Corporate derivative use and executive compensation under IFRS

Abstract

Past accounting scandals illustrated the destructive impact of improperly managed derivative portfolios. This thesis examines the possible influence of executive compensation plans on corporate derivative use among European firms. As derivatives are mainly used for risk management purposes, the research question investigates if firms' risk management strategies are affected by CEO compensation plans. For short-term compensation plans, I find that CEO cash bonus payments negatively affect the likelihood for firms to use derivatives. This finding is consistent with theory predicting a negative association because of the convex structure of cash bonus payments. Furthermore, the importance of risk management strategies is examined by analysing quantitative disclosure requirements related to risk exposures. By comparing the impact of changes in risk exposures to net income and equity, I find that the impact is small for observations between the first and third quartiles and large in most cases for observations closer to the extreme values, indicating that changes in risk exposures can have major consequences. In practice, the results indicate that the effects on risk management are significant and should advise firms to be careful in deciding on the composition of compensation plans for their key executives.

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1. Introduction

The purpose of this thesis is to examine firm’s risk management by analysing the relation between corporate derivative use and executive compensation. More specifically, this master thesis investigates the composition of CEO compensation and its influence on firm’s use of derivatives to manage risks under the International Financial Reporting Standards (IFRS). The following research question will be answered:

RQ: Does the composition of executive compensation affect firm’s risk management under IFRS?

Because past accounting scandals highlighted the misalignment between managers’ incentives driven by compensation plans and derivative use, like the Enron scandal and more recently the Vestia case in the Netherlands, it is important to investigate this association and to provide an answer to the research question. While previous research examined the relation between derivative usage and firm value, and the influences of agency costs and monitoring problems on this association (Fauver and Naranjo, 2010), there is little research about the direct influence of agency problems on corporate derivative use, especially those that arise from the composition of executive compensation. The theory of importance here relates to the convexity of certain compensation plans. Theory describes that highly convex compensation structures can induce more risk-seeking behaviour. This can influence corporate risk management decisions as risk-seeking behaviour is expected to negatively affect hedging activities (Smith & Stulz, 1985). Furthermore, a study by Supanvanij and Strauss (2010) which did examine the association between derivative use and the composition of CEO compensation was limited to US firms reporting hedging activities under Statements of Financial Accounting Standards No. 133 (FAS 133). For European companies, this area of accounting research is relatively unexplored. There are also differences between the relatively rules-based approach under FAS 133 compared to the more principles-based approach under IAS 39 and the upcoming IFRS 9 standard, which aims to provide useful information about risk management activities to reflect more accurately how an entity manages its risk (IFRS Foundation, 2014). Because of this, conducting research about the use of derivatives to manage risks among European firms and how this is affected by possible agency costs related to executive compensation creates an interesting setting.

Because of the current strict rules related to hedging activities under IAS 39, not all derivatives that are used to manage risks qualify for hedge accounting. In practice, this means that firms not always apply hedge accounting when derivatives are used to manage risks. Because of this, instead of focusing solely on hedging activities, this thesis examines the use of derivatives to manage different categories of risks. While currently no databases exist that contain data about derivative use for European firms, these firms do disclose detailed information about their financial instruments and risk management. Therefore, data about derivative use is hand-collected for a sample of non-financial firms. To measure corporate derivative use, binary variables are used indicating derivative use for firms that are exposed to certain risks. Data about executive compensation like CEO base salary and short-term cash bonus payments is accessible through common databases. I examine the influence of executive compensation on corporate derivative use by running regressions using CEO base salary and short-term cash bonus payments as independent variables and certain firm aspects as control variables. I run additional regressions using lagged variables for executive compensation data and firm aspects to control for the possibility of endogeneity or simultaneity problems. These problems relate to situations in which compensation plans are structured based on derivative use policies, or when firms' compensation plans and derivative portfolios are jointly determined. Furthermore, the impact of risk exposures on the firm is examined. This is done in order to test the importance of possible effects like CEO compensation and firm aspects on risk management strategies. The impact of risk exposures is examined by comparing quantitative disclosure information on changes in risk exposures, as required by IFRS 7, to firms' net income and equity.

For firms that are exposed to interest rate and commodity price risk, I find that CEO bonus payments are significantly associated with corporate derivative use. For these risks, an increase in CEO bonus payments is negatively associated with derivative use for the sample of European firms. These findings remain unchanged when additional regressions are ran using lagged variables to control for possible simultaneity concerns related to executive compensation plans and firm aspects. Regarding CEO base salary, I find no significant evidence for a possible influence on corporate derivative use for any of the risks that firms can hedge through the use of derivatives. As for the impact of risk exposures, I find that the impact on net income and equity for changes in risk exposures are minimal for observations between the first and third quartiles in the sample. However, in most cases the impact increases for observations closer to the extreme values, up to high ratio values. This indicates that for the corresponding firms, changes in risk exposures can have major consequences on the firm and highlights the importance of risk management strategies.

Considering the research question, the composition of executive compensation matters as CEO bonus payments are negatively associated with derivative use. This negative association affects firm's risk management as derivatives are widely used to hedge various risks that firms can be exposed to. In practice, this means that firms should be careful in deciding on the composition of compensation plans for their key executives.

This thesis tries to contribute to the current literature by being one of the first to examine the potential influence of executive compensation plans on firm's hedging policies for a sample of non-U.S. firms. By examining a sample of European firms in this regard, existing theories that were originally developed and tested for U.S. firms like executive compensation described by Smith and Stulz (1985) and the underinvestment problem described by Froot et al. (1993), are now tested for firms that report under a different set of rules.

The scope of this thesis is limited to short-term cash payments to the CEO like base salary and bonus payments. Other interesting aspects of executive compensation plans like long-term incentive plans, options and share payments are not included because current databases lack information about executive compensation for European firms. In addition, the sample is limited to 190 non-financial firms with data for two fiscal years, mainly because hand-collecting data on derivatives and risk management is time-consuming.

2. Theoretical background

2.1 Accounting for derivatives

This section explains the basic concepts and regulations related to derivatives and how derivatives can be used as hedging instruments to manage risks. Derivatives are financial instruments that derive their value from the value of an underlying entity. To further illustrate the concept of a derivative, financial instruments are explained first. IAS 32 (1995, p.2) provides the definition of a financial instrument as “any contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity.” Financial assets relate to cash, equity instruments of another firm or contracts and contractual rights with other firms. Financial liabilities are described as contracts and contractual obligations with other firms (IASC, 1995). According to IAS 39, a financial instrument is recognized as a derivative if it meets the following three requirements:

1. The value of the financial instrument changes according to changes in a specified rate like interest rate, foreign exchange rate or commodity price.
2. The initial net investment of the financial instrument is much smaller or not required at all, compared to other contracts that have a similar response to changes in market factors.
3. The financial instrument is settled at a future date.

Examples of derivatives include forwards, futures, options and swaps. The three characteristics create multiple incentives to use derivatives. The most common motivation is to manage risks by using derivatives as hedging instruments. This is done by entering into derivative contracts for which the value of the instrument is expected to move in a certain direction, while the value of the underlying entity is expected to move in the opposite direction. This way, the risk of a value change in the underlying entity is cancelled out and therefore hedged. The term underlying entity is very broad and can relate to an asset, commodity or interest rate. Derivatives used for this purpose may qualify for hedge accounting, which offers certain benefits. Hedge accounting offers a separate set of rules within IAS 39, which will be explained later. Derivatives can also be used for speculation purposes. This is done by buying or selling derivative contracts to speculate on the future price of the underlying entity. For example, stock options can be used to buy or sell a certain amount of shares in the future at a predetermined price. Once the investor decides to exercise the options, gains or losses are realized because of differences between the predetermined and actual price.

The current accounting rules under IFRS for financial instruments and derivatives are described in IAS 39. Financial instruments are classified in different categories. Regarding financial assets, this includes the following categories: fair value through profit or loss; held-to-maturity; loans and receivables; and available-for-sale. For financial liabilities, this includes the categories fair value through profit or loss; and other financial liabilities. Figure 1 provides more details on what type of financial instrument is recognised for each category. According to IAS 39, financial instruments are measured at fair value except those belonging to the following categories: held-to-maturity; loans and receivables; and other financial liabilities, which are measured at amortised cost using the effective interest method.

Figure 1: Recognition and measurement of financial instruments under IFRS

Financial instruments					
Financial assets				Financial liabilities	
Fair value through profit or loss (measured at fair value)	**Held-to-maturity** (measured at amortised cost using the effective interest method)	**Loans and receivables (**measured at amortised cost using the effective interest method)	**Available-for-sale** (measured at fair value)	**Fair value through profit or loss** (measured at fair value)	**Other financial liabilities** (measured at amortised cost using the effective interest method)
Includes financial assets held for trading; derivatives not qualifying for hedge accounting and other financial assets designated by the entity as at fair value through profit or loss (specific rules).	Includes non-derivative financial assets with fixed or determinable payments and fixed maturity that the entity has the positive intent and ability to hold to maturity.	Includes non-derivative financial assets with fixed or determinable payments that are not quoted in an active market.	Includes non-derivative financial assets that are designated as available-for-sale and other financial assets not qualifying for the other categories of financial assets.	Includes financial liabilities held for trading; derivatives not qualifying for hedge accounting and other financial liabilities designated by the entity as at fair value through profit or loss (specific rules).	Includes all other financial liabilities measured at amortised cost using the effective interest method.

