Implications of Executive Hedge Markets for Firm Value Maximization*

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Abstract

This paper analyzes the incentive implications of executive hedge markets. The manager can promise the return from his shares to third parties in exchange for a fixed payment—swap contracts—and/or he can trade a customized security correlated with his firm-specific risk. The customized security improves incentives by diversifying the manager's firm-specific risk. However, unless they are exclusive, swap contracts lead to a complete unraveling of incentives. When security customization is sufficiently high, the manager only trades the customized security—but not any non-exclusive swap contracts, and incentives improve. Access to highly customized hedge securities and/or exclusive swap contracts increases the manager's pay-performance sensitivity.

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1 Introduction

Stock-based compensation for corporate executives increased at drastic rates in the United States during the 1990s.[1] According to the agency theory of optimal contracting, stock-based pay provides the manager with the correct incentives to maximize shareholder value, because it ties the manager's compensation to firm performance. Modern portfolio theory, however, also should apply to corporate managers (Ofek and Yermack (2000)). A manager who has excessive exposure to his firm value also has an incentive to hedge this exposure by trading with third parties. Somewhat parallel with the rise in stock-based pay, a sizable market for managerial hedging emerged in the late 1990s. Investment banks and derivatives securities dealers developed and introduced sophisticated financial instruments, like executive equity swaps, basket hedges, and zero-cost collars, enabling the managers to hedge their stock ownership positions (Bettis et al. 2001).

Because of lax disclosure rules and the managers' own incentives not to attract too much market attention, these hedging transactions have been quite private.[2] The workings of this new market, and especially its implications for shareholder value maximization, are little understood. The general view on executive hedging practices, mostly shaped by the business press and scholarship in the legal profession, is negative.[3] It is argued that if the managers have unrestricted access to financial markets, they will hedge the performance incentives in their compensation schemes, rendering the incentive justification for managerial stock ownership invalid (Bank (1995), and Easterbrook (2002)). Despite the lack of any formal analysis, the negative view almost takes it as given that the whole practice of executive hedging serves to undo incentives.

In this paper, we formally address the issue of whether executive hedging is necessarily detrimental to incentives. To this end, we introduce executive hedge markets into an optimal contracting framework and analyze the implications of these markets for shareholder value maximization. We consider a standard agency model in which the shareholders optimally choose the sensitivity of their manager's pay to firm value (pay-performance sensitivity) to provide incentives, interpreted as costly managerial effort. After his compensation package is set, but before supplying effort, the risk averse manager can trade with third parties

[1] According to Morgenson (1998), in the late 1990s, the 200 largest U.S. companies had reserved more than 13 percent of their common shares for compensation awards to managers, up from less than 7 percent in 1990.

[2] The case of Autotote CEO equity swap, studied by Bolster et al. (1996), is an example of this secrecy. This was the only transaction reported to the SEC in 1994. Gregg Ip (1997) reports that the level of disclosure of such hedging transactions is far below the actual level (WSJ, September 17, 1997). Lavalle (2001) reports only 31 disclosed transactions in 2000, up from 15 in 1996. Among them were some big names in the high tech sector, including Microsoft co-founder Paul G. Allen.

[3] An editorial in *The Economist*, ('Executive Relief' April 3, 1999, p.64) takes the following view: 'Further justifying the scepticism is the current popularity of derivatives that allow managers to hedge their exposure to their own company's shares. [...] Such hedging is wholly against the spirit of the massive awards of shares and share options.'

(financial intermediaries). The key feature in our approach is distinguishing between the incentive implications of different types of side contracts. In our model, the manager can engage in two different side contracts to hedge his compensation risk: he can promise the return from his shares to third parties in exchange for a fixed payment (swap contracts), and/or he can trade a financial security whose payoff is correlated with his firm-specific risk. We refer to this second type of side contract as a *customized* hedge security: a higher correlation with firm-specific risk implies a higher degree of customization.

The analysis of these two types of side contracts, when they do not co-exist, yields the following implications for the manager's incentives.

- A customized hedge security enables the manager to diversify the firm-specific risk without undoing the link between his wealth and firm performance. Furthermore, for higher customization, the manager can diversify a larger fraction of the risk. As a result, because the randomness in the contract diminishes, customized hedging renders stock based compensation a less costly incentive device. Therefore, in equilibrium, the manager's pay-performance sensitivity—and hence the manager's effort—are increasing in the customization of the hedge security.

- Swap contracts, however, can potentially weaken the link between the firm value and the manager's wealth by simulating sale of the manager's shares. The manager's equilibrium trade in the swap market depends on whether swap contracts are exclusive or non-exclusive.

  - If the swap contracts are *exclusive*, (i.e., the manager can be restricted to trade only one swap contract), then the availability of swaps is irrelevant for equilibrium effort incentives. The main intuition for this result is as follows: the intermediary offers a contract that accounts for the manager's equilibrium effort level. In other words, the intermediary shares the manager's risk in exactly the same way as the shareholders. As a result, the shareholders find it in their best interest to sell the firm to the manager and to let the intermediary share the manager's risk. Thus, the equilibrium effort remains the same as would obtain in the absence of exclusive swap contracts.
  - If the swap contracts are *non-exclusive* (i.e., the manager cannot be prevented from trading swaps with other intermediaries), depending on parameter values the equilibrium will involve either full unraveling, with the manager swapping all his shares, or no swap trade. Full unraveling (no swap trade) occurs when the firm-specific risk/manager's risk aversion is sufficiently high (low) compared to the sensitivity of expected firm value to the manager's share ownership. After full unraveling, the manager expends no effort.

These results indicate that the manager's ability to trade a customized hedge security improves equilibrium effort incentives. On the other hand, unless they can be made exclusive, swap contracts lead to a complete unraveling of effort incentives when the firm specific risk/manager's risk aversion is sufficiently high. We then analyze how the manager chooses to hedge if both a customized hedge security and non-exclusive swap contracts are available. We find that

- if the customization of the hedge security is above a certain threshold, the manager only trades the customized security and does not trade any non-exclusive swap contracts. With sufficiently high customization, the manager is able to diversify a large fraction of his firm-specific risk. Since his compensation contract now exposes him to less risk, unwinding exposure by non-exclusive swap contracts becomes a less attractive hedging alternative. If the security customization is lower than this threshold, however, the manager completely swaps all share ownership, does not trade the customized security, and expends no effort.

Our analysis, therefore, identifies two important characteristics of executive hedge markets that are relevant for their equilibrium incentive implications: (1) the legal structure/contract enforceability that determines the degree to which the swap contracts can be made exclusive, and (2) the level of security customization that hedge markets can provide. In particular, the analysis illustrates that

- if swap contracts can be made exclusive because of high degree of contract enforceability, then the manager's hedge market access will improve effort incentives for any positive level of security customization. Lack of exclusivity in swap contracts is of no concern, and equilibrium effort is still higher than with no hedging, if the financial intermediaries can provide the manager with sufficiently high customization. The concern that hedge market access will lead the managers to undo their performance incentives is valid, and firms should prevent their access, precisely when the financial intermediaries can offer only low security customization, *and* exclusivity in swap contracts is not enforceable.

We also show that the emergence of hedge markets that can offer exclusive swap contracts, and/or provide high security customization, increases the manager's pay-performance sensitivity. With exclusive swap contracts, the shareholders sell the firm to their manager and leave the provision of insurance to the hedge market. On the other hand, if contract enforceability is poor—so that swap contracts are non-exclusive—but the hedge market provides sufficiently high security customization, then the shareholders anticipate that the manager only engages in customized hedging, which reduces the randomness in his compensation contract. Because a given level of pay-performance sensitivity now exposes the manager to less

risk and requires a lower risk premium, the shareholders optimally increase the manager's pay-performance sensitivity in order to elicit more effort.

