Corporate Hedging and Optimal Disclosure *

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Abstract

This paper considers the issue of disclosure of hedging choices. It is shown that disclosure is the preferred choice of both managers and shareholders if it removes completely the informational asymmetry among the manager and the shareholders concerning the business opportunities and risks faced by them; the optimal reward cum insurance contract for the manager can thereby be implemented. If the nature of feasible disclosure (that is credible) still leaves some informational asymmetries present, then with the renegotiation of managerial contracts at the interim date, it is possible to have the shareholders preferring nondisclosure, whereas the manager prefers to disclose at the (some) interim state(s), even though he might also prefer to pre-commit to a policy of nondisclosure ex ante. These results are quite new relative to the extant literature on "hedge accounting", and take sophisticated account of the impact of optimal contracts for managers, and renegotiations of these at the interim (post-disclosure) date.

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1 Introduction

This paper discusses the role of disclosure of information regarding corporate risk management. I examine the effects of disclosing information about corporate risk exposure and hedging upon the value of the firm to its shareholders, managerial contracts, and the selection of projects undertaken by the firm. This is a very much debated topic[1], as the current accounting rules for derivatives are not very clear or comprehensive.

For this reason, the analysis follows the current discussion of accounting rules for positions undertaken by firms in derivative financial instruments. I also compare the different results obtained in this setting under a variety of scenarios, to those of DeMarzo and Duffie (1995) — which is, to my knowledge, the only other article that directly addresses the issue of hedge accounting. Extant accounting rules and disclosure policies, as well as new proposals, are discussed.

Without questioning its reasonableness, we take for granted a managerial motive for hedging. Under these circumstances shareholders will care about risk management via managerial incentives. This is a useful assumption, also in terms of relating results to existing literature about hedge accounting.

In this framework the manager who runs the firm takes a decision that affects the probability of selecting different types of projects, and hence also affects the risk exposure of the firm. The manager's decision, as well as the consequently revealed type of project constitute proprietary information of the manager. The manager also decides the hedging policy of the risk exposure. As is usual in the literature I assume that the manager prefers to hedge as "manager of the firm", as compared to doing so privately (i.e., outside the firm); or I simply assume that the manager is not allowed to trade on his own account, which seems reasonable.

Together with the natural risk exposure, this risk management position can be disclosed to shareholders. I introduce the possibility of renegotiation of the manager's compensation contract when new information is released.

As a benchmark I show that for a simple economy the information disclosed re-establishes the symmetry between the manager and shareholders,

[1]As evidence of this, see *The Economist*'s Survey on Corporate Risk Management of 1996, February 10-16 and the more recent FASB's proposed statements.

and in this case disclosure of hedging activities leaves shareholders better off, as opposed to what DeMarzo and Duffie (1995) find in their model. In a more complex, and possibly more realistic setting, situations occur in which the information disclosed to shareholders is not rich enough to fully remove the superiority of the manager's information set. In this case, truthful disclosure is still noisy, and can be used by the manager to his advantage. Finally this can make shareholders worse off than in the absence of disclosure. I also discuss situations in which the benefits of disclosure and renegotiation can still be recovered.

A key assumption of the model is that compensation contracts cannot be contingent on "risk-parameters" such as the level of risk exposure and hedging. This is left for future research and is briefly discussed below. Contracts are contingent only on verifiable parameters such as "cash flow" or return. However a strength of the model is the fact that considering compensation contracts contingent on the realizations of the risky variable (that is subject to financial risk management) would still not solve the incentive problem between shareholders and the managers. This happens because the board of directors is not aware of the level of risk exposure that occurs after the manager takes his decision. Therefore it is not able to hedge the manager's income.

The form of renegotiation that follows disclosure suits the purpose of the paper: I allow shareholders to make a take-it-or-leave-it offer to replace the initial compensation contract. This can be found in Hermalin and Katz (1991), who discuss a general moral hazard problem (not applied to accounting) in which an exogenous signal about future performance triggers renegotiation. The model in this paper differs in important ways. First of all there is a double-moral-hazard problem, or a second layer of information asymmetry, between the manager and outsiders: besides the initial managerial decision, the project type, its inherent risk exposure and the hedging position are all managerial private information. Even if information about risk is disclosed as a "signal" to shareholders, the manager will still keep superior knowledge about other aspects of the business opportunities — he may well better predict future cash flows. Unlike Hermalin and Katz (1991) this is not because of a finer knowledge of the manager's initial action; it is rather because of the structure of the set of business opportunities available in the economy.

This paper brings together different aspects of previous research in corporate risk management. A brief discussion of how this relates to the literature is given next in section 1.1. Section 1.2 summarizes the issues under discussion in the hedge-accounting literature. The rest of the paper is organized as follows. In section 2 the basic set-up of the model is presented. In section 3 the main results are derived. Section 4 concludes with a discussion of the results, their relation to the existing literature and possible implications for disclosure rules. Appendix A has proofs, B figures, and C contains a glossary.

1.1 Background

The literature on risk management has developed along a number of different lines. One stream of the literature focuses on optimal hedge positions adopted by a risk averse owner-manager, whose stake in the firm is not fully diversified. Examples along this line are Holthausen (1979), Anderson and Danthine (1981), Stulz (1984) and DeMarzo and Duffie (1991). The focus is on the choice of optimal hedging policies that firms can adopt on behalf of their risk averse shareholders. In this chapter I assume risk neutrality of shareholders, as is expected to occur in large corporations with well diversified ownership.

Another rationale for corporate hedging deals with the existence of market imperfections: costs associated with financial distress or external financing. The effect of convexities in the corporate tax code has also been studied. Fundamental contributions in this area are Smith and Stulz (1985) and Froot, Scharfstein and Stein (1993). These market imperfections are not considered here.

Hedging activities have also been shown to improve on the sub-optimal risk allocation that results from an agency relationship between shareholders and risk averse managers of a firm. An important reference in this area, where hedging is shown to contribute to reduce the so-called agency cost, is Campbell and Kracaw (1987). Shareholders who are well-diversified can end up benefiting from their risk averse manager's active hedging policies, if this implies "cheaper" incentive contracts (i.e., the contracts already take into account the further benefit that the manager can achieve through hedging). Smith and Stulz (1985) also examine this issue. This is related to the model presented here, in which a risk averse manager is given incentives to manage risk through his compensation contract. In this strand of the literature, if the manager's compensation contract is written contingent on the risk being managed, then there is no role for risk management at corporate level. On the contrary in this paper a contract contingent on the instrument of risk management would still not fully solve the incentive problem. And hence the role for risk management at corporate level is clear, together with the disclosure effects.

A more recent perspective on these matters is DeMarzo and Duffie (1995). They analyze the information effect of financial risk management, claiming that financial hedging can improve the informativeness of corporate earnings as a signal of managerial ability and project quality, by the elimination of extraneous noise. Incentives concerning information transmission may be different for managers and shareholders, resulting in conflicts regarding an optimal hedging policy. They show how these incentives can depend on the accounting information released by the firm. In a model in which manager and shareholders are equally uninformed about the manager's ability, they find controversial results. Shareholders prefer to have no disclosure, and in such case the manager hedges risk; whilst if disclosure takes place, then the manager prefers not to hedge. Under the assumptions of this paper the results I reach are very different. This is discussed at the end. In any case we take the managerial motive for granted.

Other interesting papers that view risk management strategically in a context of information asymmetry are Breeden and Viswanathan (1996) and DeGeorge, Moselle and Zeckhauser (1996), but the issue of disclosure is disregarded.

