UK				
HSBC	102,293	HSBA	UK				

Appendix D. Variables calculation

D1) Calculating the incentives effects of stock options

In this paper, Core and Guay's (2002) is used method to measure CEO incentives to increase risk (vega) and to increase share prices (delta).The calculation formula for both vega and delta are expressed in Equations (1) and (2) below.

$$Vega = \frac{\partial value}{\partial \sigma} \times 0.01 = e^{-dT} N^{\cdot}\ (Z) s\sqrt{T} \times 0.01 \qquad \text{Eqs. (1)}$$

$$Delta = \frac{\partial value}{\partial S} \times \frac{S}{100} = e^{-dT} \times N(Z)\ \frac{S}{100} \qquad \text{Eqs. (2)}$$

$$\text{Where } Z = \frac{\ln(S/X) + (rf - d + 0.5\sigma^2)T}{\sigma\sqrt{T}}$$

N=	is the cumulative probability function for the normal distribution
S=	is the price of the underlying stock at the valuation date
X=	is the exercise price of the option
σ =	is the expected annual stock return volatility
R=	is the annual risk free interest rate

D2) Distance to default calculation

$$DD_t = \frac{\ln(V_{A;t} / L_t) + (rf - 0.5\sigma^2{}_{A;t})T}{\sigma_{A;t}\sqrt{T}}$$

$$\text{Where} \quad \sigma_{A;t} = \sigma_{E,t} V_{E,t} / (V_{E,t} + L_t)$$

$V_{A,t}$	is the market value of assets
L_t	is the book value of total liabilities
rf	is the risk-free rate
$\sigma_{A,t}$	is the annualised asset volatility at t
T	is the time to maturity
σ_E	the historical volatility of equity

Appendix E: Sub-sampling

First sample	1. Full sample 2. Control variables	-	The results are shown in the table under (Column 1)
Second sample	1. Full sample 2. Control variables 3. Dummy variable	Dummy = 1 if the country has more than 3 banks, 0 otherwise.	The results are shown in the table under (Column 2)
Third sample	1. Full sample 2. Control variables 3. Dummy variable.	Dummy variable based on the countries that have the highest number of hedging observations: Germany, Italy, Spain, Denmark, France, Portugal, and Others. Dummy = 1 if the bank operates in one of these countries, 0 otherwise.	The results are shown in the table under (Column 3)
Fourth sample	1. Full sample 2. Control variable 3. Dummy variable	Dummy based on the number of banks operating in each country (dummy = 1 if the bank operates in one of the following countries: UK, France, Italy, Portugal, Spain and Sweden, 0 otherwise)	The results are shown in the table under (Column 4)

Appendix F: Robustness checks for CDS model and firm risk model (trading)

The results of CDS for trading models and firm risk models when using different independent variables: stock options value, vega (controlling for delta), and firm risk (controlling for delta)

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A	The dependent variable is CDS for trading The independent variable is the value of stock option					
Tobit	0.287***	0.101*	0.170***	0.137***	0.278***	0.102*
	(0.000)	(0.071)	(0.001)	(0.008)	(0.000)	(0.070)
Probit	0.082***	0.104***	0.183***	0.179***	0.115***	0.063*
	(0.007)	(0.003)	(0.002)	(0.004)	(0.002)	(0.081)
Random effects	0.141***	0.136***	-	-	0.117***	0.077**
	(0.000)	(0.000)	-	-	(0.001)	(0.020)
Panel B	The dependent variable is CDS for trading The independent variable is vega (controlling for delta)					
Tobit	0.231***	0.182***	0.104*	0.116**	0.264***	-0.172**
	(0.004)	(0.003)	(0.067)	(0.021)	(0.001)	(0.029)
Probit	0.081**	0.089**	0.113*	0.126**	0.115***	0.151**
	(0.011)	(0.046)	(0.083)	(0.037)	(0.002)	(0.011)
Random effects	0.111***	0.112***	-	-	0.137***	0.075***
	(0.005)	(0.003)	-	-	(0.000)	(0.036)
Panel C	The dependent variable is firm risk The independent variable is CDS use for trading (controlling for delta)					
Distance to default (OLS)	-0.267***	-0.229**	-0.266	-0.670**	-0.186*	-0.307***
	(0.003)	(0.012)	(0.312)	(0.020)	(0.070)	(0.003)
Beta (OLS)	0.036***	0.028***	-0.003	-0.029	0.026**	0.024**
	(0.000)	(0.006)	(0.914)	(0.278)	(0.021)	(0.033)
Distance to default (random effects)	-0.267***	-0.251***	-	-	-0.315***	-0.307***
	(0.003)	(0.006)	-	-	(0.001)	(0.003)
Beta (random effects)	0.036***	0.033***	-	-	0.026**	0.031***
	(0.000)	(0.001)	-	-	(0.020)	(0.005)

Appendix G: Robustness checks for CDS model and firm risk model (hedging)

The results of CDS for hedging models and firm risk models when using different independent variables: stock options value, vega (controlling for delta), and firm risk (controlling for delta)

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A	The dependent variable is CDS for hedging The independent variable is the value of stock option					
Tobit	0.026	-0.12	0.083	0.104	-0.003	-0.010
	(0.737)	(0.886)	(0.374)	(0.298)	(0.961)	(0.904)
Probit	-0.007	-0.007	0.034	0.035	-0.063	-0.022
	(0.812)	(0.834)	(0.764)	(0.758)	(0.217)	(0.543)
Random effects	0.012	0.012	-	-	0.013	0.020
	(0.459)	(0.449)	-	-	(0.392)	(0.230)
Panel B	The dependent variable is CDS for hedging The independent variable is vega (controlling for delta)					
Tobit	-0.079	-0.101	0.127	0.130	-0.066	-0.055
	(0.339)	(0.232)	(0.138)	(0.139)	(0.368)	(0.541)
Probit	-0.045	-0.054	0.107	0.114	-0.152*	-0.053
	(0.197)	(0.131)	(0.324)	(0.313)	(0.031)	(0.237)
Random effects	0.0104	-0.011	-	-	-0.008	0.007
	(0.459)	(0.519)	-	-	(0.960)	(0.697)
Panel C	The dependent variable is firm risk The independent variable is CDS use for hedging (controlling for delta)					
Distance to default (OLS)	-0.105	-0.172	0.087	-0.236	-0.150	-0.073
	(0.606)	(0.349)	(0.855)	(0.687)	(0.130)	(0.727)
Beta (OLS)	0.048**	0.050**	0.093*	0.140**	0.050**	0.047**
	(0.029)	(0.024)	(0.054)	(0.010)	(0.025)	(0.035)
Distance to default (random effects)	-0.105	-0.065	-	-	-0.257	-0.073
	(0.606)	(0.749)	-	-	(0.189)	(0.727)
Beta (random effects)	0.042**	0.044**	-	-	0.042*	0.038*
	(0.048)	(0.043)	-	-	(0.060)	(0.068)