The novelty of our analysis lies in distinguishing between the incentive implications of different side contracts and in explicitly modeling the manager's portfolio choices in the hedge market. Along with instruments that simulate the sale of their shares (swaps), corporate executives have access to derivative securities based not on their own company stock but rather on a hybrid combination of securities customized to track the value of their stock (Schizer (2000)). This distinction allows us to illustrate the possibility that managerial hedge markets do not necessarily serve to undo performance incentives, but can improve equilibrium incentives by providing the manager with the ability to reduce the randomness in his compensation contract.[4]

In our model, the level of security customization is an exogenous feature of the financial market: it refers to the ease with which financial intermediaries can offer portfolio opportunities correlated with the manager's firm risk. The more customized is this portfolio opportunity, the more firm-specific risk the manager can diversify. In a simple extension, we also allow for the possibility that the manager can engage in wasteful risk reduction (or under-investment in risk) activities at the firm level, like avoiding profitable risky projects, or undertaking inefficient asset acquisitions to lower the firm-specific risk.[5] We show that, with no customized hedging opportunities, share ownership gives the manager an incentive to achieve portfolio diversification through inefficient risk reduction at the firm level. The availability of a customized hedge security mitigates the manager's inefficient risk reduction incentives. Accordingly, our analysis predicts that, if the managers pursue inefficient risk reduction strategies because of their inability to diversify their compensation risks, then the availability of customized hedge securities should result in riskier policies at the firm level.

1.1 Related Literature

The literature analyzing corporate agency problems when managers have access to hedge markets is quite recent. Jin (2002), Garvey and Milbourn (2003), Acharya and Bisin (2005) all study agency settings in which the managers can trade the market index and therefore can diversify only *the systematic risk* in their compensation. These papers by assumption preclude the manager's ability and incentives to diversify the firm-specific risk exposure. In practice, though, most of the managerial hedging instruments grant managers the ability to diversify firm-specific risks (Bettis et al. (2001)). The popular business press coverage of the

[4]This feauture also distinguishes the paper from Garvey (1993), Bisin et al (2006) and Ozerturk (2006) which focus only on side trades contingent on the manager's own firm value.

[5]This is well documented in the empirical corporate finance literature linking the corporate risk management policies to managerial diversification motives (Amihud and Lev (1981), May (1995), and Tufano (1996)). We further discuss the empirical evidence that supports inefficient risk reduction by managers in Section 4.

issue and studies in the legal profession also have expressed concern about the manager's ability to diversify the firm-specific risks rather than the systematic risk.[6]

In recent independent work, Bisin et al. (2006) also allow the manager to hedge his compensation risk in a standard effort type moral hazard setting. Unlike in this paper, these authors do not distinguish between the incentive implications of different hedging transactions. They implicitly assume that the manager can hedge only in a way that undoes the performance incentives in his compensation. In other words, by construction hedging is always detrimental to managerial incentives in Bisin et al. (2006). The shareholders in their model prevent the manager from hedging by costly monitoring of his portfolio, which results in an equilibrium without hedging.

The manager's access to a hedge market introduces non-exclusivity to the agency setting. This is related to a body of work that studies environments in which the agent can make non-exclusive contracts with multiple principals for the same moral hazard activity (see Kahn and Mookherjee (1995, 1998) and Bisin and Guaitoli (2004) on implications for insurance and credit markets; Bisin and Rampini (2006) for taxation without commitment; Bizer and DeMarzo (1992) on implications for banking; Parlour and Rajan (2001) for loan contracts from multiple creditors; Bizer and DeMarzo (1999) for a principal-agent model with borrowing and default, and Allen (1985) for repeated borrowing and lending). Our paper contributes to this literature by analyzing an application in optimal managerial compensation.[7]

The plan of the paper is as follows. The next section lays out the basic model. Section 3 presents the analysis and contains our main results. Section 4 considers an extension whereby the manager can engage in inefficient risk reduction at the firm level. Section 5 provides a summary and discusses the implications of the analysis. Section 6 concludes.

2 The Model

The basic model is based on the standard CARA-normal principal-agent model with linear contracts and is detailed below.

Agents, Preferences and Technology. We consider an all equity financed firm, owned by risk neutral shareholders, and run by a manager. The shareholders maximize the expected value of the firm net of the manager's compensation. The manager is risk averse,

[6]Schizer (2000, p.453) argues that the concern about managerial hedging does not apply to hedges that screen out market risk: 'Such a hedge is a bet that the manager will outperform the market, and if anything, would intensify an executive's motivation and incentives.'

[7]With this application, we also complement the empirical work by Ofek and Yermack (2000) and Antle and Smith (1986) who argue that the optimal contracting models should take into account a manager's hedging opportunities. This is also in line with Stulz (1984, p. 139) who suggests: 'It would be interesting to show how the choice of the management compensation schemes depends on the opportunities managers have to hedge.'.

and has constant absolute risk aversion—CARA—preferences represented by the utility function $u : \mathbb{R}_+ \mapsto \mathbb{R}$ specified as

$$u(w) = -\exp\{-aw\}.$$

The parameter $a > 0$ is the manager's coefficient of absolute risk aversion, and w is his final wealth. The manager expends effort $e \in [0, \bar{e}] \subset \mathbb{R}_+$ that increases the expected firm value. The firm value is a random variable $\tilde{y}$ determined by

$$\tilde{y} := f(e) + \tilde{\varepsilon},$$

where the function $f : [0, \bar{e}] \mapsto \mathbb{R}_+$, represents the productivity of effort. We specify f as $f(e) = \gamma e + \delta$, where $\gamma, \delta > 0$ are constants. The firm-specific risk $\tilde{\varepsilon}$ is a random variable normally distributed with mean 0 and variance σ_ε^2. Hence, given e, the firm value is normally distributed with mean $f(e)$ and variance σ_ε^2.[8] We denote the realizations of $\tilde{y}$ and $\tilde{\varepsilon}$, by y and ε, respectively. Supplying effort is costly for the manager. The manager's cost of effort is specified by a function $c : [0, \bar{e}] \mapsto \mathbb{R}_+$, defined as $c(e) = \frac{1}{2}e^2$.

Linear Contracts. The manager's choice of effort is not observable, and hence he cannot be compensated directly contingent on e. The shareholders use compensation in the form of managerial share ownership to provide the manager with effort incentives. We restrict attention to linear compensation contracts described by a pair (t, s) where t is a fixed wage, and s is the manager's share of the firm value. In what follows, we refer to s as the manager's pay-performance sensitivity.[9]

Hedge Markets. After his compensation package is set by the shareholders, but before he supplies effort, the manager can trade with third parties such as financial intermediaries or derivatives securities dealers. In particular, we assume that the manager is able to trade two different types of side contracts: he can trade

(**1**) contracts based on a customized hedge security whose payoff is correlated with the firm-specific risk $\tilde{\varepsilon}$, and
(**2**) contracts contingent on the firm value $\tilde{y}$—swap contracts.

Below, we give a detailed description of how these side transactions are structured.

[8] Section 4 considers a variant of this specification, where the manager also chooses an action other than the standard effort parameter that affects the variance.

[9] Linear compensation schemes are popular in the literature mostly because of their analytical tractability, yet they have practical relevance as well. Following Jensen and Murphy (1990), empirical tests often convert option ownership into "equivalent" stock ownership using Black-Scholes formula.

2.1 Customized Security

The financial intermediaries are endowed with the expertise to provide the manager with a tailored financial security whose payoff is correlated with the manager's firm-specific risk $\tilde{\varepsilon}$. Let $\tilde{b}$ represent the payoff of the security, and assume that $\tilde{b}$ is normally distributed with mean μ_b and variance σ_b^2. Critically, the security payoff $\tilde{b}$ is *customized* in the sense that it is correlated with the manager's firm-specific risk $\tilde{\varepsilon}$ according to a correlation coefficient

$$\rho = \mathsf{corr}\big(\tilde{b}, \tilde{\varepsilon}\big) \in [-1, 1].$$

For convenience, let us define $z := \rho^2 \geq 0$. As the analysis illustrates shortly, z measures the effectiveness of the security as a hedge instrument: the higher the correlation of the security payoff with firm-specific risk, the more firm-specific risk the manager can diversify by holding an optimally chosen portfolio. Accordingly, we refer to z as the security's customization. We also assume that the customization level z is given exogenously and it is a characteristic of the hedge market.