1.2 The Issue of Hedge Accounting

Partly because of the transaction-based, historical cost accounting system, the effects of price or interest rate changes on existing assets and liabilities of a firm are recognized income only when a later transaction is realized. It can happen that gains and losses on these underlying assets (liabilities) are reported in a different time-period from that of the gains (losses) reported on the financial instruments used to hedge those risks. In these circumstances the accounting result could be reporting related, offsetting accounts in income during different reporting periods. The reporting could then cause fluctuations in income, resulting in increased exposure to price or interest rate changes, when in reality this exposure has been reduced.

The basic idea behind hedge accounting is, then, the following. If gains or losses on the item being hedged are deferred (as examples we can think of an asset carried at cost, or of a future transaction), then the gains or losses on the corresponding hedging instrument would also be deferred as part of the carrying amount of the hedged item, instead of being recognized currently in income. Hedge accounting is one of the two basic approaches to the accounting treatment of derivative securities[2]. Hedge accounting is a general method of accounting, for both the income statement and the balance sheet, for an instrument used to control the risk associated with changes in prices or interest rates, as mentioned above. When certain criteria are met[3] the gains or losses on the hedging instrument are considered in the income statement and the balance sheet, only at the time at which the gains or losses on the item being hedged are also reported. A "unified package" of commitment plus hedge is considered, in which the hedging instrument does not have an accounting life of its own.

To summarize, when certain criteria are met a firm can choose whether to report only an aggregate "commitment-plus-hedge" simultaneously, or report each component separately. I emphasize the freedom given to managers, since they can choose to use hedge accounting on a case-by-case basis. This will be relevant in the analysis of the model in this paper. The standards and criteria for hedge accounting in the US (SFAS Nos. 52, 80, 105, 107, 119, 126) and the UK (SSAP No. 20) follow the same reasoning. Recent proposals from the FASB tend to require more disclosure, both qualitative and quantitative, and not only as a special footnote to the accounts[4]. There is still controversy around this issue.

2 The Model

The manager is better informed than shareholders about the projects undertaken by the firm and, therefore, about its risk exposure. This happens because the manager influences the selection of projects, depending on the effort he expends. Shareholders are not able to directly observe the manager's decisions nor the type of project the firm finally obtains. In this model the proprietary information that the manager has is partly due to his *active* role in influencing project selection. The set of projects available involves different levels of risk exposure. I assume that there exists a financial instrument in the economy that can be used to partially hedge the risk the firm is exposed to.

As in DeMarzo and Duffie (1995) the manager can communicate with shareholders — the level of exposure to a certain risk and the corresponding

[2]The other approach is known as "mark-to-market"— changes in market value are to be reported *as they occur* in earnings.

[3]An example is the requirement of a high correlation between the hedge and the underlying item.

[4]As the SEC or the Federal Reserve Board have recently suggested.

hedge position can be made observable to shareholders through disclosure. In this sense the model virtually reproduces the case-by-case option to disclose information that is contemplated in the Hedge Accounting criteria. Moreover when new information is disclosed, shareholders can make an offer to renegotiate the manager's compensation contract.

A. Time Sequence of Events

Depending on whether the manager chooses to disclose information related to hedging activities to the board of directors that represents shareholders, the sequence of events is described in Figures 1 and 2 (Appendix B). In the first case there is no disclosure of information. (1) At time $t = 0$ the board offers a compensation contract to the manager. (2) The manager takes a decision that influences the likelihood of the firm ending up with each type of project. This decision is unobservable by the board. (3) The type of the project is revealed to the manager, and is not observed by the board. (4) The manager chooses the hedging of the risk exposure. In addition, the manager does not disclose this information at time $t = 1$. (5) At time $t = 2$ the return on the project is realized, and the contract is honored.

In the alternative case, information disclosure of risk exposure and hedging takes place. Events are as follows: (1)–(4) are as above. (5) At time $t = 1$ the manager discloses the firm's risk exposure and hedging policy to the board. (6) Renegotiation of the initial compensation contract occurs: the board makes a take-it-or-leave-it offer to the manager. (7) Finally at time $t = 2$ the return on the project is realized and the contract is honored.

B. Project-Types, Cash-flows and Risk Management

J projects exist. Project types are indexed by $j = 1, \ldots, J$. A project of type j has random return, or cash-flow:

$$\tilde{y}^j = R_j + \theta_j \tilde{\varepsilon} \tag{1}$$

where R_j is a constant and $\tilde{\varepsilon}$ is a random variable. θ_j represents the level of exposure to risk $\tilde{\varepsilon}$[5]. As in DeMarzo and Duffie (1995) this risk $\tilde{\varepsilon}$ cannot be fully hedged and can be decomposed into:

$$\tilde{\varepsilon} = \tilde{z} + \tilde{\upsilon} \tag{2}$$

[5]One can think of this as exchange rate risk, interest rate risk, or oil price risk, for instance.

where $\tilde{z}$, $\tilde{\upsilon}$ are independent random variables, and:

$$E_{t<2}(\tilde{z}) = E_{t<2}(\tilde{\upsilon}) = 0$$
$$0 \leq Var(\tilde{z}) < \infty \; ; \; 0 \leq Var(\tilde{\upsilon}) < \infty$$

A project of type j is characterized by its parameters (R_j, θ_j). The risk component $\tilde{z}$ is assumed to be hedgeable, unlike $\tilde{\upsilon}$ which constitutes the basis (unhedgeable) risk of the project. A firm can partially hedge risk $\tilde{\varepsilon}$ by taking a position in a derivative instrument denoted by $\tilde{z}$. The realizations of $\tilde{z}$ can be interpreted as the net pay-offs of the financial hedging contract[6]. In the case that the firm takes a position δ_j on the financial hedging instrument, the return on the project is:

$$\tilde{y}^j = R_j + (1 - \delta_j)\theta_j \tilde{z} + \theta_j \tilde{\upsilon}, \;\; \text{for } j = 1, \ldots, J \tag{3}$$

As an illustration, $\delta_j = 0$ means no hedging, whilst $\delta_j = 1$ corresponds to full hedging. $\delta \equiv (\delta_1, \ldots, \delta_J)$ denotes the vector of hedging positions undertaken for the J types of projects. Both $\tilde{z}$ and $\tilde{\upsilon}$ are continuously distributed with support $\Re$. The probability density function (pdf) of $\tilde{z}$ is denoted by $f(z)$, and the pdf of $\tilde{\upsilon}$ is $g(\upsilon)$.

C. The Manager's Decision

After establishing an initial contract with the board of directors, the manager takes a decision $d \in D$, where D is a finite set that is common knowledge. However, shareholders cannot observe d. The decision taken affects the probability of selecting the various types of projects. $\Pr(\tilde{y}^j \mid d)$ denotes the probability of ending up with project-type j when the manager takes decision $d \in D$. The distributions $\Pr(\tilde{y}^j \mid d)$, for $d \in D$ and $j = 1, \ldots, J$ are common knowledge, and non-degenerate.

D. Preferences: Shareholders or Board of Directors

Shareholders delegate on the board of directors. The board acts on behalf of shareholders, who are risk neutral. Everywhere I assume von Neumann-Morgenstern utility functions. The expected utility of the board, when the manager takes decision d and hedging policy δ, can be represented by:

$$U_B(d, \delta, W) = E[V(\tilde{y}) \mid d, \delta] - E[W(\tilde{y}) \mid d, \delta] \tag{4}$$

[6] As DeMarzo and Duffie (1995). There is a *fair* price for the hedging instrument. The inclusion of some sort of additional premium to be paid when a hedge position is taken could be easily introduced in this model without affecting the direction of results.