Figure 1 shows recognition and measurement categories for financial instruments according to IAS 39.

Regarding derivatives, all derivatives that do not qualify for hedge accounting are recognised at fair value through the income statement. This means that gains and losses on these instruments are directly recognised as profit or loss. This can be problematic when derivatives are used as hedging instruments to offset value changes in hedged items, as it leads to mismatching.

For firms that hold multiple derivatives, this means that changes in the fair value can lead to significant fluctuations in profit or loss for the maturity of those instruments. Hedge accounting as described in IAS 39 offers a solution to this problem by improving matching between the cash in- and outflows of the hedging instrument and the hedged item. The application of hedge accounting under IAS 39 is optional, which means that firms are free to choose to apply hedge accounting or not. This is true even for firms that manage risks using derivatives that meet all the additional requirements to apply hedge accounting. For derivatives to qualify for hedge accounting, the following criteria should be met (IASC, 1999):

1. There is a formal designation and documentation at the inception of the hedge. The documentation should consist of information about the hedging instrument, the hedged item, the nature of the risk being hedged and how the entity will assess the effectiveness of the hedging instrument. Effectiveness refers to the ability of the hedging instrument to offset fair value or cash flow changes in the hedged item.
2. This effectiveness rating is expected to fall within the range of 80-125%. This means that cash flow or fair value changes of the hedging instrument fall within the 80-125% range compared to changes of the hedged item. For example, if there is a loss of 50 in the fair value of a hedged item while the related hedging instrument realizes a gain of 55, the effectiveness of the hedge can be computed as: 55/50, which is 110%. In this example, the hedge is considered effective.
3. The effectiveness can be reliably measured: both changes in the value of the hedged item and instrument can be reliably measured.
4. For cash flow hedges, forecast transactions designated as hedged items are expected to occur with a high probability and are expected to present an exposure to variations in cash flows that could affect profit or loss.
5. For the reporting periods that the hedge was designated, the hedge has been assessed on an ongoing basis and determined to be highly effective.

IAS 39 describes three different types of hedges that fall under hedge accounting rules: cash flow hedges, fair value hedges and hedges of net investment of foreign operations. Cash flow hedges cover the exposure of fluctuations in cash flows related to assets or liabilities recognised by the firm and fluctuations in the cash flows of highly probable forecast transactions that could affect profit or loss. Fair value hedges cover the exposure of fair value changes of assets and liabilities recognised by the firm and certain firm commitments. Hedges of net investment of foreign operations cover the currency risk of foreign investments.

The main benefit of applying hedge accounting is to solve matching problems between the hedging instrument and hedged item. For cash flow hedges, this effectively means that a gain or loss on the hedging instrument is initially recognised in other comprehensive income, before it affects profit or loss. A hedging reserve is formed in equity, which will be 'recycled' to profit or loss in the same reporting period during which the hedged item affects profit or loss. This way, fair value changes in both the hedging instrument and hedged item are matched to affect profit or loss during the same reporting period. The accounting for hedges of net investment in foreign operations is similar to that of cash flow hedges. For fair value hedges, the procedure is slightly different because of the nature of the hedged items, while the objective is the same. Gains or losses on the hedging instrument are recognised directly in profit or loss. At the same time, the value of the hedged item is adjusted for the corresponding amount and also recognised directly in profit or loss. The difference from cash flow hedging is that fair value hedging match and account for changes in the value of both hedging instruments and hedged items directly.

The IASB received many complaints about IAS 39 being too complicated to apply and understand. After several amendments to IAS 39 to try and provide more clarity on the standard, the IASB announced the development of a new standard on financial instruments and hedge accounting. The goal of this new standard, IFRS 9, is to provide a new set of less complex rules with a more principles-based character compared to IAS 39 (IFRS Foundation, 2014). IFRS 9 was completed in July 2014. The mandatory effective date is set to 1 January 2018. Until then, firms are free to choose between IAS 39 and IFRS 9 (IASB, 2014).

Different approaches under IFRS 9 that are expected to lead to improvements over IAS 39 include (IASB, 2014):

- A new measurement approach for financial assets which should make classification much easier. The four categories for financial assets under IAS 39 will be replaced by a new approach in which financial assets are classified based on the entity's business model and cash flow characteristics.
- A new, forward-looking impairment model that applies to all financial instruments instead of multiple impairment models under IAS 39.

- Improvements to hedge accounting rules. This includes a broader application of hedge accounting for risk management activities. For example, IFRS 9 allows hedged items to be components of non-financial items, which is not allowed under IAS 39. This will assist non-financial firms in particular, for example airlines that wish to hedge the oil price component of jet fuel.
- Different approach in testing hedge effectiveness. IFRS 9 adopts more principles-based criteria in testing hedge effectiveness compared to the effectiveness rating of 80-125% under IAS 39.

2.2 Disclosure requirements related to risk management

As stated in the previous section, derivatives can be used to manage a variety of risks that firms can be exposed to. According to disclosure rules of IFRS 7, firms are required to report additional qualitative and quantitative information on their related risks and how these risks are managed. The risks that are described include credit risk, liquidity risk and market risk. Credit risk relates to the risk that one of the two firms in a contract of a financial instrument causes a loss on the other firm by failing to make the required payments. Liquidity risk is the risk that a firm encounters difficulty in making the required payments related to financial liabilities. Market risk includes different risks related to fluctuations in the fair value or future cash flows of financial instruments because of market price changes (IFRS Foundation, 2007). Market risk[1] can be divided into (1) currency risk, relating to fluctuations in foreign exchange rates, (2) interest rate risk, relating to fluctuations in interest rates, and (3) other price risk, relating to fluctuations in commodity market prices.

For these risks, the qualitative information that firms are required to provide includes a detailed plan on the risk exposure and all objectives, policies and processes used in managing the risks. Quantitative information provides numerical information about the extent to which the firm is exposed at the end of the fiscal year. In addition, specific quantitative information is required for each type of risk. The most relevant quantitative disclosure requirements for derivatives include maturity analyses for derivative financial liabilities related to liquidity risk, and sensitivity analyses related to the three risk components of market risk. A sensitivity analysis simulates the effects on profit or loss and equity for changes in the relevant risk. IFRS 7 provides extensive guidance on the application of sensitivity analyses, including the option of aggregating information, possible changes in the relevant risk to be considered for

[1] For the scope of this thesis, the focus will be on the three components of market risk, as these risk components are most frequently managed using derivatives.

the analysis and the time frame to be used in making the assessment (IFRS Foundation, 2007). However, instead of using sensitivity analyses, it is stated that firms can opt for a value-at-risk (VaR) approach in providing quantitative information. This includes the use of mathematical models like Monte Carlo simulations, given that firms provide details on how the model works and its main assumptions on assessing the possible effects on profit or loss for changes in the relevant risk. These assumptions should state the time frame and confidence interval used. Different sections within IFRS 7 provide disclosure rules on risk exposures managed by derivatives that are used for hedge accounting. For these hedge accounting activities, firms are required to disclose information on the following three aspects (IFRS Foundation, 2007):

1. Information on the risk management strategy and how it is applied to manage risks. This includes details on how the relevant risks arise, the extent of exposures related to these risks and an explanation on how the firm manages the risks.
2. Information on the possible effects of hedging activities on future cash flows of the firm. This relates to quantitative aspects about future cash flows like the amount, timing and uncertainty.
3. All amounts related to hedging activities and the effects on profit or loss and equity. This includes carrying amounts like the fair values of hedging instruments, nominal amounts, amounts related hedge ineffectiveness and gains or losses from hedging instruments recognised in other comprehensive income.

In short, IFRS 7 provides an extensive set of rules about the disclosure of financial instruments. Firms are required to report detailed quantitative and qualitative information about the use of derivatives like sensitivity analyses or value-at-risk models. For firms that apply hedge accounting, additional information is required on hedging activities like specific details on managing risk exposures.

2.3 Derivative use and firm value

This section moves on from the rulesets related to derivatives and discusses existing literature on corporate derivative use, starting off with the incentives to use derivatives. Prior literature suggests a wide variety of incentives for firms to use derivative instruments. Among other factors this includes the use of derivatives because of cash flow management, taxes, bankruptcy costs, asymmetric information, moral hazard and economies of scale (Froot et al., 1993; Stulz, 1996; Mello and Parsons, 2000; Berkman et al., 2002). Because of these factors, derivative usage is believed to increase firm value. This association is tested by multiple papers. For a sample of large non-financial firms, Allayannis and Weston (2001) examine the effects of the use of foreign currency derivatives on firm market value. In this paper, firms' use of foreign currency derivatives is found to be positively associated with Tobin's Q, which is the proxy used to measure firm value. The result that the use of currency derivatives increase firm value is also tested for reverse causation. Allayannis and Weston (2001) argue that it could also be the case that the incentives to use derivatives are greater for firms with higher growth opportunities. Testing this statement using time-series analysis indicates that there is no threat of reverse causation. Consistent with the findings of Allayannis and Weston (2001), Belghitar et al. (2008) examine this association using a sample of U.K. firms. For these firms, the relation between the use of foreign currency and interest rate derivatives and firm value is even stronger. This difference could be due to biases in U.S. samples or differences in the bankruptcy rulesets between the U.S. and U.K., leading to increased financial distress costs for U.K. firms (Belghitar et al., 2008).