The financial intermediaries that can offer the customized security are assumed to be risk neutral and competitive. To keep the analysis simple, we abstract from any moral hazard or asymmetric information considerations between the manager and the intermediaries. If the manager creates a position $\alpha \in \mathbb{R}$ in the customized security, he is entitled to a claim $\alpha\tilde{b}$. In exchange, the manager pays the intermediary $p\alpha$ where $p \in \mathbb{R}_+$ is the share price of the security. The risk neutrality and competitiveness of intermediaries imply that each share of the security is priced at

$$p = \mathsf{E}\big[\tilde{b}\big] = \mu_b,$$

so that the intermediary receives zero expected profits.

2.2 Swap Contracts—simulated sale of shares

The manager also can trade side contracts directly contingent on his own firm value $\tilde{y}$. One common financial instrument that serves this purpose is an *executive equity swap* (see Bolster et al. (1996), and Bettis et al. (2001)). In a swap transaction, the manager enters into a bilateral agreement with a financial intermediary. In this agreement, the shares in his firm are *synthetically* sold by being deposited with the intermediary. For a prespecified time period, the intermediary gets the return from the manager's shares, while the manager gets the return from an alternative investment, such as a fixed income security. A swap transaction thus simulates the sale of the manager's shares and reduces his effective ownership stake in the firm.

We model a swap contract in the following simple way. After the shareholders set his pay-performance sensitivity s, the manager can contract with an intermediary to promise a portion $\phi \leq s$ of $\tilde{y}$, $\phi\tilde{y}$, in exchange for receiving a fixed payment $\pi(\phi)$. The financial

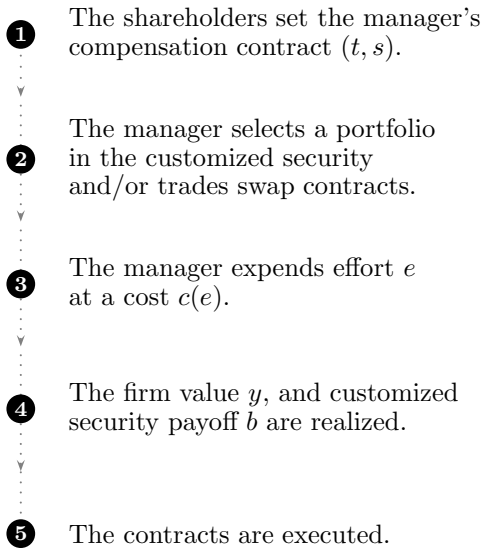
intermediaries that can trade swap contracts with the manager again are assumed to be risk neutral and competitive. An intermediary makes the manager a fixed payment $\pi(\phi)$ equal to the expected value of the claim $\phi\tilde{y}$ that the manager swaps, conditional on the manager's subsequent effort choice $\hat{e}$. Therefore,

$$\pi(\phi) = \phi \mathsf{E}[\tilde{y}|\hat{e}] = \phi f(\hat{e}).$$

Depending on enforceability, the contracts traded in the swap market can be exclusive or non-exclusive. In an exclusive swap market, the manager can be restricted to trade only one swap contract. If swap contracts are non-exclusive, then the manager can trade swap contracts with different intermediaries. Under non-exclusivity, the financial intermediaries do not observe, but anticipate and take into consideration the manager's further swap trades with other intermediaries while they price their swap transaction. We leave the detailed description of how non-exclusive swap contracts are priced to Section 3.3.

Figure 1 summarizes the sequence of moves in the model.

Figure 1: Sequence of Moves



3 The Manager's Side Trades and Equilibrium Incentives

In this section, we analyze the manager's portfolio choices in the hedge market, and describe the implications of different types of side contracts for the manager's equilibrium effort incentives and pay-performance sensitivity. For ease of exposition, we first separately

illustrate the manager's portfolio choices under different trading opportunities, assuming that either the customized security only or the swap contracts only—but not both—are available. Finally, we characterize the full equilibrium when both the swap contracts and the customized security are available.

3.1 Only Customized Security Is Available

Suppose that the manager can trade only the customized security. Given a compensation contract (t, s), if the manager acquires a position $\alpha \in \mathbb{R}$ in the customized security, and subsequently chooses an effort e, his wealth is represented by a random variable $\tilde{w}(\alpha, e)$ in the following way:

$$\tilde{w}(\alpha, e) = sf(e) + s\tilde{\varepsilon} + t - c(e) + \alpha\tilde{b} - \alpha p.$$

The CARA preferences and the normality assumptions on $\tilde{\varepsilon}$ and $\tilde{b}$ imply that the manager's problem of choosing α and e to maximize $\mathsf{E}\left[u\big(\tilde{w}(\alpha, e)\big)\right]$ is equivalent to maximizing the certainty equivalent wealth

$$U(\alpha, e) := \mathsf{E}\big[\tilde{w}(\alpha, e)\big] - \frac{a}{2}\mathsf{Var}\big[\tilde{w}(\alpha, e)\big].$$

Given the share price $p = \mathsf{E}\big[\tilde{b}\big] = \mu_b$ of the customized security, $U(\alpha, e)$ can be written as

$$U(\alpha, e) = sf(e) + t - c(e) - \frac{a}{2}\big(s^2\sigma_\varepsilon^2 + \alpha^2\sigma_b^2 + 2s\alpha\rho\sigma_\varepsilon\sigma_b\big). \tag{1}$$

Since, for any $e \in [0, \bar{e}]$, $U(\cdot, e)$ is concave and parabolic in α, straightforward maximization of (1) with respect to α yields

$$\alpha^*(s) = -\rho\frac{\sigma_\varepsilon}{\sigma_b}s.$$

The size of the optimal portfolio in the customized security is increasing in the manager's pay-performance sensitivity s. The sign of the correlation coefficient ρ determines whether the optimal portfolio involves buying or short-selling the security with $\alpha^*(s)$ and ρ having opposite signs.[10] Substituting for $\alpha^*(s)$ in (1) and using $z = \rho^2$, we obtain the reduced form certainty equivalent wealth as

$$U(\alpha^*, e) = sf(e) + t - c(e) - \frac{a}{2}(1 - z)s^2\sigma_\varepsilon^2.$$

In the above expression, the risk averse manager's disutility from holding an exposure s is given by $(a/2)(1-z)s^2\sigma_\varepsilon^2$. Therefore, the availability of a hedge security with a customization level z enables the manager to diversify a fraction z of the firm-specific risk exposure in his

[10] Note that when $\rho = 0$, the payoff of the security is orthogonal to firm specific risk, and an agent with CARA preferences who wants to diversify $\tilde{\varepsilon}$ has no use of it. This is not necessarily true with more general preferences (see Franke et al. (1998)).

compensation.

In the manager's subsequent optimal effort problem, we note that $U(\alpha^*, \cdot)$ is concave and parabolic in $e \in [0, \bar{e}]$. Substituting for $f(e) = \gamma e + \delta$ and $c(e) = e^2/2$, the optimal effort is given by[11]

$$e^*(s) = \gamma s.$$

The above optimal effort choice illustrates the standard incentive effect of tying the manager's compensation to firm value: as the manager holds more exposure to firm value, he supplies more effort. For ease of reference, it is useful to define the *sensitivity of expected firm value to the manager's share* s as

$$\begin{aligned}\varphi &:= \frac{d\mathsf{E}\big[\tilde{y}|e^*(s)\big]}{ds} = f'\big(e^*(s)\big)\frac{de^*}{ds} \\ &= \gamma^2.\end{aligned}$$

φ measures the effectiveness of managerial share ownership in increasing expected firm value: the more productive the manager's effort (higher γ), the more responsive is his optimal effort choice to share ownership. Accordingly, a higher γ implies that the managerial share ownership is more effective in increasing expected firm value (higher φ).