The first term can be interpreted as the expected value of a stochastic function of the manager's decision d and subsequent risk management. $V[\tilde{y} \mid d, \delta]$ can be understood as the value of the firm, given that the manager chooses d, and δ_j for each project-type j, excluding the expected payment made to the manager. Since y is the financial return on the assets of the firm, one can consider the case where $V[\tilde{y} \mid d, \delta]$ is simply the expected value of $\tilde{y}$, in which case:

$$V[\tilde{y} \mid d, \delta] = \sum_{j=1}^{J} E[\tilde{y}^j \mid \delta_j] \Pr(\tilde{y}^j \mid d) \tag{5}$$

$E[W]$ represents the expected payment made to the manager, where $W(y)$ is the compensation the manager receives under his contract when the cash flow is y at $t = 2$. In all cases we are assuming that the board's reservation level of utility is reached so that non-trivial solutions of the problem exist.

E. Preferences: Manager

The manager is risk averse with expected utility U_M, additively separable in two components: income W, received according to a contract signed with the Board, and the cost $C(d)$ associated with taking decision d. Hence:

$$U_M(d, \delta) = E[U(W(\tilde{y})) \mid d, \delta] - C(d) \tag{6}$$

$U(.)$ is assumed to be continuous, concave, unbounded and strictly increasing. With these assumptions we make sure that there exists, implicitly, an inverse function $U^{-1}(.)$ in a relevant range. The manager has a reservation utility level U_0.

$C(d)$ is the disutility of taking decision d. Two sources of private costs for the manager are considered. First, the manager's initial decision d per se is already costly, as in the standard moral hazard literature. This private cost is $C_1(d), \forall d \in D$. The second potential private cost that the manager faces derives from hedging. This is costly because it requires extra "effort" from the manager. I write $C_2(\delta_j)$ to denote the private cost faced by the manager by taking a position δ_j on financial instrument $\tilde{z}$ to hedge a project of type j[7]. One can interpret C_2 as a constant cost the manager faces in order to acquire the know-how to use derivatives, and to estimate or measure the level of risk exposure. But it is also conceivable that hedging higher

[7] I could write explicitly $C_2(\delta_j \theta_j)$, but this is irrelevant for the subsequent analysis.

exposures will require more time, thought and search for a hedge contract. Thus the total expected private cost is:

$$C(d) = C_1(d) + \sum_{j=1}^{J} C_2(\delta_j) \Pr(\tilde{y}^j \mid d) \tag{7}$$

F. Managerial Compensation Contracts

At the initial stage of the game the board of directors (the "principal") will offer the manager a contract $W(y)$, among the acceptable class of compensation contracts. Contracts can be written contingent upon a verifiable performance measure, which is the realization of the cash flow $\tilde{y}$. I assume that even when information about risk exposure, θ_j, and the hedging position, δ_j, is disclosed, contracts dependent on these parameters cannot be written. There are some arguments supporting this assumption. The first is that in reality such incentive contracts contingent on risk exposure and hedging positions do not exist. Also, this model shows a simplified illustration of reality — a more complex setting could complicate greatly the writing of such contracts. Another justification for the nature of the contracts is that hedging disclosure is not *compulsory*, according to the hedge accounting standards and criteria. Hence, a contract contingent upon θ's and δ's can be viewed by a court as a contract conditional upon not necessarily verifiable information, which is problematic. Furthermore, even if it were possible to sign such contracts, making hedging "parameters" *verifiable* would require serious auditing in order to convince a court[8] — which also means that the firm would face important costs. Moreover this could actually be an incentive for the manager to lie about risk exposure and hedging. A court would probably lack the expertise to detect false disclosure, even if a more knowledgeable board of directors were able to observe whether disclosure is truthful. We leave different contracts for future research.

It is worth mentioning that considering contracts contingent on $\tilde{z}$ still would not fully solve the incentive problem. This happens because the board is not aware of the level of risk exposure that occurs after each managerial decision d. Therefore it is not able to hedge the manager's income by offering him a contract of that nature.

[8]Even if the board, by means of internal controls and because of its expertise, can observe whether the disclosed information is truthful. In terms of modelling, it is easy to see how how hard (costly) verification would be the case, if the exposure to additional unhedgeable risk (like $\tilde{v}$ in this model) were also stochastic.

G. Contract Renegotiation

The initial contract typically involves risk-bearing by the manager. When additional information regarding θ_j and δ_j is disclosed to the board of directors, it can make a take-it-or-leave-it renegotiation offer to replace the initial contract. This type of contract is possibly more intuitive than the idea of "menu contracts" pursued by Fudenberg and Tirole (1990). The two stages of the contracting game contribute separately to two effects: providing incentives for the manager to take a certain decision; and providing him with "insurance". The equilibrium is Perfect Bayesian. Concerns with existence of equilibria are disregarded.

This form of renegotiation is found in Hermalin and Katz (1991). However, the structure of this model differs from theirs in one important way: the ex ante (before the manager takes his initial decision d) probability of the final cash flow conditional on decision d and a future signal (θ_j, δ_j), is not the same for the manager as this probability after the project is revealed to him. The way the sufficient statistic conditions for the signals are set in Hermalin and Katz (1991), does not apply here — this is because the second layer of information superiority of the manager regarding the project's type and hedging position is not necessarily dependent on the manager's initial decision d.

3 Results on Disclosure of Hedging Information

The equilibrium hedging policy and disclosure depends on the characteristics of the set of projects available in the economy. As a benchmark I start by discussing a simple world in which disclosure always benefits all parties. This happens when the information released is noiseless and removes the superior ability of the manager over shareholders in predicting future payoffs.

Later in section 3.2, we consider a more complex setting where disclosure can be chosen in equilibrium, but is harmful to shareholders. This is what I call the "uninformative" case because the information that is disclosed about risk exposure is not enough to put the board of directors on the same footing as the manager. Even after disclosure, the manager preserves superior information to predict future pay-offs. The manager still chooses to disclose information when taht stage is reached, but if it is possible to pre-commit to nondisclosure, he himself might have preferred to do so, as would shareholders.

3.1 A Simple World: Disclosure is "Informative"

In this simple economy, the business opportunities are such that there are no two projects (j, k) with the same level of risk exposure $(\theta_j = \theta_k)$ that can offer different expected returns $(R_j \neq R_k)$. This assumption is interesting because when the manager discloses information (θ_j, δ_j) at time $t = 1$ — after having taken some decision d, ended up with a project type j and hedged δ_j — both he and the board can *equally* predict *at that stage* the future realization of $\tilde{y}^j$. They both understand what is the project-type that the firm faces. To put it more formally the claim is that disclosure is "informative" because the following property[9] is satisfied:

$$\theta_j = \theta_k \Rightarrow R_j = R_k \qquad \forall j = 1, \dots, J \quad \forall k = 1, \dots, J \tag{8}$$

The result is relevant as a benchmark because there is only one project-type that results in each level of risk exposure θ_j. Whenever information concerning θ_j is disclosed, the board can update its beliefs about the final outcome y — because it learns what is the updated density of y, independently of the manager's previous action d. Moreover this is the same updated density that the manager considers[10].