Other studies report positive valuation effects for firms using interest rate and foreign exchange derivatives (Bartram et al., 2009) and commodity price derivatives (Carter et al., 2006). Bartram et al. (2009) differ from the majority of the related literature by using a large sample of global data of non-financial firms. They find evidence for alternative explanations on why firms use derivatives. Carter et al. (2006) specifically investigate the use of commodity derivatives in the U.S. airline industry. For this industry, they find evidence that the use of jet fuel derivatives is positively associated with airline firm value. The added value of hedging fuel price risk is comparable to the findings of Allayannis and Weston (2001), and for some firms even greater than that. The added value to the firm from hedging is explained as giving airlines more ability to invest in times when fuel prices are high. Other industry specific studies include the work of Adam and Fernando (2006), who investigate the U.S. gold mining industry. For a sample of North American firms active in this industry, they find evidence for significant economically cash flow gains from transactions in derivative instruments, leading to increases in shareholder value.

More studies report on the relation between the use of derivative instruments and firm value when derivatives are being used as hedging instruments. By using derivatives to hedge risks, firms reduce the volatility of cash flows which would otherwise make it impossible for those firms to invest in valuable growth opportunities (Géczy et al., 1997). Hedging risks also grants firms the ability to enhance firm value through the increase of debt capacity from the use of financial instruments (Graham and Rogers, 2002). Prior research also measured investor reaction to the use of derivatives. Investors believe that managers who use derivatives show a higher level of decision-making care compared to managers who do not use derivatives (Koonce et al., 2007). This leads to investors assigning a higher firm value and therefore rewarding firms who use derivatives. Based on these findings it can therefore be argued that derivative usage has a positive impact on firm value.

However, in contrast to these positive valuation effects, other studies report either no valuation effects or conditional negative valuation effects associated with the use of derivatives. For a sample of large non-financial firms, Guay and Kothari (2003) examine the magnitude of market risk exposures. They simulate shocks to interest rate, foreign exchange rate and commodity prices to investigate the potential impact of changes in the value of derivative portfolios relative to firm size. To simulate these shocks, they assume low probability changes equal to three standard deviations. They find that changes in the value of interest rate, foreign exchange rate and commodity derivatives caused by these shocks lead to modest changes in the value of firm's derivative portfolio relative to the overall firm size. This finding suggests a need to carefully interpret existing empirical evidence about the importance of firm's derivative use. In particular studies that report positive valuation effects but do not take into account the size of firms' derivative portfolios to create those valuation effects. In this regard the authors refer to the findings of Allayannis and Weston (2001) and Graham and Rogers (2002), as these studies measure derivative use in general among the sample instead of examining the size of derivative portfolios. The same could be true for other studies in later years that examine valuation effects like Belghitar et al. (2008), who report results which are in line with Allayannis and Weston (2001).
Other studies examine the relation between derivative usage and firm value in the presence of agency costs and monitoring problems. For example, Tufano (1998) studied the effects of agency problems between managers and shareholders and the impact on overall shareholder wealth in cases when derivatives are used for cash-flow hedging. The underlying theory in this paper is that firms use cash-flow hedging strategies to set their internal cash flows equal to their investment needs, thereby avoiding the deadweight costs related to external financing (Tufano, 1998). This mechanism allows managers to avoid being forced to turn to expensive external financing like capital markets for financing. While this looks like an efficiency enhancing strategy at first sight, Tufano (1998) argues that this mechanism may reduce shareholder value as it also removes the discipline that capital markets would have imposed on the managers, had they gone for external financing instead. Avoiding capital market restrictions allows managers to allocate resources improperly and inefficiently, like pursuing

negative-NPV projects to enjoy certain private benefits, thereby introducing the risk that this mechanism will ultimately reduce shareholder value.

Géczy et al. (2007) add to this by examining managers' incentives when derivatives are used for speculation purposes in order to identify characteristics related to firms that use derivatives to speculate. To gather data about derivative speculation as effectively as possible, the authors use survey data to identify firms that speculate. Among the findings are monitoring problems for firms that frequently speculate: firms that speculate are associated with weaker governance mechanisms. In addition, by examining executive compensation plans, managers' self-interests are one of the indicators for speculation. Executive compensation plans for speculating firms differ from non-speculating firms; managers at speculating firms increase their short-term cash compensation in cases of profitable speculation.

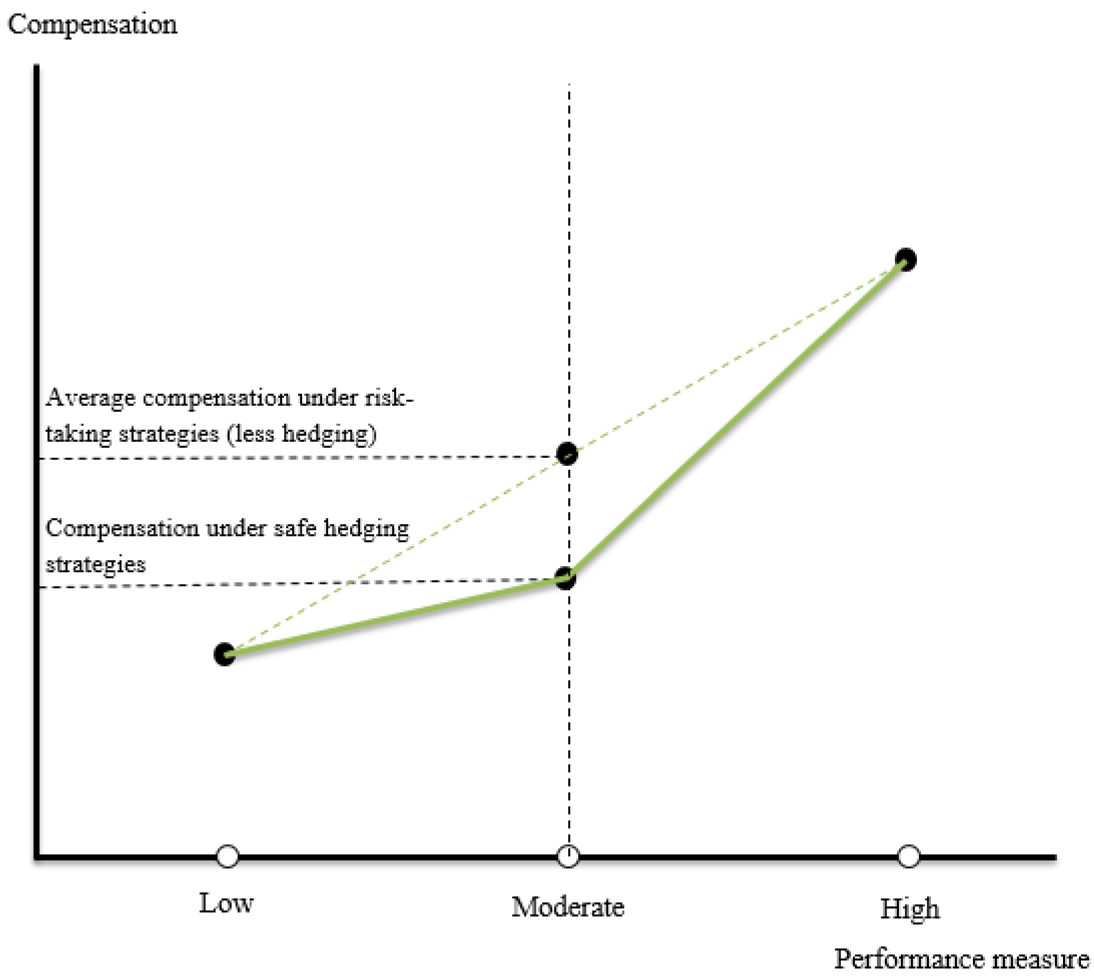
These papers illustrate potential losses of shareholder and firm value in cases of monitoring and agency problems. Fauver and Naranjo (2010) build on this and try to provide more empirical evidence on the relation between derivative use and firm value in the presence of agency costs and monitoring problems. Using a large sample of U.S. non-financial firms, Fauver and Naranjo (2010) find that the negative effects on firm value related to derivative use, are partly driven by factors related to agency costs and monitoring problems. Thus, it should be noted that agency costs and monitoring problems are important factors in determining the effect of derivative use on firm value. Section 2.4 examines this relation further by focusing on the influence of executive compensation on derivative use.