In setting the manager's compensation contract (t, s), the shareholders take into account the manager's optimal portfolio in the customized security and his subsequent effort choice. Formally, they choose s and t to maximize the expected firm value net of manager's compensation, $(1 - s)f(e^*) - t$, subject to the participation constraint $U(\alpha^*, e^*) \geq 0$.[12] In equilibrium, the participation constraint holds as an equality. Solving for t and substituting it into the shareholders' objective function, the problem becomes choosing s to maximize the net surplus

$$f\big(e^*(s)\big) - c\big(e^*(s)\big) - \frac{a}{2}(1 - z)s^2\sigma_\varepsilon^2 \tag{2}$$

from the contractual relationship with the manager. The manager's equilibrium pay-performance sensitivity is determined by the trade-off between the benefit of providing effort incentives by increasing s (measured by φ) and the cost of this incentive provision in the form of higher risk premium that must be paid to the manager. A higher φ calls for increasing the pay-performance sensitivity for incentive reasons, whereas a higher a and/or σ_ε^2 calls for less pay-performance sensitivity due to the insurance consideration. The availability of a customized hedge security allows the manager to diversify a fraction z of the firm-specific risk exposure. Accordingly, it reduces the risk premium that the manager demands for bearing a given risk exposure rendering provision of incentives less costly. We summarize the analysis in this section with the following result.

[11] More precisely, we should have a condition stating: $e^* \in [0, \bar{e})$ and $e^* = \gamma s$, or $e^* = \bar{e}$. To avoid unnecessary algebra and notation, we assume that $\bar{e} \geq \gamma$ so that we have an interior solution for e^*.

[12] We normalize the manager's certainty equivalent wealth from his outside option to zero.

Proposition 1 *Suppose the manager can only trade the hedge security with customization z. In the equilibrium, the manager's pay-performance sensitivity is $s^* = \varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$. Subsequently, he chooses a customized security portfolio $\alpha^* = -\left(\rho\frac{\sigma_\varepsilon}{\sigma_b}\right)\varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$ and supplies an effort $e^* = \gamma\varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$. The manager's equilibrium pay-performance sensitivity s^* and equilibrium effort e^* are increasing in the customization z.*

3.2 Only Exclusive Swap Contracts Available

Suppose now that only swap contracts are available to the manager and swap contracts can be made exclusive: an intermediary can write an enforceable clause in the swap contract so that the manager cannot trade further swap contracts with other intermediaries.

Given s, if the manager chooses an exclusive swap of size ϕ_{E}, his subsequent optimal effort satisfies $e^* \in \arg\max V(s - \phi_{\text{E}}, e)$, where

$$V(s - \phi_{\text{E}}, e) := (s - \phi_{\text{E}})f(e) + t - c(e) - \frac{a}{2}(s - \phi_{\text{E}})^2\sigma_\varepsilon^2 + \pi_{\text{E}}(\phi_{\text{E}}). \tag{3}$$

For $f(e) = \gamma e + \delta$ and $c(e) = e^2/2$, maximizing $V(s - \phi_{\text{E}}, e)$ with respect e yields $e^*(\phi_{\text{E}}) = \gamma(s - \phi_{\text{E}})$. The more shares the manager swaps, the less incentives he has to expend effort.

While pricing the exclusive swap transaction, the intermediary takes into account the effect of the swap size ϕ_{E} on $e^*(\phi_{\text{E}})$. The risk neutral intermediary's zero-profit condition implies that, conditioning on the optimal effort level for given ϕ_{E}, the payment π_{E} that the manager receives from swapping a claim $\phi_{\text{E}}\tilde{y}$ is $\pi_{\text{E}}(\phi_{\text{E}}) = \phi_{\text{E}}\mathsf{E}\big[\tilde{y}|e^*(\phi_{\text{E}})\big] = \phi_{\text{E}}f\big(e^*(\phi_{\text{E}})\big)$. Accordingly, the manager chooses his optimal exclusive swap size ϕ_{E} to maximize

$$V(s - \phi_{\text{E}}, e^*(\phi_{\text{E}})) := sf(e^*(\phi_{\text{E}})) + t - c(e^*(\phi_{\text{E}})) - \frac{a}{2}(s - \phi_{\text{E}})^2\sigma_\varepsilon^2,$$

which yields

$$\phi_{\text{E}}^*(s) = \left(\frac{a\sigma_\varepsilon^2}{\varphi + a\sigma_\varepsilon^2}\right)s.$$

The manager's optimal exclusive swap trade is determined by the following trade-off: swapping more shares achieves more insurance, as the manager's wealth becomes less tied to firm value. However, increasing the swap size also implies less effort incentives. The intermediary offers a swap price that accounts for the manager's equilibrium effort level. As a result, the intermediary provides the manager with insurance in exactly the same terms that the shareholders would, by adjusting the swap price according to the incentives the manager retains. This implies that the more sensitive is the expected firm value to the manager's share ownership (higher φ), the less incentive the manager has to swap shares. The optimal exclusive swap size ϕ_{E}^* depends on the relative magnitude of φ, and the manager's insurance motive, measured by $a\sigma_\varepsilon^2$. It is decreasing in φ and increasing in $a\sigma_\varepsilon^2$. The manager does not swap all of his share ownership when the swap contract is exclusive. Furthermore, the sole

incentive to do a swap deal stems from the manager's aversion ($a > 0$) to the exposure to the firm-specific risk σ_ε^2, and the resulting insurance motive. As the coefficient of risk aversion a and/or the firm-specific risk σ_ε^2 approach zero, the manager's demand for a swap contract also tends to zero.

The shareholders optimally choose the manager's pay-performance sensitivity s taking into account $\phi_{\text{E}}^*(s)$ and the subsequent effort choice $e^*(\phi_{\text{E}})$. Using standard arguments, the shareholders' problem is to choose s to maximize the net surplus

$$f(e^*) - c(e^*) - \frac{a}{2}\big(s - \phi_{\text{E}}^*(s)\big)^2\sigma_\varepsilon^2 \tag{4}$$

from contracting with the manager. Note the similarity between the shareholders' problem in (4) and the manager's problem of choosing the optimal exclusive swap size ϕ_{E}. These two problems differ in only one aspect. The shareholders' problem involves maximizing the expected firm value $f(e^*)$, whereas the manager's problem maximizes $sf(e^*)$, minus the cost of effort and the manager's disutility from exposure to firm risk because of risk aversion. Both problems have the same trade-off between insurance and incentives. If the shareholders set $s^* = 1$, the manager completely internalizes the shareholders' trade-off while choosing the exclusive swap size. The manager then enters into an exclusive swap deal that reduces his pay-performance sensitivity to the level that would obtain if the swap contracts were not available. The following result establishes that the availability of exclusive swap contracts is irrelevant for equilibrium incentives.

Proposition 2 *Suppose the manager can only trade exclusive swap contracts. In the equilibrium, the shareholders sell the firm to the manager, i.e.* $s^* = 1$*, and the manager trades an exclusive swap of size* $\phi_{\text{E}}^* = a\sigma_\varepsilon^2/(\varphi + a\sigma_\varepsilon^2)$*, which reduces his pay-performance sensitivity to the level that would obtain if no swaps were available. The equilibrium effort* $e^* = \gamma\varphi/(\varphi + a\sigma_\varepsilon^2)$ *is the same as what would obtain without exclusive swap contracts.*

3.3 Only Non-Exclusive Swap Contracts Available

Suppose again that the swap contracts are the only available hedge instrument, but the swap contracts are *non-exclusive*. The manager cannot be precluded from trading different swap contracts with different financial intermediaries. As in the case of an exclusive swap contract, an intermediary's expected payoff depends on the manager's subsequent optimal effort choice. However, the optimal effort level is determined by the manager's *final* exposure to firm value, and yet an intermediary knows only the size of the swap that the manager trades with him. The manager can lower his effective pay-performance sensitivity, and reduce his incentives to supply effort, by engaging in further swap transactions with other intermediaries. Consequently, while pricing a non-exclusive swap transaction, the rational

intermediaries should take into account the negative externality that the manager can impose on them by further trades.