In the renegotiation process of the sort considered, the manager always has an incentive to disclose information. In this informative situation everyone benefits from disclosure. When the manager reveals the level of natural risk exposure and hedging, both parties identify the project's type. The board is able to offer insurance to the manager through a renegotiated compensation contract, and all parties benefit. To clarify why this happens consider first a situation in which disclosure is forbidden. Suppose that contract W is offered at time $t = 0$ and that subsequently the manager takes decision $d' \in D$. Afterwards the manager learns the type of project $j \in \{1, \dots, J\}$ and chooses hedging policy $\delta_j^*(W)$. If the firm ends up with project type j, the manager will choose δ_j^* according to:

$$\delta_j^* = \arg\max_{\delta_j} E\{U_M[W(\tilde{y}^j(\delta_j))]\} \tag{9}$$

[9]The disclosed information is a sufficient statistic.

[10]In Hermalin and Katz (1991) the equivalent condition is that the density of y conditional on (θ_j, δ_j) and on d is the same for all $d \in D$. This would not work as a benchmark in the model of this paper: the condition can be met ex ante even if there are different projects with the same θ - but after knowing the project's type the manager updates his beliefs about y in a way that he cannot communicate to the board; and this is not dependent on his initial decision d.

Denoting the vector of hedging positions for the various types of projects by $\delta^* = (\delta_1^*, \ldots, \delta_J^*)$, the problem faced by the board when there is no disclosure is the following:

$$\max_{W,d'} \quad E_{t=0}[V(\tilde{y}) - W(\tilde{y}) \mid d', \delta^*]$$

subject to

$$\sum_{j=1}^{J} E[U(W(\tilde{y}^j) \mid \delta_j^*)] \Pr(\tilde{y}^j \mid d') - C(d') \geq$$
$$\sum_{j=1}^{J} E[U(W(\tilde{y}^j) \mid \delta_j^*)] \Pr(\tilde{y}^j \mid d) - C(d) \tag{10}$$
$$\forall \;\; d \in D \qquad d' \in D$$
$$\sum_{j=1}^{J} E[U(W(\tilde{y}^j) \mid \delta_j^*)] \Pr(\tilde{y}^j \mid d') - C(d') \geq U_0 \tag{11}$$
$$C(d) = \sum_{j=1}^{J} C_2(\delta_j^*) \Pr(\tilde{y}^j \mid d) + C_1(d) \text{ for all } d \in D \tag{12}$$
$$\delta_j^* \text{ is selected according to (9)}$$

Inequality (10) represents the incentive compatibility conditions. It says that the manager prefers to take decision d' given the incentive contract W, the distributions $\Pr(\tilde{y}^j \mid d)$, and the equilibrium hedging policy. (11) is the participation constraint. When $d' \in D$ satisfies these constraints it is implementable by the board, given compensation contract W. When disclosure is possible (and not necessarily mandatory), how is this problem altered if renegotiation follows? Proposition 1 states that disclosure cannot harm shareholders. A corollary offers some conditions under which shareholders are made strictly better off by the existence of hedging disclosure.

Proposition 1 *Suppose the manager would accept contract W and take decision d', if no disclosure were allowed. Then in equilibrium:*

1. *When project type j ($j = 1, \ldots, J$) is revealed to the manager, he takes hedging position δ_j^*, and discloses information (θ_j, δ_j^*) to the board.*

2. *The set of managerial decisions $d \in D$ that the board can induce the manager to take is the same with or without the information disclosure/renegotiation process taking place.*

3. *With disclosure and renegotiation, when a managerial decision is implementable by the board, the expected cost of doing so is never greater than without disclosure and renegotiation.*

Proof: Appendix A. The intuition lies in the fact that the board can insure the manager for the remaining risk after disclosure. This happens because at renegotiation the board predicts y as well as the manager, by updating its beliefs according to the new information learned. Knowing (θ, δ) amounts to knowing precisely the type of project at stake. At the renegotiation stage the board will manage to offer the updated certainty equivalent of the initial contract to the risk averse manager, knowing that it will be accepted in equilibrium. The benefit of disclosure and renegotiation to shareholders relies on reducing the expected cost of implementing managerial decisions.

The manager's utility will be higher for each possible project the firm may end up with, after having taken any decision $d \in D$ — therefore ex-ante the manager forecasts this, and the board can benefit by insuring him at the renegotiation stage, and actually paying him less. Because disclosure is not noisy there is no perverse consequence in terms of incentives given to the manager. When disclosure and renegotiation occur, the manager will not deviate from a decision he would have taken under W if disclosure had not taken place.[11]

A comment on out-of-equilibrium beliefs: if the board believes it is implementing a decision d for which the probability of project type j is zero, how does it react if it receives hedging-information (θ_j, δ_j) at time $t = 1$? The "reasonable" out-of-equilibrium in this case is to believe that project type j has actually been selected. In such case the renegotiation process follows as before, by offering the certainty equivalent of the manager's expected utility at that stage, conditional on project type j. This does not alter at all the result above and its proof. The following gives conditions under which shareholders strictly benefit from disclosure. **Proof**: Appendix A.

Corollary 1 *Suppose $U^{-1}(.)$ is strictly convex and in equilibrium decision d' is implemented with initial contract W. Suppose there exists one project type j for which $\Pr(\tilde{y}^j \mid d') > 0$ and: given δ_j^*, there exist at least two possible realizations (y_1 and y_2) of $\tilde{y}^j$ with positive density, and furthermore $W(y_1) \neq W(y_2)$. Then the expected gain from hedging-disclosure and renegotiation is strictly positive to shareholders.*

[11] Conditions (10) and (11) are unchanged.

3.2 A More Complex Case: Disclosure is "Uninformative"

In a more complex economy, business opportunities are such that there are projects with different expected returns ($R_j \neq R_k$), but the same exposure to hedgeable risk ($\theta_j = \theta_k$). The consequences of disclosure are not as clear as before. Even after disclosure about the risk exposure, information asymmetry still remains between the board of directors and the manager. Besides the level of risk exposure, the manager also knows the *precise* type of project[12], whereas the board can still be in doubt. This is what is meant by "uninformative" disclosure.

The asymmetry that persists is not due to the non-observability of the manager's decision d, but rather to the manager's subsequent knowledge of the project type. In this case the manager will still have incentives to disclose information, but it is not clear that shareholders will benefit from it. In fact shareholders may be worse off when there is disclosure. The manager himself could also be made worse off (in ex ante terms), but not disclosing information is not a time consistent option for him.

In this framework the "informativeness condition" (8), does not hold when there is disclosure of information and renegotiation, as opposed to the previous section. We **cannot** say that:

$$\theta_j = \theta_k \Rightarrow R_j = R_k$$

I no longer find results as those of proposition 1, where in general those managerial decisions that were implementable without disclosure, are also implementable at no greater cost when disclosure and renegotiation occur. An example illustrates the intuition of how the problem is changed. Suppose there are only two managerial decisions, i.e., $D = \{d, \hat{d}\}$, and three project-types, such that:

$$\begin{aligned} \tilde{y}^1 &= R_1 + \theta_1 \tilde{\varepsilon} & & \\ \tilde{y}^2 &= R_2 + \theta_1 \tilde{\varepsilon} & \qquad & R_1 \neq R_2 \\ \tilde{y}^3 &= R_3 + \theta_3 \tilde{\varepsilon} & \qquad & \theta_1 \neq \theta_3 \end{aligned}$$

Furthermore assume that if decision d is taken, project type 2 is for sure not obtained:

$$\begin{aligned} \Pr(\tilde{y}^1 \mid d) &> 0 \\ \Pr(\tilde{y}^2 \mid d) &= 0 \\ \Pr(\tilde{y}^3 \mid d) &> 0 \end{aligned}$$

[12]The manager also knows for sure R_j.