2.4 Executive compensation and derivative use

Relatively few studies document on the influence of executive compensation on corporate derivative use. The first theoretical papers on this relation are provided by Stulz (1984) and Smith and Stulz (1985). Stulz (1984) derives a theoretical model on foreign currency hedging policies of a risk-averse manager. The model assumes that markets are perfect and that the manager tries to maximise his expected utility. Managers are the people in charge to decide on the hedging policies of the firm. Shareholders want to maximise the value of the firm in order to maximise their own wealth and are the ones who choose the compensation plans for the managers. Furthermore, the model assumes managers and shareholders agree on a certain compensation plan for the managers before they decide on the firm's holdings of derivative contracts. The compensation plan is constructed in such a way that shareholders try to maximise their own wealth while choosing an expected pay-off for the managers high enough to induce those managers to work for them (Stulz, 1984). In addition, this compensation plan is composed to correctly align managers' incentives with those of the shareholders. Given the assumption that markets are perfect, shareholders are indifferent about hedging policies regarding foreign currency risk. However, deciding not to hedge may lead to an increased volatility of the value of the firm, as the firm will be exposed to foreign currency fluctuations. As managers are assumed to be risk-averse, with their compensation plans tied to firm value, they will hedge currency risks to try to reduce firm value fluctuations (Stulz, 1984). Because of this theory, Stulz (1984) concludes that value-maximizing firms pursue active hedging policies. Smith and Stulz (1985) build on this theory and examine how compensation plans affect risk-averse manager's behaviour regarding hedging policies. By taking into account manager's utility function, shareholders can affect manager's hedging policies through the design of compensation plans. To illustrate this, assume different cases in which a risk-averse manager behaves according to an expected utility function which is a concave, linear and convex function of the value of the firm. In each of these cases the manager is assumed to be risk-averse, which means he or she will only choose to bear more risk if the change in expected income is higher than the extra amount of risk taken. In case of an expected utility function which is a concave function of the value of the firm, the manager does not want to bear any (additional) risk and decides to hedge the firm completely, in order to maximize his or her expected income (Smith and Stulz, 1985). This partly holds for risk-averse managers who receive linear compensation plans, like payment in stock shares. In this case, the manager is expected to hedge less than in the first case, but will still try to maximize his or her expected income by hedging most risks. For compensation plans with a convex function, the manager is expected to take more risks, even though he or she is risk-averse. As Smith and Stulz (1985) describe, the manager will take more risk by hedging less than in previous cases. What these cases try to illustrate, is a theoretical motivation how managers can be affected by their compensation plans in taking risk management decisions. By hedging less, the manager increases his or her expected income because convex compensation plans increase the additional expected income for the additional amount of risk taken.

According to this motivation, Smith and Stulz (1985) predict that managers who receive relatively more options in their compensation plans, are expected to hedge less. This relation is also predicted for cash bonus payments that depend on accounting earnings to meet or beat certain targets. As these payments can assume a convex function of accounting earnings, managers are expected to behave less risk-averse and therefore hedge less (Smith and Stulz, 1985). In contrast to these kind of payments, share payments and significant share ownership of the manager should positively affect the use of derivatives for hedging purposes, as the manager's end-of-period wealth will be more a linear function of the value of the firm (Smith and Stulz, 1985). For options and cash bonus payments, potentially increasing earnings by increased risk-taking pays off for the manager, which is illustrated in Figure 2. This figure is based on the works of LeRoy (2010), who discuss convex compensation plans in relation to investment strategies. In this figure, the manager receives compensation based on a performance measure, for example firm earnings. The structure of this compensation plan is convex because the additional amount of compensation increases in the performance measure: the additional amount of compensation is higher when earnings increase from moderate to high, compared to when earnings increase from low to moderate. If the manager decides to safely hedge and not take excessive risks, the firm will generate steady moderate earnings over time. In this case, the manager will realize personal compensation equal to the level of compensation under safe hedging strategies as shown in the figure.

Figure 2: Convex compensation and firm performance



On the other hand, the manager can decide to employ more risk-taking strategies by hedging less. This increases the volatility of earnings and can potentially increase earnings to a high level, or a low level in case increased risk-taking lead to losses. Either way, the average personal compensation for the manager over time is higher in this case. The convex structure of compensation induces the manager to take risks because the personal pay-offs are higher for a combination of low and high earnings years than for moderate earnings years. However, there are costs related to these risk-taking strategies like costs of financial distress and decreased predictability of earnings. While managers may benefit from risk-taking strategies, stakeholders are the ones that bear the costs. This illustrates the cause of agency problems as convex compensation plans can lead to misalignments between managers' incentives with those of the shareholders of the firm.

Based on the theory of convex payments provided by Smith and Stulz (1985), other studies examine this relation and provide empirical evidence. The work of Tufano (1996) is the first to analyse this relation in a single-industry setting. For a sample of North American gold mining firms between the years 1990 and 1993, Tufano (1996) finds that managers who hold more stock options tend to use less derivative instruments to hedge gold price risk. Managers that hold more shares in the firm tend to use more derivative instruments to hedge gold price risk. These findings are consistent with Smith and Stulz (1985). Other papers investigating the effects of managerial motives on corporate derivative use include Haushalter (2000), Rogers (2002) and Supanvanij and Strauss (2010). For instance, Haushalter (2000) tests the relation between managerial risk aversion and hedging policy for a sample of oil and gas producers between the years 1992 and 1994. To test for managerial risk aversion, the model uses proxies for executive ownership which include the firm's outstanding shares held by officers and directors and the market value of the firm's equity owned by officers and directors. Haushalter (2000) predicts a positive relation between these proxies and the fraction of production hedged, as the incentives for managers to hedge should be increasing in the amount of privately owned firm's equity. The model also includes different variables to measure the effect of options used in manager's compensation plans on derivative usage. For these variables, a negative relation is predicted. According to the results, Haushalter (2000) finds no empirical evidence that the extent of hedging is increasing in the degree of managerial stock ownership, which is inconsistent with the theory about the influence of managerial risk aversion on hedging policy. However, a negative relation is found between the amounts of options used in manager's compensation plans and the fraction of production hedged (Haushalter, 2000). This finding is consistent with the theoretical model provided by Smith and Stulz (1985).

Rogers (2002) contributes to the existing literature about risk management and corporate hedging by examining CEO risk-taking incentives from stock and option holdings, and their influence on the use of derivatives. Consistent with prior literature, a negative relation is found between manager's risk-taking incentives from options and the use of derivatives (Rogers, 2002). Because the sample consists of 850 random firms generated from the population of 10-K filings in the SEC's EDGAR database, the relation is not limited to a single industry unlike Tufano (1996).

Supanvanij and Strauss (2010) focus entirely on the influence of CEO compensation on corporate derivative use and are the first to address the difference between short- and long-term compensation. Analysing the composition of compensation plans is important because it determines whether or not CEO incentives are correctly aligned with shareholders' interests. If this is not the case, CEO's could be encouraged to take more risks and pursue short-term cash flow objectives instead of acting in the shareholders' interests like focusing on long-term objectives. They utilize a model which tests the effects of CEO salary, bonus, exercisable options and owned shares on the use of derivatives. Consistent with prior literature, significant negative relations on the use of derivatives are found for CEO salary, short-term bonus payments and exercisable options, indicating a possible risk for agency problems, while the estimated fraction of shares owned by a CEO is positively related to the use of derivatives (Supanvanij and Strauss, 2010).

3. Hypothesis development

As discussed in the previous section, prior studies show that corporate hedging policies are a determinant of firm value. Shareholders want their firm to pursue projects that lead to the highest possible firm value, yet wrong incentives can induce managers to act in their own interests, thereby creating agency problems. Because of this, it is important to recognize the possible influence of executive compensation plans on hedging policies. Executive compensation is examined by considering annual payments to the CEO like base salary and bonus payments. Related to prior studies discussed in the previous section, a negative influence of short-term payments on derivative use is predicted. Following the theoretical model provided by Smith and Stulz (1985), the convex structure of bonus payments may result in more risk-seeking behaviour by the CEO, negatively impacting corporate derivative use. Supanvanij and Strauss (2010) find evidence that salary payments or short-term payments in general encourage CEOs to pursue short-term cash flow objectives and more easily ignore risks related to long-term objectives, resulting in a negative impact on derivative use. Based on these theoretical arguments, the following hypothesis is presented:

H1: Short-term executive compensation plans lead to fewer hedging activities among firms reporting under IFRS.

Furthermore, this thesis tries to test the impact of risk exposures on the firm. This is done in order to test the importance of the possible effects on risk management strategies as described by H1. By testing the impact on the firm for fluctuations in risk exposures, one can draw conclusions on the importance of policies that firms maintain to manage risk exposures. The underlying theory relates to the findings of Guay and Kothari (2003). Based on the results that simulated changes in market risk components lead to modest changes in the value of derivative portfolios, the authors question the importance of firms' strategies on derivative use. For the scope of this hypothesis, a comparable approach is employed by analysing quantitative disclosure information related to risk exposures, as required by IFRS 7. As firms are required to simulate changes related to market risk components, this information can be used to analyse how firms are affected. The impact of these risk exposures is tested by comparing the effect of fluctuations in the risk exposure to net income and total equity.

In line with this argumentation and the results related to Guay and Kothari (2003), the following hypothesis is presented:

H2: Changes in risk exposures related to market risk, as reported in quantitative disclosures, lead to insignificant changes on firm's net income and equity.

4. Research design

4.1 Sample

To test for the influence of executive compensation on derivative use among European firms, I use a random sample drawn from the Euro Stoxx 600. The original sample consists of a random selection of 190 firms and includes European non-financial listed firms. Of these firms, data is collected for the fiscal years 2012 and 2013. This leads to a total of 379[2] observations in the sample. For the selected firms, data on firm characteristics and executive compensation can be retrieved from Compustat Global and Capital IQ. Because statistical databases lack information about the use of derivatives on European firms, this data part is hand-collected from the firms' financial statements.

Firms report whether derivatives are held for speculative purposes or not. For the total sample of 190 firms, only one firm enters into energy derivatives for speculative purposes. Another firm reports that it may enter in derivative instruments from time to time for speculative purposes. The other 188 firms either specifically state they don't enter in derivative instruments for speculative purposes or they present derivatives they hold as hedging instruments and don't mention a speculative character at all.