To analyze this strategic environment, we model the problem with the following sequential game. Suppose that there are two intermediaries $i \in \{1, 2\}$ that compete in the market. We rely on this assumption only for the ease of exposition; our results follow for any $n > 1$. The manager's contract (t, s) is given and common knowledge among all the parties that are involved. In the first stage of the game, the intermediaries simultaneously make an offer $\mathcal{P}_i \geq 0$ to the manager, where $\mathcal{P}_i$ is the share price offered by intermediary i. Subsequently, the manager observes the two offers $(\mathcal{P}_1, \mathcal{P}_2)$, and chooses his swap sizes (ϕ_1, ϕ_2). A swap ϕ_i with intermediary $i \in \{1, 2\}$ yields the manager a payment $\phi_i \mathcal{P}_i$. Let $\phi = \phi_1 + \phi_2$ denote the total swap size, and $\sigma := s - \phi$ the final exposure to firm value that the manager retains. We analyze the subgame perfect equilibrium of this game.

Intermediary i's Problem. Given $\mathcal{P}_{j \neq i}$, and (ϕ_1, ϕ_2), an intermediary i's objective is to choose $\mathcal{P}_i \geq 0$ to maximize

$$u_i\big(\mathcal{P}_1, \mathcal{P}_2, (\phi_1, \phi_2)\big) = \phi_i\Big(\mathsf{E}\big[\tilde{y}|e^*(\sigma)\big] - \mathcal{P}_i\Big). \tag{5}$$

The intermediary's payoff for unit share swapped is the expected firm value conditional on the manager's optimal effort level $e^*(\sigma)$ when he retains a final exposure $\sigma = s - \phi$, net of the payment $\mathcal{P}_i$ promised to the manager.

The Manager's Problem and Best Response. For given price offers $(\mathcal{P}_1, \mathcal{P}_2)$, the manager, on the other hand, chooses swap sizes (ϕ_1, ϕ_2) and retains a final exposure $s - \phi = \sigma \in [0, s]$ to maximize his certainty equivalent wealth

$$\begin{aligned} W\big(\sigma, (\mathcal{P}_1, \mathcal{P}_2)\big) := \quad & \sigma f\big(e^*(\sigma)\big) + t - c\big(e^*(\sigma)\big) - \frac{a}{2}\sigma^2\sigma_\varepsilon^2 + \phi_1\mathcal{P}_1 + \phi_2\mathcal{P}_2 \\ & = \frac{1}{2}\big(\varphi - a\sigma_\varepsilon^2\big)(s - \phi)^2 + \delta(s - \phi) + t + \phi_1\mathcal{P}_1 + \phi_2\mathcal{P}_2, \end{aligned}$$

where the second equality follows from using $e^*(\sigma) = \gamma\sigma$ and substituting for $f(e) = \gamma e + \delta$ and $c(e) = e^2/2$. In the above expression, $\phi_1\mathcal{P}_1 + \phi_2\mathcal{P}_2$ is the manager's revenue from the swap transactions. The first term $\sigma f\big(e^*(\sigma)\big) + t$ is the manager gross benefit from retaining an exposure σ to firm value, whereas the total cost he faces is the sum of the cost of effort $c\big(e^*(\sigma)\big)$, and the risk aversion related cost of σ, given by $(a/2)\sigma^2\sigma_\varepsilon^2$.

To understand the manager's best response behavior in the face of a price pair $(\mathcal{P}_1, \mathcal{P}_2)$, it is illustrative to first look at his behavior given a single price $\mathcal{P}$. In fact, it is straightforward to see that if $\phi > 0$, in cases where $\mathcal{P}_1 \neq \mathcal{P}_2$, the manager swaps only with the intermediary who offers the higher price. This is because there is no capacity constraint on how much an intermediary can swap. Therefore, for all practical purposes we can define $\mathcal{P} = \max\{\mathcal{P}_1, \mathcal{P}_2\}$,

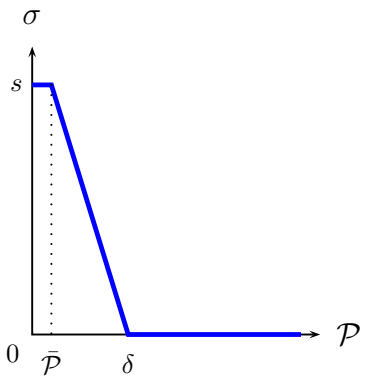
and analyze the manager's behavior when he is offered $\mathcal{P}$. In this case, his objective is to choose a swap size ϕ to maximize

$$W(\sigma, \mathcal{P}) = \frac{1}{2}(\varphi - a\sigma_\varepsilon^2)(s-\phi)^2 + \delta(s-\phi) + t + \phi\mathcal{P}.$$

The manager's optimal behavior depends on the relative magnitudes of φ and $a\sigma_\varepsilon^2$. Precisely, the sign of $\varphi - a\sigma_\varepsilon^2$ determines a structural shift in the manager's best response. Recall from Section 3.2 that the manager's demand for swap contracting stems from his incentive to lower the disutility $(a/2)s^2\sigma_\varepsilon^2$ associated with aversion to firm specific risk in his contract. This incentive to eliminate risk with swaps is more pronounced, the higher is the firm-specific risk σ_ε^2 and/or the manager's risk aversion a. On the other hand, retaining exposure to firm value is more beneficial, the more sensitive is the expected firm value to the manager's share ownership (higher φ). We now proceed to derive the manager's best response to a given price $\mathcal{P}$ separately when $\varphi - a\sigma_\varepsilon^2 < 0$, and when $\varphi - a\sigma_\varepsilon^2 > 0$.

CASE I: $\varphi - a\sigma_\varepsilon^2 < 0$. This is the case when the benefit of retaining exposure to firm value is weaker than the benefit of swapping away risk. In particular, when the price $\mathcal{P}$ is equal to or above δ, which is the expected firm value corresponding to zero effort level[13], then the manager chooses to swap all share ownership. For a price $\mathcal{P}$ less than δ, but higher than a threshold level $\bar{\mathcal{P}} := \delta - s(a\sigma_\varepsilon^2 - \varphi)$, the manager optimally chooses a swap size $\phi = s - \frac{\delta - \mathcal{P}}{a\sigma_\varepsilon^2 - \varphi}$. When the price $\mathcal{P}$ is low enough ($\mathcal{P} \leq \bar{\mathcal{P}}$), the manager retains all of his initial exposure. The manager's best response for this case is illustrated in Figure 2.

FIGURE 2: THE MANAGER'S BEST RESPONSE–CASE I ($\varphi - a\sigma_\varepsilon^2 < 0$)



The optimal share that the manager retains for a given price level $\mathcal{P}$ when $\varphi - a\sigma_\varepsilon^2 < 0$. $\bar{\mathcal{P}} := \delta - s(a\sigma_\varepsilon^2 - \varphi)$.

Now, keeping in mind that the manager interacts only with the intermediary offering the highest price, we can summarize his optimal behavior. For $\varphi - a\sigma_\varepsilon^2 < 0$, the manager chooses

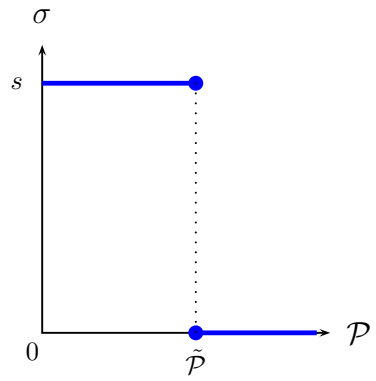
[13] Recall that $\mathsf{E}[\tilde{y}|e] = f(e) = \gamma e + \delta$.