On the contrary, if decision $\hat{d}$ is taken, there is a positive probability of ending up with any project-type, i.e.:

$$\Pr(\tilde{y}^j \mid \hat{d}) > 0 \quad j = 1, 2, 3$$

Without disclosure of information the board induces the manager to take decision d if, when offering him contract $W(y)$, the following incentive compatibility and participation constraints are satisfied, as usual:

$$\begin{aligned} \Pr(\tilde{y}^1 \mid d)\{E[U(W(\tilde{y}^1)) \mid \delta_1^*] - C_2(\delta_1^*)\} + \\ \Pr(\tilde{y}^3 \mid d)\{E[U(W(\tilde{y}^3)) \mid \delta_3^*] - C_2(\delta_3^*)\} - C_1(d) \geq \\ \geq \sum_{j=1}^{3} \Pr(\tilde{y}^j \mid \hat{d})\{E[U(W(\tilde{y}^j)) \mid \delta_j^*] - C_2(\delta_j^*)\} - C_1(\hat{d}) \end{aligned} \tag{13}$$

$$\begin{aligned} \Pr(\tilde{y}^1 \mid d)\{E[U(W(\tilde{y}^1)) \mid \delta_1^*] - C_2(\delta_1^*)\} + \\ \Pr(\tilde{y}^3 \mid d)\{E[U(W(\tilde{y}^3)) \mid \delta_3^*] - C_2(\delta_3^*)\} - C_1(d) \geq U_0 \end{aligned} \tag{14}$$

where $\delta_j^*, j = 1, 2, 3$ satisfy condition (9). Now suppose that the manager does disclose information regarding risk exposure and hedging positions. If the board believes that it is implementing decision d when offering an initial contract W, what should it do after disclosure? In comparison to the case of informative disclosure, the difference arises when the manager discloses (θ_1, δ_1^*). If the board believes that the manager has taken decision d, then for sure the board can only gain by making a take-it-or-leave-it renegotiation offer, since it believes that the firm has project-type $j = 1$. If the manager took decision d he expects to earn at that point, without renegotiation:

$$E[U(W(\tilde{y}^1)) \mid \delta_1^*] = \int\int U[W(R_1 + \theta_1(1 - \delta_1^*)z + \theta_1 v)] f(z) g(v) dz dv$$

Then the board can offer its certainty equivalent, knowing that the manager will accept it:

$$U^{-1}\{E[U(W(\tilde{y}^1)) \mid \delta_1^*]\}$$

The difference is that now the board also has to consider a possible deviation of the manager: having taken decision $\hat{d}$, ending with project-type "*j=2*" and pretending that decision d has been taken and project-type "*j=1*" selected. This can clearly happen.

In the presence of disclosure there are now additional constraints in the board's program, if it wants to be sure to implement decision d when offering initial contract W. Condition (13) has to be adjusted so that the left hand side of the inequality stays the same, but the right hand side is replaced by:

$$[\Pr(\tilde{y}^1 \mid \hat{d}) + \Pr(\tilde{y}^2 \mid \hat{d})]\{\max(E[U(W(\tilde{y}^1)) \mid \delta_1^*], E[U(W(\tilde{y}^2)) \mid \delta_1^*]) + \\ -C_2(\delta_1^*)\} + \Pr(\tilde{y}^3 \mid \hat{d})\{E[U(W(\tilde{y}^3)) \mid \delta_3^*] - C_2(\delta_3^*)\} - C_1(\hat{d})$$

Notice the slight, but important, difference from the usual incentive compatibility condition. If the board wants to make sure it implements decision d it has to offer an initial contract W such that it is still better for the manager to choose d — considering that by taking $\hat{d}$ he might be offered at renegotiation the certainty equivalent of the utility derived from project type 1, even if having selected project type 2. This may constitute a more expensive contract for shareholders than what it would be if no disclosure and renegotiation were expected. The example just discussed is sufficient as a proof of the following proposition, which is the main result of the paper.

Proposition 2 *Disclosure can be harmful to shareholders and also to the manager - even if disclosing hedging-related information is his equilibrium choice. The set of implementable decisions when there is disclosure of risk-information and renegotiation, is not necessarily the same as it would be in the absence of disclosure. A managerial decision that is implementable in the absence of disclosure, may be non-implementable in the presence of disclosure. This could result in higher expected costs for shareholders in order to implement a desired managerial decision.*

In the example discussed adjustments on the right hand side of the incentive compatibility constraints had to be made. For a setting more general than this example, even more adjustments are made, also on the left hand side of the constraints[13].

Besides the differences pointed out above in the example, there are additional constraints to be considered. Even if $\Pr(\tilde{y}^2 \mid d) > 0$ there is still room for the manager to deviate and for disclosure to be noisy. The left hand side of the incentive compatibility (13) and participation (14) constraints would also have to be adjusted so that an initial contract W can implement d.

To make the example more general consider now that there is no shifting support of signals, i.e., $\Pr(\tilde{y}^2 \mid d) > 0$. Furthermore suppose to start

[13]Unlike Hermalin and Katz (1991).

with that $\delta_1^* \neq \delta_2^*$[14]. We are supposing that the board is capable of inducing decision d by offering W, in the absence of disclosure. Under such circumstances, at time $t = 1$ the manager expects utility: $E[U(W(\tilde{y}^j)) \mid \delta_j^*]$, if the firm faces project type $j = 1, 2, 3$. It is useful to define now U_j:

$$U_j \equiv E[U(W(\tilde{y}^j)) \mid \delta_j^*] - C_2(\delta_j^*)$$

And we assume that $U_1 > U_2$. Now suppose that disclosure is allowed, and occurs, being followed by renegotiation. If the board offers the same initial contract W and the firm ends up with project $j = 3$, then the renegotiation offer is as before, $U^{-1}[U_3 + C_2(\delta_3^*)]$. It is accepted and no complication arises. The problem occurs when (θ_1, δ_1^*) is disclosed. It can simply have happened that project $j = 2$ was selected and the manager tries to convince the board that it is type $j = 1$. If the board offers at renegotiation $U^{-1}[U_1 + C_2(\delta_1^*)]$, then in order to be sure it implemented decision d, the following constraint has to be added to the problem:

$$\begin{aligned}(\Pr(\tilde{y}^1 \mid d) + \Pr(\tilde{y}^2 \mid d))U_1 + \Pr(\tilde{y}^3 \mid d)U_3 - C_1(d) \geq \\ (\Pr(\tilde{y}^1 \mid \hat{d}) + \Pr(\tilde{y}^2 \mid \hat{d}))U_1 + \Pr(\tilde{y}^3 \mid \hat{d})U_3 - C_1(\hat{d})\end{aligned}$$

It is also natural to question the board's beliefs: why does it not offer the certainty equivalent of the worst of the two possibilities — $U^{-1}[U_2 + C_2(\delta_1)]$ — when the manager discloses (θ_1, δ_1)? It would seem that the board would still be able to benefit from "cheaper" managerial compensation after renegotiation for projects $j = 2, 3$, and would not be made worse off when $j = 1$. The problem in this case is credibility. If this is the board's policy, then the manager would choose δ_1^* when facing project type $j = 1$, and δ_2^* when facing project type $j = 2$. But then it would not be time consistent for the board to stick to his announced renegotiation policy. The board would again have incentive to make a renegotiation offer of $U^{-1}[U_1 + C_2(\delta_1^*)]$ after observing (θ_1, δ_1^*), and we are back at the starting point. The board's threat is not credible. Hence the additional constraint must be considered.