Firms present their financial statements in different currencies, varying per country. The majority reports in euro amounts, other currencies include USD, SEK, NOK, GBP, DKK and CHF. All data is converted to total amounts in euro, using 2012 and 2013 year-end conversion rates.

4.2 Regression model

Proxies for short-term executive compensation include base salary (SAL_C) and bonus payments (BON_C) to the CEO of the corresponding firms and fiscal years included in the

[2] For one firm included in the random selection of firms, the financial statements of 2012 contain data related to a period of only 4 months. This observation is dropped.

sample. As described in the 2013 annual report of ISS A/S, which is part of the sample, bonus payments relate to performance-based annual payments and are rewarded to the CEO for achieving performance targets for the firm's key financial KPIs. For the sample of 190 firms, this data is collected through the Capital IQ database. However, Capital IQ does not contain complete data about CEO compensation for all firms. For the remaining part of firms, this data is either unable to collect or it is hand-collected using remuneration and annual reports for the corresponding fiscal years.

To measure the use of derivatives among firms, the following proxies are considered: binary variables which measure (1) interest rate, (2) foreign exchange rate and (3) commodity price risk derivatives and (4) total notional amounts of derivatives. Prior studies examining this relation for samples of U.S. firms mainly use notional amounts of derivatives to measure derivative use. However, for the sample of European firms used in this thesis, not all firms disclose notional amounts of derivatives probably because there are differences in the recognition and disclosure requirements under IFRS 7 compared to FAS 133[3]. The number of observations reduces from 379 to 226 when using the total notional amount of derivatives as a proxy. Because of this, the binary variables are considered as proxies for derivative use instead. To narrow down the possible association between CEO compensation and derivative use, it is important to only include firms that are exposed to one of the risks. No exposure to one of the risks explains why firms don't use derivatives. These firms are meaningless and therefore excluded from the sample. For each regression using one of the binary variables as dependent variable, firms without exposure to that specific risk are excluded.

This leads to the following regression model:

$$DRV_{it} = \alpha_i + \beta_1 SAL\_C_{it} + \beta_2 BON\_C_{it} + \beta_3 CONTROLS + \varepsilon_{it}$$

where:

DRV_{it} = binary variable on the use of interest rate, foreign exchange and commodity price risk derivatives of firm i for year t;

SAL_C_{it} = base salary for the CEO of firm i for year t;

BON_C_{it} = bonus payments to the CEO of firm i for year t;

[3] Under FAS 133, derivative instruments are only recognized if they have a notional value (Financial Accounting Standards Board, 1998). For firms reporting under IAS 39, this is not required.

CONTROLS = control variables included in the regression as explained in section 4.3.
H1 predicts a negative association between DRV_{it} and the variables SAL_C_{it} and BON_C_{it} resulting in negative coefficients β_1 and β_2. The association between DRV_{it} and the control variables are explained in section 4.3. Libby boxes of the regression are displayed in Figure 4 in Appendix A.

4.3 Control variables

Control variables included in the regression are based on prior literature about the use of derivatives and executive compensation. This includes variables to control for the underinvestment problem as described by Froot et al. (1993), the costs of financial distress, profitability, liquidity, firm size and CEO aspects.
The first control variable accounts for the costs of financial distress. Firms with relatively more debt face higher expected costs of financial distress, giving these firms larger incentives to hedge (Smith and Stulz, 1985). Thus, the association between the costs of financial distress and derivative use is predicted to be positive. To measure this variable, the ratio of total long-term debt divided by total assets is used. Similarly, expected costs of financial distress increase for firms with lower profitability, increasing the need to hedge (Rogers, 2002). In addition, the pecking order theory states that firms prefer to finance new projects using internal funds. This implies that highly profitable firms are less likely to use derivatives. Therefore, the association between profitability and derivative use is predicted to be negative. Profitability is controlled for by including the ratio of net income divided by total assets.
The third variable controls for growth opportunities because of the underinvestment problem related to corporate hedging. The underinvestment problem occurs when firms have to give up on certain profitable investment opportunities in situations when internally generated cash flows are low while the costs of external financing are high. Hedging enables these firms to reduce fluctuations in their investment spending and external financing, granting them sufficient internal funds to pursue profitable investments (Froot et al., 1993). Other papers provide empirical evidence and confirm this positive relation (Géczy et al., 1997; Gay and Nam, 1998). Tobin's Q is used as a proxy for growth opportunities, which is described as the market value of assets divided by the book value of assets. The market value of assets is measured using different accounting variables from the Compustat database, and is computed by summing the book value of assets and the market value of common stock minus the book value of common stock and deferred taxes. To calculate the market value of common stock, the amount of common outstanding shares is multiplied by the firm's share price at the end of

the fiscal year. As Compustat is incomplete about share prices of European firms for the sample period, data in this regard is gathered through Yahoo Finance.
Similar to Supanvanij and Strauss (2010), the quick ratio is included to measure firms' liquidity rating. Firms with a relatively high quick ratio are expected to hedge less because it should be easier for these firms to meet their cash flow needs. Therefore, the association between the quick ratio and derivative use is predicted to be negative. This ratio is computed as current assets minus inventories divided by current liabilities.
Furthermore, firm size is included as a control variable. The predicted sign of this variable is unclear as there are multiple theories about the possible effects of firm size on the use of derivatives. Certain theories predict a negative relation because of bankruptcy costs as a motivation for hedging and information asymmetry related to small firms. According to Warner (1977), bankruptcy costs are higher for smaller firms, which are therefore expected to hedge more. In addition, because of greater information asymmetry problems related to smaller firms, these firms could benefit more from hedging activities (Géczy et al., 1997). However, more recent studies provide empirical evidence for a positive relation between firm size and the use of derivatives because of cost-driven incentives related to hedging. Because setting up hedging programs can be costly, larger firms benefit more through economies of scale (Haushalter, 2000; Supanvanij and Strauss, 2010). Firm size is measured using the natural logarithm of total assets.
Finally, certain CEO aspects like CEO tenure and age are included to control for a possible influence of personal characteristics on the use of derivatives. CEO tenure is measured using a binary variable which equals 1 if a firm's CEO was newly appointed during the fiscal year. The predicted sign of CEO age is unclear. Regarding CEO tenure, Tufano (1996) finds a negative association between the tenure of senior executives and the use of derivatives for a sample of firms active in the gold mining industry. Therefore, the predicted sign of CEO tenure is negative.

4.4 Impact of risk exposures

For the second part of this thesis, the importance of risk management is tested. This is done by analysing quantitative disclosure information related to risk exposures, as required by IFRS 7. Firms are required to disclose quantitative information about risk exposures by providing sensitivity analyses or value-at-risk models. In addition, firms that apply hedge accounting are required to disclose additional information on risk exposures before and after hedging. The impact of these risk exposures can be tested by comparing the effects of fluctuations in interest rate, foreign exchange rates and commodity prices to net income and equity. The first step in analysing quantitative disclosure information is establishing the most frequently used methods and assumptions to disclose this information. Because firms are able to decide on their methods and assumptions, reducing the sample to the most frequently used ones is done in order to be able to present a clear overview including all risk exposures. For these observations, information is presented by means of a five-number summary. A five-number summary describes the sample by presenting the minimum and maximum extreme values, the median, and the first and third quartiles (25^{th} and 75^{th} percentiles). To test the second hypothesis for the relative impact of changes in the risk exposures on net income and equity, the five-number summary presents ratios for the different assumptions. The higher the absolute value of the ratios, the greater the impact on net income or equity.

5. Empirical results and analysis

5.1 Results logit regressions H1

This section provides the results of the logit regressions of the first hypothesis. Descriptive statistics are presented in Table 1. Outliers are accounted for by winsorizing data to prevent them from significantly influencing the results. By winsorizing data, outliers are dealt with by replacing extreme values with less extreme values, instead of deleting them. Because the dataset I use is limited to 190 firms, winsorizing is preferred above data trimming to not further reduce the sample. I winsorize data at the 1st and 99th percentiles for the variables Salary, Bonus, Financial distress costs, Profitability, Firm size, Tobin's Q and Quick ratio.

Table 1
Summary statistics for used variables

Variable	***N***	**Mean**	**Std Dev**	**1st %ile**	**99th %ile**
Derivative variables					
Binary variable: Interest rate	379	0.736	0.441	0	1
Binary variable: FX rate	379	0.834	0.373	0	1
Binary variable: Commodity risk	379	0.311	0.464	0	1
Compensation variables					
Salary: euro (mil)	315	0.830	0.446	0.086	2.664
Bonus: euro (mil)	299	0.759	0.748	0	4.257
Control variables					
Financial distress costs	378	0.228	0.153	0	0.767
Profitability	378	0.045	0.055	−0.138	0.216
Firm size	378	22.427	1.369	18.681	25.869
Tobin's Q	357	2.149	4.098	0.628	38.319
Quick ratio	377	1.086	0.613	0.238	4.049
CEO age	351	57.516	6.153	41	74
CEO tenure	367	0.082	0.274	0	1

Table 1 shows descriptive statistics of all variables used in the regression. The binary variables of interest rate, foreign exchange rate and commodity price risk are equal to 1 for firms that use derivatives related to one of those risks. Salary and Bonus are short-term payments to the CEO, measured in million euros. Control variables include financial distress costs, measured as the ratio of total long-term debt to total assets; profitability, measured as the ratio of net income to total assets;

firm size, measured as the natural logarithm of total assets; Tobin's Q, measured as the market value of assets divided by the book value of assets; the quick ratio, measured as current assets minus inventories divided by current liabilities and CEO aspects like age and tenure. CEO tenure is measured using a binary variable which is equal to 1 if a firm's CEO was newly appointed during the fiscal year.