(ϕ_1, ϕ_2) as described below.

$$\hat{\phi}(\mathcal{P}_1, \mathcal{P}_2) = \begin{cases} \{(\phi_1, \phi_2) : \phi_1 + \phi_2 = s\} & \text{if } \mathcal{P}_i = \mathcal{P}_j \text{ and } \mathcal{P}_i \geq \delta, \\ \{(\phi_1, \phi_2) : \phi_i = s, \phi_j = 0\} & \text{if } \mathcal{P}_i > \mathcal{P}_j \text{ and } \mathcal{P}_i \geq \delta, \\ \left\{(\phi_1, \phi_2) : \phi_i = s - \frac{\delta - \mathcal{P}_i}{a\sigma_\varepsilon^2 - \varphi}, \phi_j = 0\right\} & \text{if } \mathcal{P}_i > \mathcal{P}_j \text{ and } \delta \geq \mathcal{P}_i \geq \bar{\mathcal{P}}, \\ \left\{(\phi_1, \phi_2) : \phi_1 + \phi_2 = s - \frac{\delta - \mathcal{P}_i}{a\sigma_\varepsilon^2 - \varphi}\right\} & \text{if } \delta \geq \mathcal{P}_i = \mathcal{P}_j \geq \bar{\mathcal{P}}, \\ (0, 0) & \text{if } \mathcal{P}_i, \mathcal{P}_j \leq \bar{\mathcal{P}}. \end{cases}$$

CASE II: $\varphi - a\sigma_\varepsilon^2 > 0$. This is the case when the benefit of retaining exposure to firm value is stronger than the benefit of swapping away risk. In this case, the manager trades only if the price $\mathcal{P}$ covers not only δ, but also his certainty equivalent net benefit. In particular, when facing a price $\mathcal{P} < \tilde{\mathcal{P}} := \delta + \frac{s}{2}(\varphi - a\sigma_\varepsilon^2)$, the manager does not trade swap contracts at all. On the other hand, for a price $\mathcal{P} \geq \tilde{\mathcal{P}}$, the manager trades away all of his shares, i.e., $\phi = s$. Figure 3 illustrates the optimal behavior when $\varphi - a\sigma_\varepsilon^2 > 0$.

FIGURE 3: THE MANAGER'S BEST RESPONSE–CASE II ($\varphi - a\sigma\varepsilon^2 > 0$)



The optimal share that the manager retains for a given price level $\mathcal{P}$ when $\varphi - a\sigma_\varepsilon^2 > 0$. $\tilde{\mathcal{P}} := \delta + \frac{s}{2}(\varphi - a\sigma_\varepsilon^2)$.

As in the previous case, we report the manager's optimal behavior as a response to a price pair $(\mathcal{P}_1, \mathcal{P}_2)$ for the case $\varphi - a\sigma_\varepsilon^2 > 0$ below.

$$\hat{\phi}(\mathcal{P}_1, \mathcal{P}_2) = \begin{cases} \{(\phi_1, \phi_2) : \phi_i + \phi_j = s\} & \text{if } \mathcal{P}_i = \mathcal{P}_j \text{ and } \mathcal{P}_j \geq \delta + \frac{s}{2}(a\sigma_\varepsilon^2 - \varphi), \\ \{(\phi_1, \phi_2) : \phi_i = s, \phi_j = 0\} & \text{if } \mathcal{P}_i > \mathcal{P}_j \text{ and } \mathcal{P}_i \geq \delta + \frac{s}{2}(a\sigma_\varepsilon^2 - \varphi), \\ (0, 0) & \text{if } \mathcal{P}_i, \mathcal{P}_j < \delta + \frac{s}{2}(a\sigma_\varepsilon^2 - \varphi). \end{cases}$$

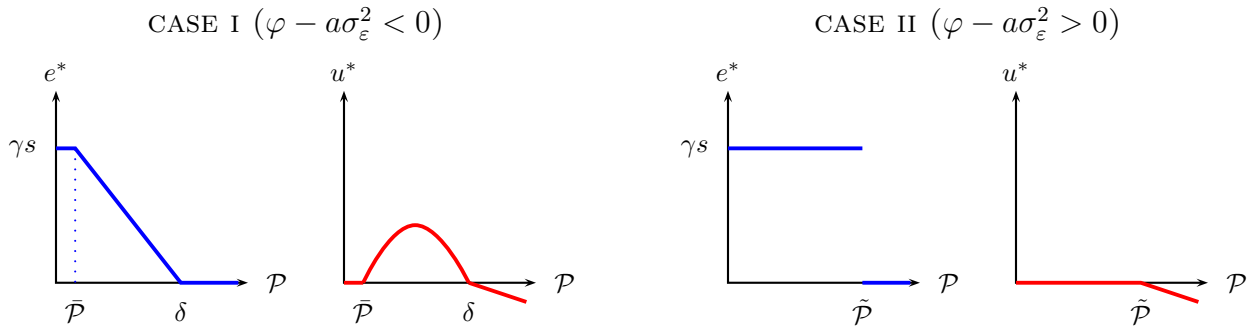
INTERMEDIARIES' OPTIMAL BEHAVIOR. The intermediaries anticipate the manager's optimal behavior in the subgame and play a simultaneous price setting game. Using the manager's subsequent optimal effort level $e^* = \gamma(s - \phi_1 - \phi_2)$, one can rewrite the intermediary

i's problem as choosing $\mathcal{P}_i$ to maximize

$$\hat{\phi}_i(\mathcal{P}_1, \mathcal{P}_2)\Big(\delta + \varphi\big(s - \hat{\phi}_1(\mathcal{P}_1, \mathcal{P}_2) - \hat{\phi}_2(\mathcal{P}_1, \mathcal{P}_2)\big) - \mathcal{P}_i\Big).$$

From our earlier discussion, we know that if $\phi > 0$, the manager swaps only with the intermediary who offers the higher price. Therefore, it is again illustrative to focus on the intermediary i who offers $\mathcal{P} = \mathcal{P}_i > \mathcal{P}_j$. Figure 4 illustrates the situation for the two cases. The two graphs on the left side depict CASE I: the first is the manager's equilibrium effort for a given price $\mathcal{P}$ offered, whereas the second is the intermediary's corresponding maximum expected payoff at that price. The two graphs on the right are for CASE II.

FIGURE 4: THE HIGH-OFFER INTERMEDIARY'S MAXIMUM UTILITY



In each case, the graph on the left shows the manager's optimal effort level e^* for a given price, and the graph on the right shows the maximum utility u^* that the intermediary who makes the higher offer gets accordingly. $\tilde{\mathcal{P}} := \delta + \frac{s}{2}(\varphi - a\sigma_\varepsilon^2)$ *and* $\bar{\mathcal{P}} := \delta - s(a\sigma_\varepsilon^2 - \varphi)$.

Now we are ready to describe the equilibria of the trading game in the non-exclusive swap market.

EQUILIBRIUM WITH COMPLETE UNRAVELING. Let us start with CASE I, $\varphi - a\sigma_\varepsilon^2 < 0$. Recall that, the swap transaction only occurs with the intermediary who offers the higher price. Also note that, from Figure 4, any price $\mathcal{P} \leq \bar{\mathcal{P}}$ and $\mathcal{P} > \delta$ is strictly dominated by the prices $\bar{\mathcal{P}} \leq \mathcal{P} \leq \delta$. This immediately implies that, in equilibrium, $\mathcal{P}_1 = \mathcal{P}_2 = \delta$. This is so, because for any offer by intermediary i, the other intermediary j offers a price slightly higher. At $\mathcal{P}_1 = \mathcal{P}_2 = \delta$, no intermediary has an incentive to increase the price, since any price higher than δ leads to a negative payoff. Similarly, no one has an incentive to offer less, because the manager then shifts all his swap trade to the other party.