The final case to be examined is when $\delta_1^* = \delta_2^* = \delta^*$. The time inconsistency of the renegotiation offers discussed just now is not present. Again I assume that $U_1 > U_2$. If the board observes at $t = 1$: (θ_1, δ_1^*), after offering W at $t = 0$ in order to induce the manager to take decision d, then it must update its beliefs in the following way. Let P_1 (P_2) denote the updated probability of project type $j = 1$ ($j = 2$). It is defined as: $P_1 = \frac{\Pr(\tilde{y}^1|d)}{\Pr(\tilde{y}^1|d)+\Pr(\tilde{y}^2|d)}$, and $P_2 = 1 - P_1$.

[14] Where δ_j^* derives from (9), as usual.

Before making the renegotiation offer, the board expects to pay the manager: $P_1 E[W(\tilde{y}^1) \mid \delta^*] + P_2 E[W(\tilde{y}^2) \mid \delta^*]$. At the renegotiation stage, the board will make one of two offers: $U^{-1}[U_1 + C_2(\delta^*)]$ or $U^{-1}[U_2 + C_2(\delta^*)]$. In case the former offer is made, the manager will accept it, both if the project is type $j = 1$ or $j = 2$. The board must balance the benefit it gets from reducing the expected payment in case the project really is $j = 1$, with the possibly more expensive "safe" renegotiation contract than the risky one W, in case the project is actually $j = 2$. If the latter renegotiation contract is offered, then it is only accepted by the manager if the project is $j = 2$, in which case the board benefits from "insuring" the manager. If the project is $j = 1$, then the manager rejects the new offer. When, in equilibrium, the board offers the latter contract, then we recover the benefits of disclosure and renegotiation.

From the arguments presented, it results that disclosure of hedging-information can complicate the incentive scheme that shareholders need to offer in order to make the manager take a certain decision. This is reflected in additional constraints that can lead to more expensive contracts faced by shareholders. However it is possible to find a set of sufficient conditions under which disclosure followed by renegotiation results in an improved relationship between both parties in the firm. These conditions are stated next.

Proposition 3 *Suppose $d \in D$ is implemented with initial contract W if no disclosure were allowed. Suppose also that $\Pr(\tilde{y}^j \mid d) > 0 \ \ \forall j$. Suppose there are only two project types such that $R_j \neq R_k$, $\theta_j = \theta_k$, and $\delta_j^* = \delta_k^*$, and also $U_j > U_k$.*

The board can still implement d, at no higher cost, when there is disclosure and renegotiation if: when (θ_j, δ_j^*) is disclosed, the board offers at renegotiation the certainty equivalent of the lowest of the levels of expected utility that the manager could be facing: $U^{-1}[U_k + C_2(\delta_j^*)]$. This happens in equilibrium if $P_j E[W(\tilde{y}^j)] + P_k U^{-1}[U_k + C_2(\delta_j^*)] \geq U^{-1}[U_j + C_2(\delta_j^*)]$.

Proof: Appendix A. Summarizing, under "uninformative" disclosure, which can result in persistence of information asymmetry between the board and the manager — *even* after disclosure — renegotiation may reduce the set of implementable managerial decisions, or make them more "expensive". It is not true that shareholders benefit in general from receiving additional information and making offers in renegotiation. Still there are conditions under which the benefits of disclosure can be found even under the "uninformative" condition. These depend on the credibility of the renegotiation offers and the updated beliefs of the board, and were characterized in the final result presented.

4 Concluding Remarks

This paper discusses the effects on shareholder value, on management's utility, on project selection, and on risk management policies, of disclosure of information about risk exposure and hedging activities. This is done in light of the current debate on hedge accounting.

In a different setting, DeMarzo and Duffie (1995) also address the information effect of financial risk management. In that framework financial hedging improves the informativeness of earnings as a signal of management ability and project quality, by eliminating extraneous noise. Managerial and shareholder incentives regarding information disclosure may differ, resulting in conflicts about optimal hedging policy. These incentives depend on the accounting information made available by the firm. DeMarzo and Duffie (1995) show that under some circumstances, if hedge transactions are not disclosed, managers concerned with their careers hedge in order to achieve greater risk reduction than what they would obtain if full disclosure were required — making it optimal for shareholders to request aggregate accounting reports, rather than discriminated. In their model manager and shareholders are equally informed about managerial ability but managers are better informed about sources and magnitude of risks the firm faces. This last aspect is also considered in this chapter. They reach the controversial conclusion that, given the convex nature of the shareholders' objective and the concave nature of the manager's, non-disclosure is "more informative" than disclosure. They find that managers may prefer a regime of disclosure in order not to hedge and disclose nothing.

In the model above I examine the same type of problem as DeMarzo and Duffie, as I consider issues relating to hedging disclosure when conflicting interests exist between shareholders and managers. However, in this paper, the manager plays an active role in both influencing the "production technology" of the firm and choosing hedging positions in some available financial security. This is the reason for the relevance of proprietary information in this framework. The hedging disclosure policy that most benefits shareholders depends clearly on the complexity of the underlying business opportunities.

Besides, and much in the spirit of the current accounting rules for hedge accounting, the manager in this model has the opportunity of choosing (on a case-by-case basis) whether to disclose or not information regarding risk exposure and hedging. As in DeMarzo and Duffie (1995) I consider disclosure to be credible (shareholders, or the board are able to "observe" this).

As a benchmark, I find that if the disclosed hedging-information is sufficiently informative — in the sense that it removes the information asymmetry between the manager and shareholders — disclosure will be chosen by the manager *in equilibrium*, and both manager and shareholders benefit from it, since they are able to provide insurance to the risk averse manager after he discloses; this results in inducing the same managerial decisions as if no hedging disclosure occurred, in a less costly way.

For a more complex investment set, probably closer to reality, the manager may still possess superior information regarding the firm's future performance, even after disclosure occurs. Under these circumstances I find that it is possible that the shareholders' preferred decisions — which perhaps were implementable in case no disclosure occurred — are no longer implementable, or are still implementable but at a higher cost, when there is renegotiation. In such situations, shareholders would prefer non-disclosure of information regarding risk exposure to information disclosure. The difficulty with disclosure here is that the manager expects renegotiation to occur, and can behave accordingly in a strategic way. He always has an incentive to disclose information at $t = 1$. Although ex ante even the manager might be better off from not disclosing information at $t = 1$, this would not be dynamically consistent. Conditions are3 also offered for the benefits of disclosure and renegotiation to be recovered, even if disclosure is noisy.

Appendix A - Proofs

A.1 Proof of Proposition 1

The proof follows a sequence of steps. (i) Without renegotiation, for a certain initial contract $W(y)$, and subsequent $\delta^*(W)$, an implementable decision $d^{'}$ satisfies incentive compatibility and participation constraints (10)–(11). If the manager has taken decision $d^{'}$ and the firm ended up with a project type j, this means that the firm faces risk exposure θ_j and hedges δ_j^*, according to (9).

(ii) Now consider disclosure. If the manager discloses information (θ_j, δ_j^*) at time $t = 1$, the board learns as well as the manager what is the density of y conditional on (θ_j, δ_j^*), given condition (8). By that stage, under the initial contract, the manager would expect utility[15]:

$$E_{t=1}[U \mid \text{NR}] = \int \int U[W(R_j + (1 - \delta_j^*)\theta_j z + \theta_j v)] f(z) g(v) dz dv$$

where NR stands for "No Renegotiation". The board knows that if disclosure were to occur, it could offer at renegotiation the certainty equivalent of this $E[U \mid \text{NR}]$. So, after the manager discloses the information, the board can insure him. The manager chooses δ_j^* according to (9), in order to maximize expected utility (the difference between expected utility of this certainty equivalent and $C(d^{'})$) — has no incentive to deviate to some $\delta_j \neq \delta_j^*$. This proves the first part of the proposition.