Table 2

Pearson correlation coefficients

Variable	SAL_C	BON_C	FDC	PROF	SIZE	TOBQ	QUICK	AGE_C
SAL_C								
BON_C	0.52***							
FDC	−0.11*	−0.13**						
PROF	0.08	0.12**	−0.22***					
SIZE	0.44***	0.39***	0.26***	−0.14***				
TOBQ	0.06	−0.02	−0.02	0.04	0.08			
QUICK	0.04	−0.05	−0.14***	0.18***	−0.26***	0.06		
AGE_C	0.08	0.15**	−0.13**	−0.03	0.17***	−0.01	−0.09	
TEN_C	−0.08	−0.09	−0.04	0.04	0.02	−0.02	0.03	−0.08

Table 2 shows Pearson correlation coefficients for all independent variables used in the regressions. Salary (SAL_C) and Bonus (BON_C) are short-term payments to the CEO. Control variables include financial distress costs (FDC), measured as the ratio of total long-term debt to total assets; profitability (PROF), measured as the ratio of net income to total assets; firm size (SIZE), measured as the natural logarithm of total assets; Tobin's Q (TOBQ), measured as the market value of assets divided by the book value of assets; the quick ratio (QUICK), measured as current assets minus inventories divided by current liabilities and CEO aspects like age (AGE_C) and tenure (TEN_C). CEO tenure is measured using a binary variable which is equal to 1 if a firm's CEO was newly appointed during the fiscal year. *, **, *** indicate significance of the coefficients at confidence levels of 10%, 5% and 1%, respectively.

According to Table 1, the average firm included in the sample owns 15.3 billion euros in assets. As not all firms report data about CEO compensation, the sample to be used in the regressions is limited to the amount of firms that do report CEO salary and bonus payments. CEO salary is reported for 315 observations, either through the Capital IQ database or firms' financial statements. Information on bonus payments to CEO's is reported for 299 observations. On average, CEO's receive a base salary of 830,000 euros and annual bonus payments of 759,000 euros. Data on control variables is mostly complete except for some firms not reporting CEO details like age, name and information on executive tenure. In addition, data on share prices for the sample period is missing for 22 observations, which explains why Tobin's Q cannot be computed for all firms. For all independent variables, the Pearson correlation coefficients are presented in Table 2. Relatively high and significant correlations to notice are CEO base salary related to bonus payments, CEO base salary and bonus payments related to firm size, and firm size related to the quick ratio. A positive correlation indicates variables move in the same direction. This means that if CEO salary increases, bonus payments tend to increase as well in the same direction. This is also true for CEO salary and bonus payments related to firm size: an increase in firm size will lead to increases in base salary and bonus payments to the CEO. A negative correlation indicates variables move in the opposite direction. This implies that an increase in value of firm size tends to lead to a decrease in value of the quick ratio.

Table 3 presents results for the logit regressions using binary variables which measure (1) interest rate, (2) foreign exchange rate and (3) commodity price risk derivatives. For each regression, the sample is further reduced to only include firms that are exposed to the corresponding risk. For the total sample, firms report exposure to: interest rate risk for 354 observations; foreign exchange risk for 351 observations and commodity price risk for 161 observations. The total number of observations is further reduced because of data availability. According to the logit regressions presented in Table 3, I find significant evidence at the confidence level of 5% that CEO bonus payments explain corporate derivative use, for both interest rate and commodity price risk. For these risks, an increase in CEO bonus payments is negatively associated with derivative use for the sample of European firms. The odds ratios for CEO bonus payments are 0.51 and 0.48 for interest rate and commodity price risk, respectively. This indicates that for an additional unit in CEO bonus payments, in this case one million euros, the odds of using derivatives are lowered by a factor of 0.511 for interest rate risk and 0.484 for commodity price risk. In terms of probability this means that an increase in CEO bonus payments of a million euros, leads to a reduction in the probability of using derivatives by 49% for interest rate risk and 52% for commodity price risk. An increase of a million euros is equal to a change in the standard deviation of bonus payments of about 1.3. This change, leading to a reduction in the probability of using derivatives by 49% for interest rate risk and 52% for commodity price risk, can therefore be considered to be economically significant. This result is in line with H1 and consistent with theory predicting a negative association because of the convex structure of bonus payments, resulting in more risk-seeking behaviour by the CEO. Regarding CEO base salary, I find no significant evidence for a negative influence on derivative use for any of the risks. This result is not in line with H1 and fails to confirm existing empirical evidence about the effect of CEO base salary on derivative use (Supanvanij and Strauss, 2010).

Regarding the control variables, I find mixed results. The control variable measuring financial distress costs is significant at the confidence level of 10% for commodity price risk. However, the sign is negative which implies that firms would decrease their derivative use as the costs of financial distress increase, which is inconsistent with prior literature. The variable controlling for firms' profitability is significant for interest rate risk at the confidence level of 5% and for commodity price risk at the confidence level of 10%. For both risks, the sign is negative which is consistent with the theory that highly profitable firms are less likely to use derivatives. Firm size is also significant at the confidence level of 1%, again for both interest rate and commodity price risk. The sign is positive for both risks which supports the theory that larger firms benefit more for setting up hedging programs through economies of scale. The variable Tobin's Q, which measures the underinvestment problem related to corporate hedging, is not significantly related to derivative use. This means that there is no significant evidence that the use of derivatives can be a solution to firms with profitable investment opportunities while facing low cash flows.

The quick ratio which measures firms' liquidity rating is significant for both foreign exchange rate risk and commodity price risk at the confidence levels of 10% and 5%, respectively. The predicted sign is negative which is true for foreign exchange derivatives, indicating that firms with a high liquidity rating tend to use less derivatives. There is no explanation for the positive sign regarding commodity price risk. Control variables for CEO aspects like age and tenure are not significant except for CEO age regarding commodity price risks, which is positively significant at the confidence level of 1%. This result indicates that older executives acting as CEO at firms with exposure to commodity price risk tend to use more derivatives.

Based on the overall results discussed in this section, I conclude that H1 is supported regarding short-term bonus payments to the CEO. For two of the three risks that firms can be exposed to, CEO bonus payments are significantly and negatively associated with derivative use for the sample of European firms that report under IFRS.

On a final note, it should be noticed that the results of the commodity derivative regression are related to a greatly reduced sample, because firms report exposure to commodity price risk for only 161 observations, which is further reduced to 119 because of data availability. This means that the results are limited and only apply to certain industries where commodity price risk is common, like metals and gas industries. Therefore, the significance and meaning of these results should be interpreted carefully.

5.2 Robustness test

Existing literature show that one major concern is the possibility for simultaneity problems when examining the relation between derivative use and executive compensation (Géczy et al., 1997; Rogers, 2002; Supanvanij and Strauss, 2010). This problem occurs when choices about executive compensation plans are made simultaneously with the decision to use derivatives. The same reasoning applies for choices about capital structure in relation to executive compensation plans. When decisions are being made simultaneously, it is impossible to draw conclusions about the influence of executive compensation plans or firm aspects on derivative use, based on the results presented in Table 3.

A possible solution to test for simultaneity concerns is to use lagged values for the independent variables related to CEO compensation and firm aspects, and examine the association between the lagged variables and derivative use. For the same sample of 190 firms, I use lagged values of CEO base salary and bonus payments and the same set of firm aspects. Because data is collected for the fiscal years 2012 and 2013, this means all independent variables relate to fiscal year 2012 while the choice of derivative use relate to fiscal year 2013. The unavoidable drawback of this method is that it will further reduce the sample. The regressions are presented in Table 4. Overall, the results related to compensation plans are unaffected by the method of using lagged variables. The sign and significance of CEO bonus payments on derivative use is similar, while the odds suggest a more negative impact compared to the results in Table 3. The odds of using derivatives in this case are lowered by a factor of 0.327 for interest rate risk and 0.230 for commodity price risk. In terms of probability this means that an increase in CEO bonus payments of a million euros, leads to a reduction in the probability of using derivatives by 67% for interest rate and 77% for commodity price risk. Results related to firm aspects are less significant, especially for commodity derivatives, while the signs are similar.

5.3 Impact of risk exposures

For the second part of this thesis, the importance of risk management is tested. This is done by analysing quantitative disclosure information related to risk exposures, as required by IFRS 7. As explained in section 2.2, firms are required to disclose quantitative information about risk exposures by providing sensitivity analyses or value-at-risk models. In addition, firms that apply hedge accounting are required to disclose additional information on risk exposures before and after hedging. For the sample of 379 observations, disclosure choices are presented in Figure 3. Most firms provide quantitative information in means of sensitivity analyses, while value-at-risk models are reported for only a few observations. This could be explained by the extensive guidance on the application of sensitivity analyses provided by IFRS 7, which is not the case for value-at-risk models. Additional information on hedging activities is disclosed for 17 observations for IR risk, for 76 observations for FX risk and for 2 observations for CO risk. Any missing information on risk exposures in the annual reports could be due to errors in the data collecting process or because of firms decide to report this kind of information in the management commentary or risk report instead. Focusing on firms' annual reports, the vast majority of firms disclose quantitative information using sensitivity analyses. Therefore, this method is further analysed.