As a result, when $\varphi - a\sigma_\varepsilon^2 < 0$, in the equilibrium, the intermediaries both offer $\mathcal{P} = \delta$, and the manager swaps all of his shares, $\phi^* = s$, and exits the swap market with $\sigma^* = 0$. With no exposure to firm value retained, the manager does not supply any effort, $e^* = 0$. This equilibrium in the swap market, therefore, leads to a complete undermining of effort incentives. Since for any share ownership s he is offered, the manager swaps away $\phi^* = s$ and

exerts no effort, incentives can be sustained only if the shareholders prevent the manager from trading swap contracts.

Equilibrium with no Swap Trade. Does the manager always swap away all of his shares, when swaps are non-exclusive? The answer is no. In case ii where $\varphi - a\sigma_\varepsilon^2 > 0$, the price offers $\mathcal{P} > \tilde{\mathcal{P}}$ are strictly dominated. Therefore, an equilibrium offer has to be less than $\tilde{\mathcal{P}}$. However, as can be seen from Figure 3, the manager in this case does not swap any shares. Since this is true for any s, for the case $\varphi - a\sigma_\varepsilon^2 > 0$ the shareholders offer their manager the same contract that they would offer if non-exclusive swap contracts were not available.

We summarize the above analysis in the following Proposition.

Proposition 3 *Suppose the manager can trade only non-exclusive swap contracts.*
(i) If $\varphi < a\sigma_\varepsilon^2$, for any pay-performance sensitivity s he is given, the manager swaps away all exposure to firm value, $\phi^* = s$, and he does not supply any effort $e^* = 0$. Therefore, unless the manager is prevented from trading swap contracts, incentive contracting fails completely.
(ii) If $\varphi > a\sigma_\varepsilon^2$, then the manager's equilibrium pay performance sensitivity is $s^* = \varphi/\left(\varphi + a\sigma_\varepsilon^2\right)$. The manager does not trade any non-exclusive swap contracts, $\phi^* = 0$, and he supplies effort $e^* = \gamma\varphi/(\varphi + a\sigma_\varepsilon^2)$.

3.4 Both Swap Contracts and Customized Security Available

The preceding analysis shows that a customized hedge security, because it allows the manager to diversify—but not unwind—the firm specific risk in his contract, has the potential for improving incentive contracting. Swap contracts, on the other hand, serve to reduce risk by simply unwinding the manager's exposure to firm value. Unless they can be made exclusive, swap contracts lead to a complete unraveling of effort incentives when the firm-specific risk/manager's risk aversion is sufficiently high. Therefore, a natural question to ask is how will the manager choose to hedge if both the customized security and swap contracts are available?

First consider the case when the swap contracts are exclusive, and they are available along with a hedge security with customization z. The availability of exclusive swap contracts again does no damage in terms of the equilibrium effort implemented: the manager's hedge market access improves effort incentives for any level of security customization. The following result follows from Propositions 1 and 2.

Corollary 1 *Suppose the manager can trade both a hedge security with customization z, and an exclusive swap contract. In the equilibrium, the shareholders sell the firm to the manager, i.e. $s^* = 1$. The manager trades an exclusive swap of size $\phi_{\text{E}}^* = a(1-z)\sigma_\varepsilon^2/(\varphi +$*

$a(1-z)\sigma_\varepsilon^2)$ and holds a customized security portfolio $\alpha^* = -\left(\rho\frac{\sigma_\varepsilon}{\sigma_b}\right)\varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$. The equilibrium effort level is $e^* = \gamma\varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$.

The more interesting case is when the manager can trade both the customized hedge security and *non-exclusive* swap contracts. Will the manager retain exposure to firm value while reducing the randomness in his compensation contract by trading the customized security or will he unwind all exposure to firm value with non-exclusive swap contracts? We analyze this question next.

From the analysis in Section 3.1, it follows that if the manager retains a final exposure σ to firm value after trading swap contracts, he optimally holds a customized security portfolio $\alpha^* = -(\rho\sigma_\varepsilon/\sigma_b)\sigma$. This portfolio eliminates a fraction z of the disutility from holding exposure to firm-specific risk. Accordingly, for given price offers $(\mathcal{P}_1, \mathcal{P}_2)$, the manager's swap problem is now choosing swap sizes (ϕ_1, ϕ_2), and hence retaining a final exposure $s - \phi_1 - \phi_2 = \sigma \in [0, s]$, to maximize his certainty equivalent wealth:

$$\hat{W}\big(\sigma, (\mathcal{P}_1, \mathcal{P}_2), z\big) := \sigma f\big(e^*(\sigma)\big) + t - c\big(e^*(\sigma)\big) - \frac{a}{2}\sigma^2(1-z)\sigma_\varepsilon^2 + \phi_1\mathcal{P}_1 + \phi_2\mathcal{P}_2,$$

where the disutility from holding exposure to firm-specific risk is now given by $(a/2)\sigma^2(1-z)\sigma_\varepsilon^2$. A customization level z effectively reduces the firm-specific risk that the manager faces to $(1-z)\sigma_\varepsilon^2$. But this implies that the manager's incentive to swap away exposure is now given by $a(1-z)\sigma_\varepsilon^2$, *not* by $a\sigma_\varepsilon^2$. *The higher the customization z of the hedge security, the lower is the manager's incentive to unwind exposure to firm value by swap contracts.* Indeed, after substituting for $e^*(\sigma) = \gamma\sigma$, $f(e) = \gamma e + \delta$ and $c(e) = e^2/2$, the manager's objective function $\hat{W}(\sigma, (\mathcal{P}_1, \mathcal{P}_2), z)$ above takes the form

$$\hat{W}\big(\sigma, (\mathcal{P}_1, \mathcal{P}_2), z\big) = \frac{1}{2}\big(\varphi - a(1-z)\sigma_\varepsilon^2\big)\sigma^2 + \delta\sigma + t + \phi_1\mathcal{P}_1 + \phi_2\mathcal{P}_2.$$

The equilibrium in the non-exclusive swap market again depends on how pronounced is the insurance incentive to unwind exposure by swaps (now measured by $a(1-z)\sigma_\varepsilon^2$) as compared to incentive benefit of retaining exposure to firm value (measured by φ). We state the full equilibrium as a corollary to Propositions 1 and 3.

Corollary 2 *Suppose the manager can trade both a hedge security with customization z and non-exclusive swap contracts. Define*

$$z^* := 1 - \frac{\varphi}{a\sigma_\varepsilon^2}.$$

(i) For $z > z^*$, in the equilibrium, the shareholders offer a contract with pay-performance sensitivity $s^* = \varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$. The manager chooses a customized security portfolio $\alpha^* = -\left(\rho\frac{\sigma_\varepsilon}{\sigma_b}\right)\varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$ and does not trade swap contracts, $\phi^* = 0$. The manager

subsequently chooses an effort level $e^* = \gamma\varphi/(\varphi + a(1-z)\sigma_\varepsilon^2)$.
(ii) For $z < z^*$*, for any pay-performance sensitivity* s *he is given, the manager swaps away all exposure to firm value,* $\phi^* = s$*, does not trade the customized security,* $\alpha^* = 0$*, and supplies no effort* $e^* = 0$*. In this case, the manager should not be allowed to hedge.*

If the customization of the hedge security is below a certain threshold z^*, the manager completely unwinds all exposure with swaps and does not trade the customized hedge security. With low security customization and non-exclusive swap contracts, the manager should not be allowed to hedge, since hedging ability completely undermines incentives. If the security customization is above this threshold, though, then the manager only trades the customized security, and does not trade any non-exclusive swap contracts. Accordingly, when the market can provide highly customized hedge securities, the manager's access to a hedge market improves effort incentives, even when exclusivity is not enforceable in swap contracts. A high level of security customization enables the risk averse manager to diversify a larger fraction of the firm-specific risk from his compensation contract. This, in turn, makes unwinding exposure to firm value by swap contracts a less attractive hedging alternative. We summarize these results in Figure 5, and further discuss the implications in Section 5.