(iii) Looking backwards at the problem, when choosing $d^{'}$, the manager knows already that if disclosure and renegotiation occur he can get, in expected terms, at the initial stage:

$$E_{t=0}[U_M \mid d^{'}, \text{DR}] =$$

$$\sum_{j=1}^{J} \Pr(\tilde{y}^j \mid d^{'}) U\{U^{-1}[\int \int U[W(R_j + (1 - \delta_j^*)\theta_j z + \theta_j v)] f(z) g(v) dz dv]\}$$

$$-C(d^{'})$$

where $C(d^{'})$ is defined as in (12); and DR stands for "Disclosure followed by Renegotiation". The last expression we found is the same as in (10)–(11). Therefore the set of constraints that an implementable managerial decision

[15] Having already incurred in $C_2(\delta_j^*)$.

has to satisfy in the presence of disclosure is the same. This proves the second part of the proposition.

(iv)To prove the third part note that, in order to implement decision $d^{'} \in D$, the board of directors expects at time $t = 0$ to pay the manager:

- Without Disclosure/Renegotiation:

$$\sum_{j=1}^{J} \Pr(\tilde{y}^j \mid d^{'})[\int\int W(R_j + (1-\delta_j^*)\theta_j z + \theta_j \upsilon) f(z) g(\upsilon) dz d\upsilon] \quad (15)$$

- With Disclosure and Renegotiation:

$$\sum_{j=1}^{J} \Pr(\tilde{y}^j \mid d^{'}) U^{-1}[\int\int U[W(R_j + (1-\delta_j^*)\theta_j z + \theta_j \upsilon)] f(z) g(\upsilon) dz d\upsilon] \quad (16)$$

Since (15) can be rewritten as $\sum_{j=1}^{J}[\Pr(\tilde{y}^j \mid d^{'})[\int\int U^{-1}\{U[W(R_j + (1-\delta_j^*)\theta_j z + \theta_j \upsilon)] f(z) g(\upsilon) dz d\upsilon\}$ then, by Jensen's Inequality (15) $\geq$ (16). This completes the proof. □

A.2 Proof of Corollary 1:

Take into account the proof of proposition 1. Rewrite (15) as:

$$\Pr(\tilde{y}^1 \mid d^{'}) \int\int U^{-1}\{U[W(R_1 + (1-\delta_1^*)\theta_1 z + \theta_1 \upsilon)]\} f(z) g(\upsilon) dz d\upsilon +$$

$$+ \Pr(\tilde{y}^J \mid d^{'}) \int\int U^{-1}\{U[W(R_J + (1-\delta_J^*)\theta_J z + \theta_J \upsilon)]\} f(z) g(\upsilon) dz d\upsilon \quad (17)$$

and (16) as:

$$\Pr(\tilde{y}^1 \mid d^{'}) U^{-1}\{\int\int U[W(R_1 + (1-\delta_1^*)\theta_1 z + \theta_1 \upsilon)] f(z) g(\upsilon) dz d\upsilon\} +$$

$$+ \Pr(\tilde{y}^J \mid d^{'}) U^{-1}\{\int\int U[W(R_J + (1-\delta_J^*)\theta_J z + \theta_J \upsilon)] f(z) g(\upsilon) dz d\upsilon\} \quad (18)$$

We already know from the proof of Proposition 1 that (17) $\geq$ (18). Under the conditions stated in the Corollary, it is easy to understand that at least for one $j \in \{1, \ldots, J\}$ of the J terms of (17) and (18) it is true that:

$$\Pr(\tilde{y}^j \mid d^{'}) \int\int U^{-1}\{U[W(R_j + (1-\delta_j^*)\theta_j z + \theta_j \upsilon)]\} f(z) g(\upsilon) dz d\upsilon >$$

$$> \Pr(\tilde{y}^j \mid d^{'}) U^{-1}\{\int\int U[W(R_j + (1-\delta_j^*)\theta_j z + \theta_j \upsilon)] f(z) g(\upsilon) dz d\upsilon\}$$

For all other $(J-1)$terms at least we have (17) $\geq$ (18). Therefore overall (17) $>$ (18). This completes the proof. □

A.3 Proof of Proposition 3:

The proof is straightforward. Because $Pr(\tilde{y}^j \mid d) > 0, \forall j$ the initial problems identified in the example of section 3.2 are avoided. Moreover, having $\delta_j^* = \delta_k^*$ avoids the time inconsistency problem of offering at renegotiation the lowest of the two possible certainty equivalents to the expected utility of the manager at that stage.

For those project types l that have unique levels of exposure, the renegotiation offers after disclosure are as in the previous propositions (i.e., $U^{-1}[U_l + C_2(\delta_l^*)]$), which is cheaper in expected terms for the board than $\int\int W(R_l + (1-\delta_l^*)\theta_l z + \theta_l \upsilon) f(z) g(\upsilon) dz d\upsilon$.

Before the renegotiation offer, the board would expect to pay at time $t = 1$: $P_j E[W(\tilde{y}^j)] + P_k E[W(\tilde{y}^k)]$. If it offers $U^{-1}[U_j + C_2(\delta_j^*)]$, then the manager accepts this for both project j and k because $U_j > U_k$. If so, the expected payment for the board is $U^{-1}[U_j + C_2(\delta_j^*)]$. If it makes an offer $U^{-1}[U_k + C_2(\delta_j^*)]$, then the manager only accepts it when the project is k. The expected payment made by the board is: $P_j E[W(\tilde{y}^j)] + P_k U^{-1}[U_k + C_2(\delta_j^*)]$. Under the conditions of the proposition the board offers the second alternative in equilibrium, which leaves the constraints unaltered, when compared to the no disclosure setting. This completes the proof. □

Appendix B - Time Line of Events

Figure 1: Time Line of Events when there is no disclosure of information.

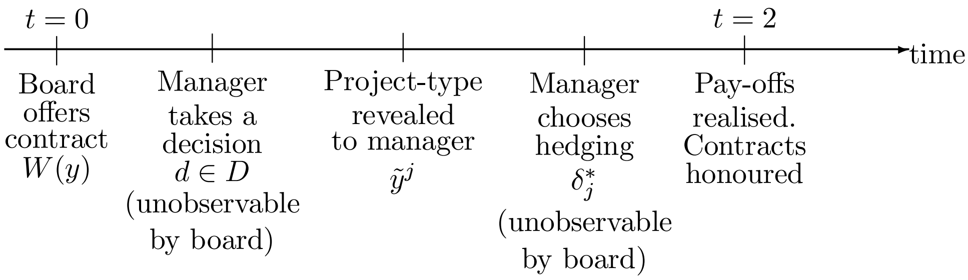
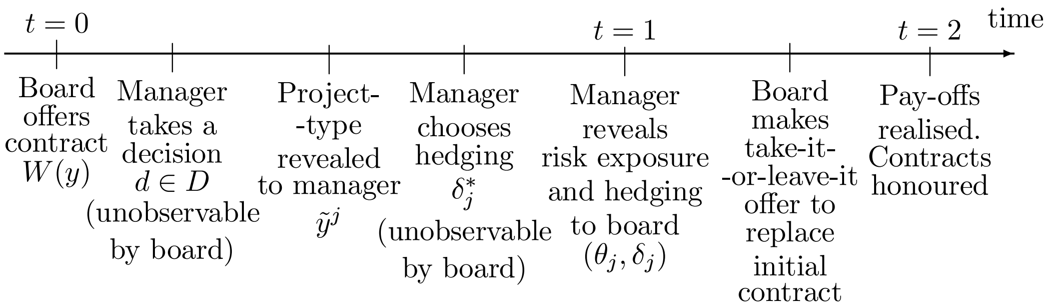


Figure 2: Time Line of Events when disclosure of information regarding risk exposure and hedging occurs.