Figure 3: Quantitative disclosure information related to risk management

No. of users	**IR risk**	**FX risk**	**CO risk**
Sensitivity analysis	262	252	68
Value-at-risk model	4	20	9
Risk exposure on hedging activities	17	76	2

Figure 3 shows quantitative disclosure choices related to different risk exposures for the total number of observations.

Table 5 provides more detailed information about sensitivity analyses for the most frequently used assumptions that firms disclose in their annual reports. For interest rate risk, firms report assumptions based on percentage or basis points (bp) change. Used assumptions for changes in interest rates vary between −1% (or −100bp) and 1.69% (or 169bp). Table 5 includes assumptions that most firms use: 50bp, used by 41 firms and 100bp, used by 161 firms. For foreign exchange rate risk, a majority of the firms assume fluctuations in foreign exchange rates of 10% for currencies they are exposed to. Other used assumptions vary between −10% and 20%. Most firms are exposed to fluctuations in U.S. Dollar. Other reported exposures mostly include European currencies other than the functional currency. For example, exposure to Swedish crowns or Swiss francs for firms that have business in those countries and report in euro amounts. Because currencies that lead to exposure differ per firm, Table 5 presents exposure to U.S. Dollar for 116 observations and exposure to the second most important currency, C2, for 106 observations. For commodity price risk, most firms report assumptions based on 10% price changes of commodities. This is shown in Table 5 for 44 observations.

For each risk and assumption, the mean shows the effects on profit or loss and equity in million euros. Ratios indicate the relative effects on net income and total equity. According to Table 5, for interest rate risk, the average impact on profit or loss for changes in the interest rate of 50 and 100 basis points are −1 and −12.25 million euros respectively. The average impact on equity for similar changes are 20.89 and 6.78 million euros respectively. For foreign exchange rate risk, the average impact on profit or loss for changes of 10% in the exchange rates of U.S. Dollar and the second most important currency are 1.31 and −1.35 million euros respectively. The average impact on equity for similar changes are −1.22 and 15.89 million euros respectively. For commodity price risk, the average impact on profit or loss for a change in commodity prices of 10% is 11.86 million euros. The average impact on equity for a similar change is −1.96 million euros. The absolute value of these numbers does not seem large, however, the high standard deviations of the different risks indicate that the effects on profit or loss and equity vary a lot among the observations. This is also shown by the values in the first and third quartiles (Q1 and Q3), as well as the extreme values in the Min and Max columns. This implies that for some firms, market risk exposure is a lot greater than for other firms.

In order to test the second hypothesis for the relative impact of changes in the risk exposures on net income and equity, the five-number summary in Table 5 presents ratios for the different assumptions. The higher the absolute value of the ratios, the greater the impact on net income or equity. Overall, the majority of the ratios are close to zero, especially for ratios between the first and the third quartiles. These ratios become larger for values closer to the extreme values. This means that for at least half the observations around the median, the relative impact on net income and equity for changes in market risk components is minimum. However, the impact increases for values closer to the extreme values. For example, the negative impact on net income for changes in the interest rate of 100 basis points can be up to 66% of the corresponding year's net income. For foreign exchange rate risk, a change of 10% in the exchange rate of the second most important currency can lead up to a negative impact on net income of more than twice the amount of the corresponding year's net income. This could mean that the related firm is highly exposed to foreign exchange rate risk. However, the drawback of using firm year net income numbers is that net income could be incidentally low due to non-recurring costs.

The results in Table 5 show mixed evidence in support of H2. The results related to ratio values for the majority of observations around the median show support in favour of H2. However, as the ratios become larger for values closer to the extreme values, the impact on net income and equity increases. As the extreme values show, this impact can be quite significant. The results related to these findings indicate the importance of risk management strategies to control for changes in market risk components. For these firms, risk management is important as changes in risk exposures can have major consequences. This finding adds value to the results of H1, as the use of derivatives plays an important role in firms' risk management strategies.

Table 3
Logit regressions of the effects of CEO compensation and firm aspects on derivative use

Variable	**IR derivatives**			**FX derivatives**			**Commodity derivatives**		
	Coeff.	*p* value	Odds	Coeff.	*p* value	Odds	Coeff.	*p* value	Odds
Intercept	−14.783	0.002	0.000	−4.644	0.424	0.010	−32.511	0.000	0.000
SAL_C: euro (mil)	0.278	0.614	1.321	0.335	0.641	1.397	−1.540	0.129	0.213
BON_C: euro (mil)	−0.670**	0.012	0.511	−0.097	0.833	0.907	−0.725**	0.045	0.484
FDC	2.341	0.112	10.391	−2.126	0.228	0.119	−5.684*	0.079	0.003
PROF	−11.064**	0.026	0.000	−1.602	0.788	0.201	−15.376*	0.064	0.000
SIZE	0.709***	0.001	2.032	0.366	0.160	1.442	1.085***	0.003	2.960
TOBQ	0.355	0.192	1.426	0.019	0.867	1.019	−0.013	0.791	0.987
QUICK	−0.078	0.777	0.925	−0.622*	0.073	0.537	1.733**	0.020	5.658
AGE_C	0.001	0.963	1.001	0.005	0.910	1.005	0.197***	0.000	1.218
TEN_C	0.697	0.291	2.007	−0.573	0.428	0.564	1.619	0.189	5.048
Number of obs.	267			265			119		
Adj./Pseudo R^2	0.165			0.084			0.340		

Table 3 shows the results of logit regressions using binary variables for interest rate, foreign exchange and commodity price risk derivatives as dependent variables. The odds ratio displays the factor impact on the use of derivatives resulting from a change in the independent variable. Proxies for CEO compensation include salary (SAL_C) and bonus (BON_C). Control variables include financial distress costs (FDC); profitability (PROF); firm size (SIZE); Tobin's Q (TOBQ); quick ratio (QUICK); CEO age (AGE_C) and tenure (TEN_C). The original sample consists of a random selection of 190 firms from the Euro Stoxx 600 which includes European non-financial listed firms. Of these firms, data is collected for the fiscal years 2012 and 2013. This leads to a total of 379 observations in the sample. Number of observations shows the amount of observations that are exposed to the corresponding risk for which all data is available. For the total sample, firms report exposure to: interest rate risk for 354 observations; foreign exchange risk for 351 observations and commodity price risk for 161 observations. These numbers are reduced to 267, 265 and 119 respectively because of data availability. *, **, *** indicate significance of the coefficients at confidence levels of 10%, 5% and 1%, respectively.

Table 4

Logit regressions using lagged variables of CEO compensation and firm aspects

Variable	**IR derivatives**			**FX derivatives**			**Commodity derivatives**		
	Coeff.	*p* value	Odds	Coeff.	*p* value	Odds	Coeff.	*p* value	Odds
Intercept	−14.008	0.025	0.000	−6.292	0.432	0.002	−24.688	0.022	0.000
SAL_C(-1): euro (mil)	0.400	0.644	1.491	0.540	0.632	1.717	−0.359	0.833	0.698
BON_C(-1): euro (mil)	−1.117**	0.024	0.327	0.079	0.917	1.083	−1.470**	0.040	0.230
FDC(-1)	2.382	0.265	10.822	−0.901	0.741	0.406	−6.071	0.225	0.002
PROF(-1)	−15.357*	0.051	0.000	−2.343	0.757	0.096	−19.905	0.146	0.000
SIZE(-1)	0.673**	0.020	1.960	0.436	0.270	1.547	1.237**	0.021	3.447
TOBQ(-1)	0.593	0.207	1.810	−0.051	0.441	0.951	−0.031	0.597	0.969
QUICK(-1)	0.095	0.801	1.100	−0.699	0.135	0.497	1.491	0.105	4.443
Number of obs.	127			127			55		
Adj./Pseudo R^2	0.161			0.132			0.283		

Table 4 shows the results of logit regressions using binary variables for interest rate, foreign exchange and commodity price risk derivatives as dependent variables. All independent variables are lagged variables (-1) and are as defined before. The odds ratio displays the factor impact on the use of derivatives resulting from a change in the lagged independent variable. The original sample consists of a random selection of 190 firms from the Euro Stoxx 600 which includes European non-financial listed firms. Of these firms, data is collected for the fiscal years 2012 and 2013. This leads to a total of 379 observations in the sample. Number of observations shows the amount of observations that are exposed to the corresponding risk for which all data is available. Because lagged variables are used in the regressions, the sample is further reduced. *, **, *** indicate significance of the coefficients at confidence levels of 10%, 5% and 1%, respectively.

Table 5
Sensitivity analyses and relative impact on net income and equity

Exposure to: Assumptions	**No. of users**	**Mean**	**Std Dev**	**Min**	**Q1**	**Median**	**Q3**	**Max**
Effect on profit or loss: euro (mil)								
IR risk								
50bp	41	−1.00	27.21	−82.40	−2.72	0	0.77	117.05
100bp	161	−12.25	76.51	−727.73	−2.68	0	1.70	45.20
50bp/net income	41	0.03	0.20	−0.11	−0.01	0.00	0.01	1.26
100bp/net income	161	−0.01	0.07	−0.66	−0.01	0	0.01	0.22
FX risk								
USD, 10% change	116	1.31	31.33	−90.00	−2.74	0	2.29	185.63
C2, 10% change	106	−1.35	22.28	−195.65	−1.22	0	0.16	67.74
USD, 10%/net income	116	0.02	0.14	−0.24	−0.01	0	0.01	1.01
C2, 10%/net income	106	−0.01	0.24	−2.07	−0.00	0	0.00	0.89
CO risk								
Price change, 10%	44	11.86	44.80	−13.61	0	0	4.70	290.00
10%/net income	44	0.03	0.09	−0.01	0	0	0.01	0.44
Effect on equity: euro (mil)								
IR risk								
50bp	41	20.89	47.41	−1.85	0	0	5.02	198.00
100bp	159	6.78	42.76	−98.48	0	0	1.00	425.00
50bp/total equity	41	0.01	0.02	−0.00	0	0	0.00	0.09
100bp/total equity	159	0.00	0.01	−0.01	0	0	0.00	0.08
FX risk								
USD, 10% change	116	−1.22	248.61	−1689.00	0	0	2.78	716.64
C2, 10% change	106	15.89	186.02	−204.00	0	0	0.03	1887.3
USD, 10%/total equity	116	0.01	0.05	−0.08	0	0	0.00	0.46
C2, 10%/total equity	106	0.02	0.15	−0.05	0	0	0.00	1.51
CO risk								
Price change, 10%	44	−1.96	27.22	−174.00	0	0.00	3.95	23.59
10%/total equity	44	0.00	0.00	−0.00	0	0.00	0.00	0.02

Table 5 shows the effects on profit or loss and equity for exposure changes in interest rate risk, foreign exchange risk and commodity price risk. Changes in exposure are displayed for the most frequently used assumptions that firms disclose in their annual reports. Ratios indicate relative effects on net income and total equity. For exposure to interest rate risk, the most frequently used assumptions in sensitivity analyses include changes in the interest rate of 50 basis points (or 0.5%) and 100 basis points (or 1%). For exposure to foreign exchange risk, the most frequently used assumptions in sensitivity analyses include changes of 10% in the rates of USD and the second most important currency (C2) reported by firms. For exposure to commodity price risk, the most frequently used assumption in sensitivity analyses is a change of 10% in commodity prices. Amounts are presented in million euros.

6. Conclusions

Past accounting scandals like Enron and more recently the Vestia case in the Netherlands showed the negative consequences of a misalignment between managers' incentives and corporate derivative use. Agency problems arise when compensation plans affect managers' incentives in a way that they are not in line with the best interests of the shareholders. This thesis examines the possible influences of executive compensation plans on corporate derivative use among European firms. As derivatives are mainly used for risk management purposes, the research question investigates if firms' risk management strategies are affected by CEO compensation plans, as well as certain control variables to account for existing theories. Furthermore, the importance of risk management strategies is tested by analysing quantitative disclosure requirements. Quantitative disclosure requirements like sensitivity analyses provide information on risk exposures and how changes in risk exposures affect firms' net income and equity.

The sample consists of a random selection of 190 non-financial firms from the Euro Stoxx 600. Of these firms, data is collected for the fiscal years 2012 and 2013. The first hypothesis states that short-term executive compensation plans lead to fewer hedging activities for the sample of firms used. Results of the logit regressions support this hypothesis for firms that are exposed to interest rate and commodity price risk. The results remain unchanged when additional regressions are ran using lagged variables to control for possible simultaneity concerns related to executive compensation plans and firm aspects. The second hypothesis states that changes in risk exposures, as reported in quantitative disclosures, do not lead to significant changes on firm's net income and equity. Using a five-number summary, results show mixed evidence in support of this statement. The ratio values for observations between the first and the third quartile indicate that the impact of changes in risk exposures have a minimum impact on net income and equity. However, the ratios become larger for values closer to the extreme values, suggesting that the impact on net income and equity increases.

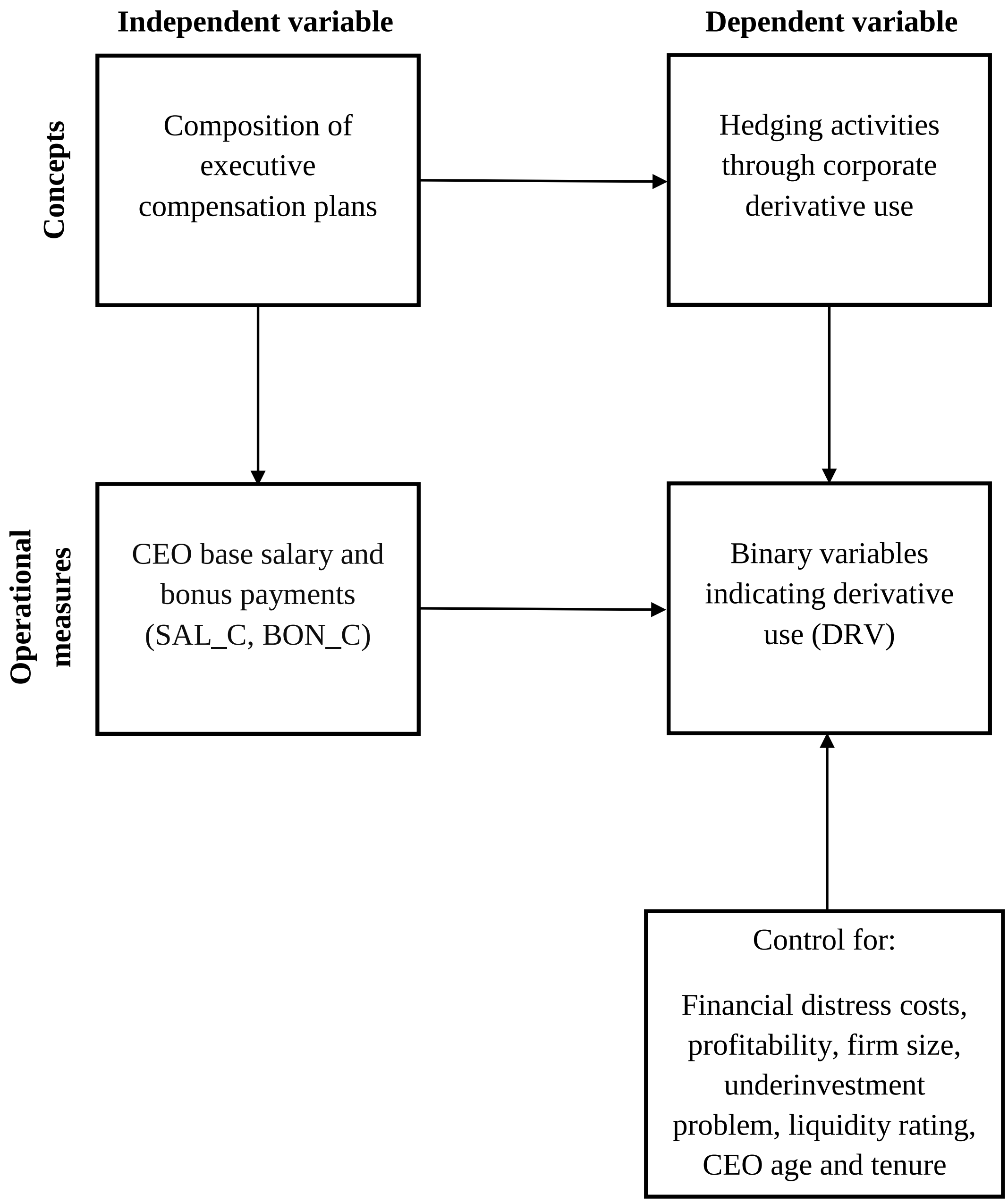
As the extreme values show, the impact on these firms can be quite significant. For these firms, risk management is important as changes in risk exposures can have major consequences. This finding adds value to the results of the first hypothesis, as the use of derivatives play an important role in firms' risk management strategies.

To answer the research question, the composition of executive compensation plans matters because CEO bonus payments are negatively associated with derivative use. This result is consistent with theory predicting a negative association because of the convex structure of bonus payments (Smith and Stulz, 1985). Regarding other theories that are controlled for, the most significant associations are found for firm size and firm profitability. The positive sign on firm size possibly suggests that larger firms benefit more for setting up hedging programs through economies of scale. As for firm profitability, the results support the theory that firms with higher levels of profitability are less likely to use derivatives. However, results related to the control variables lose some significance when lagged variables are used.

The findings contribute to the existing literature by being one of the first to examine the potential influence of executive compensation plans on firm's use of derivatives for a sample of European firms. Existing theories about executive compensation described by Smith and Stulz (1985) and firm aspects like firm size and profitability are tested for these firms. By showing that bonus payments negatively affect corporate derivative use, compensation plans that reward executives with high short-term bonus payments can induce riskier behaviour. This can lead to misalignments between managers' incentives with those of the shareholders of the firm. The implication of this finding is that firms should be careful in deciding on the composition of compensation plans for their key executives. However, it should be noted that the scope of this thesis is limited to short-term salary and bonus payments to the CEO. Other aspects of executive compensation plans like long-term incentive plans, options and share payments are not included because current databases lack information about executive compensation for European firms. In addition, the sample is limited to 190 firms with data for two fiscal years, mainly because hand-collecting data on derivatives and risk management is time-consuming. A suggestion for future research is to extend the sample and include other compensation plan aspects to provide a more complete picture on the association between executive compensation and corporate derivative use.

7. Appendix A. Libby boxes

Figure 4: Libby boxes H1



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