Appendix C - Glossary

Table 1: Glossary for Chapter 2

$\tilde{y}^j = R_j + (1-\delta_j)\theta_j\tilde{z} + \theta_j\tilde{v}$	cash flow of project type j
R_j	expected cash flow of project type j
θ_j	natural exposure to risk of project type j
δ_j	hedging position of project type j
$\tilde{z}$	hedgeable risk
v	unhedgeable risk
$\delta = (\delta_1, \ldots, \delta_J)$	vector of hedging positions
d	managerial decision
D	set of managerial decisions
$\Pr(\tilde{y}^j \mid d)$	probability of project type j given decision d
$U_B(d, \delta, W)$	expected utility of board of directors
$W(\tilde{y})$	managerial compensation contract
$U_M(d, \delta, W)$	expected utility of manager
$U(W)$	manager's income-derived utility
$C(d)$	manager's disutility of decision d
$C_1(d)$	fixed component of private cost
$C_2(\delta_j)$	disutility of δ_j-hedging project type j

References

1. Amihud, Yakov and Baruch Lev, 1981, "Risk Reduction as a Managerial Motive for Conglomerate Mergers", *The Bell Journal of Economics*, 12, Autumn, 605–617

2. Anderson, Ronald W. and Jean-Pierre Danthine, 1980, "Hedging and Joint Production: Theory and Illustrations", *The Journal of Finance*, v.35, N.5, 487–498

3. Anderson, Ronald W. and Jean-Pierre Danthine, 1981, "Cross Hedging", *Journal of Political Economy*, v.89, N.6, 1182–1196

4. Anson, M. J. P., 1996, "Recent Corporate and Pension Plan Initiatives

in Derivatives Risk Management", *The Journal of Financial Engineering*, v.5, N.4, 303–315

5. Breeden, D. and Viswanathan, 1996, "Why do Firms Hedge?", working paper, Duke University

6. Campbell, Tim S. and William A. Kracaw, 1987, "Optimal Managerial Incentive Contracts and the Value of Corporate Insurance", *Journal of Financial and Quantitative Analysis*, v.22, N.3, 315–328

7. DeGeorge, Moselle and Zeckhauser, 1996, "Hedging or Gambling: when Informing the Market", CEPR Discussion Paper No. 1520

8. DeMarzo, Peter and Darrell Duffie, 1991, "Corporate Financial Hedging with Proprietary Information", *Journal of Economic Theory*, 53, 261–286

9. DeMarzo, Peter and Darrell Duffie, 1995, "Corporate Incentives for Hedging and Hedge Accounting", *The Review of Financial Studies*, v.8, N.3, 743–771

10. *The Economist*, "A Survey on Corporate Risk Management", 1996, February, v. 338, N. 7952,

11. Feder, Gershon, Richard E. Just and Andrew Schmitz, 1980, "Futures Markets and the Theory of the Firm under Price Uncertainty", *Quarterly Journal of Economics*, 94, March, 317–328

12. Financial Accounting Standards Board, 1980, "Foreign Currency Translation", SFAS No. 52

13. Financial Accounting Standards Board, 1984, "Accounting for Futures Contracts", SFAS No. 80

14. Financial Accounting Standards Board, 1990, "Disclosure of Information about Financial Instruments with Concentration of Credit Risk", SFAS No. 105

15. Financial Accounting Standards Board, 1991, "Disclosure about Fair Value of Financial Instruments", SFAS No. 107

16. Financial Accounting Standards Board, 1994, "Disclosure about Derivatives Financial Instruments and Fair Value of Financial Instruments", SFAS No. 119

17. Financial Accounting Standards Board, June 1996, "Accounting for Derivatives and Similar Financial Instruments and for Hedging Activities", Proposed SFAS

18. Financial Accounting Standards Board, December 1996, "Exemption from Certain Required Disclosures about Financial Instruments for Certain Non-Public Entities — an Amendment to FAS No. 107, SFAS No. 126

19. Francis, Jennifer, 1990, "Accounting for Futures Contracts and the Effect on Earnings Variability", *The Accounting Review*, 591–614

20. Froot, K. A., D. S. Scharfstein and J. C. Stein, 1993, "Risk Management: Co-ordinating Corporate Investment and Financing Policies", *The Journal of Finance*, v.48, N.5, 1629–1658

21. Fudenberg, Drew and Jean Tirole, 1990, "Moral Hazard and Renegotiation in Agency Contracts", *Econometrica*, v.58, N.6, 1279–1319

22. Grossman, Sanford J. and Oliver D. Hart, 1983, "An Analysis of the Principal-Agent Problem", *Econometrica*, v.51, N.1, 7–45

23. Hermalin, Benjamin E. and Michael L. Katz, 1991, "Moral Hazard and Verifiability: the Effects of Renegotiation in Agency", *Econometrica*, v.59, N.6, 1735–1753

24. Herz, Robert H., 1994,"Hedge Accounting, Derivatives and Synthetics: The FASB Starts Rethinking the Rules", *Journal of Corporate Accounting and Finance*, 5, 323–335

25. Ho, Thomas S. Y. and Anthony Saunders, 1983, "Fixed Rate Loan Commitments, Take-Down Risk, and the Dynamics of Hedging with Futures", *Journal of Financial and Quantitative Analysis*, 18, December, 499–516

26. Holmstrom, Bengt, 1979, "Moral Hazard and Observability", *The Bell Journal of Economics*, 10, 74–91

27. Holthausen, Duncan M. 1979, "Hedging and the Competitive Firm under Price Uncertainty", *The American Economic Review*, 69, December, 989–995

28. Lessard, Donald R. 1990, "Global Competition and Corporate Finance in the 1990s",*Continental Bank Journal of Applied Corporate Finance*, 1, 59–72

29. Lewent, Judy C. and A. John Kearney, 1990, "Identifying, Measuring and Hedging Currency Risk at Merck", *Continental Bank Journal of Applied Corporate Finance*, 2, 19–28

30. Pereira, V., R. Paterson and A. Wilson, 1994, 'A Comparison Between UK and US Accounting Principles', Ernst & Young

31. Ramakrishnan, Ram T. S. and Anjan V. Thakor, 1984, "The Valuation of Assets under Moral Hazard", *The Journal of Finance*, v.39, N.1, 229–238

32. Rawlls,III, S. Waite and Charles W. Smithson, 1990, "Strategic Risk Management", *Continental Bank Journal of Applied Corporate Finance*, 1, 6–18

33. Rolfo, Jacques, 1980, "Optimal Hedging under Price and Quantity Uncertainty: The Case of a Cocoa Producer", *Journal of Political Economy*, 88, February, 100–116

34. Singleton, J. Matthew, 1993, "Hedge Accounting: a State-of-the-Art Review", in '*Advanced Strategies in Financial Risk Management*' eds. Schwartz and Smith, 579–589

35. Smith, C. W. and R. Stulz, 1985, "The Determinants of Firms' Hedging Policies", *Journal of Financial and Quantitative Analysis*, v.20. N.4, 391–405

36. Stewart, John E., 1989,"The Challenges of Hedge Accounting", *Journal of Accountancy*, November, 48–60

37. Stulz, René, 1984, "Optimal Hedging Policies", *Journal of Financial and Quantitative Analysis*, 19, 127–140