Figure 5: The Summary of the Results

	EXCLUSIVE SWAP CONTRACTS	NON-EXCLUSIVE SWAP CONTRACTS
HIGH CUSTOMIZATION $z > z^* = 1 - \frac{\varphi}{a\sigma_\varepsilon^2}$	$s^* = 1$ $\alpha^* = -\rho\frac{\sigma_\varepsilon}{\sigma_b}\left(\frac{\varphi}{\varphi+a(1-z)\sigma_\varepsilon^2}\right)$ $\phi_{\mathrm{E}}^* = 1 - \frac{\varphi}{\varphi+a(1-z)\sigma_\varepsilon^2}$ $e^* = \gamma\left(\frac{\varphi}{\varphi+a(1-z)\sigma_\varepsilon^2}\right)$	$s^* = \frac{\varphi}{\varphi+a(1-z)\sigma_\varepsilon^2}$ $\quad \phi^* = 0$ $\alpha^* = -\rho\frac{\sigma_\varepsilon}{\sigma_b}s^*$ $\quad e^* = \gamma s^*$
LOW CUSTOMIZATION $z < z^* = 1 - \frac{\varphi}{a\sigma_\varepsilon^2}$		*For any* s *we have:* $\alpha^* = 0 \quad \phi = s \quad e^* = 0$

This figure summarizes equilibrium values of the manager's pay-performance sensitivity s^**, his position in the customized security* α^**, the swap size* ϕ^**, and his equilibrium effort* e^**, according to whether swap contracts are exclusive or non-exclusive, and whether the security customization is above or below* $z^* = 1 - \frac{\varphi}{a\sigma_\varepsilon^2}$.

4 Customized Hedging Mitigates Inefficient Risk Reduction

Another and perhaps relatively less emphasized implication of tying the manager's compensation to firm value is that it may provide the manager inefficient risk reduction incentives

in his technology choice, merely to reduce the risk embedded in his compensation contract. For example, the manager may respond to a higher pay-performance sensitivity by choosing to avoid risky projects with positive net present values (as in Lambert (1986)) or, similarly, he may undertake inefficient asset acquisitions to lower the firm-specific risk (as in Amihud and Lev (1981)).

The empirical corporate finance literature documents that the managers' personal diversification motives do play a role in their firm level risk choices. Amihud and Lev (1981) and May (1995) report that the managers with a higher proportion of their personal wealth tied up in their firm value tend to pursue mergers without any obvious benefit to shareholders in order to diversify their own portfolios. Tufano (1996) examines corporate risk management activity in the North American gold mining industry and confirms that firms whose managers hold more stock based compensation manage more gold price risk. His study concludes that risk reduction policies may be set to satisfy the needs of poorly diversified managers, and do not necessarily maximize firm value. Along these lines, this section allows the manager to undertake inefficient risk reduction activity at the firm level. With this simple extension, we show that the availability of a customized hedge security mitigates the risk averse manager's inefficient risk reduction incentives.

Consider the following extension where the manager can affect the distribution of firm value with two actions: as before, he chooses effort e that increases expected firm value by $f(e) = \gamma e + \delta$ and costs the manager $c(e) = e^2/2$. The manager also implements a risk reduction policy x. The firm value $\tilde{y}$, as a function of e and x, is now determined by

$$\tilde{y}(e, x) := f(e) - \lambda(x) + \tilde{\varepsilon}(x).$$

The firm-specific risk $\tilde{\varepsilon}(x)$ is normally distributed with mean 0, and variance $\sigma_\varepsilon^2 - \Delta x$, where $\Delta > 0$ is a constant, and x lies in the interval $[0, \bar{x}]$ such that $\bar{x} < \sigma_\varepsilon^2/\Delta$. The risk reduction activity x is inefficient: it reduces expected firm value by $\lambda(x)$ where $\lambda(\cdot)$ is a differentiable, convex and increasing loss function.

For brevity of exposition, we only illustrate the manager's inefficient risk reduction policies with and without the customized hedging opportunity. Suppose first that the manager has no access to customized hedge security. Given a compensation contract (t, s), the manager's problem is to choose the effort level e and the inefficient risk reduction policy x to maximize

$$u(e, x) := s\big(f(e) - \lambda(x)\big) + t - c(e) - \frac{a}{2}s^2\big(\sigma_\varepsilon^2 - \Delta x\big).$$

The optimal effort choice is again given by $e^*(s) = \gamma s$. For $s > 0$ and $a > 0$, the inefficient risk reduction policy x^*_{NH} with *no customized hedging opportunity* is characterized by

$$-\lambda'(x^*_{\text{NH}}) + \frac{a}{2}\Delta s = 0.$$

Because of the inability to diversify the firm-specific risk exposure, the manager has an incentive to engage in wasteful risk reduction, or under-investment in risk, i.e., $x^*_{\text{NH}} > 0$.[14] Furthermore, x^*_{NH} is increasing in the manager's pay-performance sensitivity s:

$$\frac{dx^*_{\text{NH}}}{ds} = \frac{a\Delta}{2\lambda''} > 0.$$

Customized Hedging. Now suppose that after his compensation contract is set by the shareholders, but before choosing his effort and risk reduction policies, the manager can trade a customized hedge security correlated with his firm-specific risk. As before, let $\tilde{b}$, which is normally distributed with mean μ_b, and variance σ_b^2, denote the payoff of the hedge security available and assume that $\tilde{b}$ is correlated with the firm-specific risk $\tilde{\varepsilon}$ according to a correlation coefficient $\rho \in [-1, 1]$. Again, let $z := \rho^2 > 0$ denote the customization level of the hedge security. The following result shows that a customized hedging opportunity mitigates the manager's inefficient risk reduction incentives.

Proposition 4 *If the manager can trade a hedge security with customization z, his inefficient risk reduction policy x^*_{H} is characterized by*

$$-\lambda'(x^*_{\text{H}}) + \frac{a}{2}(1-z)\Delta s = 0.$$

x^*_{H} is decreasing in z. A customized hedging opportunity reduces (for $z = 1$, it completely eliminates) the manager's inefficient risk reduction incentives.

The customized hedging opportunity aligns the manager's attitude toward firm-specific risk with the shareholders' attitude. To the extent that the risk averse manager can diversify the firm-specific risk in his compensation contract by creating a position in the customized security, he has less appetite for inefficient risk reduction at the firm level to achieve personal portfolio diversification.

5 Implications and Discussion

Hedging, Incentives and Pay-Performance Sensitivity Does managerial hedging necessarily undermine incentives, as suggested by the popular business press and some recent scholarship in the legal profession? This paper distinguishes between managerial hedge transactions that can improve incentives and those that can undermine them; this distinction is key to the insights we provide. Equity swap contracts—that promise the return from manager's shares to third parties in exchange for a fixed payment—can undermine incentives

[14] With no hedging opportunities, the optimal managerial compensation package therefore should take into account and mitigate the manager's incentives for inefficient risk reduction. This objective calls for lowering the manager's pay-performance sensitivity.

by undoing the link between the firm value and the manager's wealth. On the other hand, a customized hedge security—correlated with firm-specific risk—reduces the randomness in the manager's compensation contract, while retaining performance incentives. Hedging ability undermines incentives if the manager chooses to undo his exposure to firm value with swaps. If, instead, the manager chooses to diversify the firm-specific risk with the customized security, then hedging improves incentives.

We show that, when gains access to the hedge market, the manager's portfolio choice depends both on the legal structure/contract enforceability—which determines whether swap contracts can be made exclusive—and on the level of security customization the hedge market can provide, which determines how much of his firm-specific risk the manager can diversify.

- When the swap contracts are exclusive, the manager trades both the swap and the customized security for any positive level of security customization. In this case, managerial hedging improves incentives. The shareholders sell the firm to their manager and leave it to the hedge market to provide insurance (Corollary 1).

- When exclusivity in swaps is not enforceable,

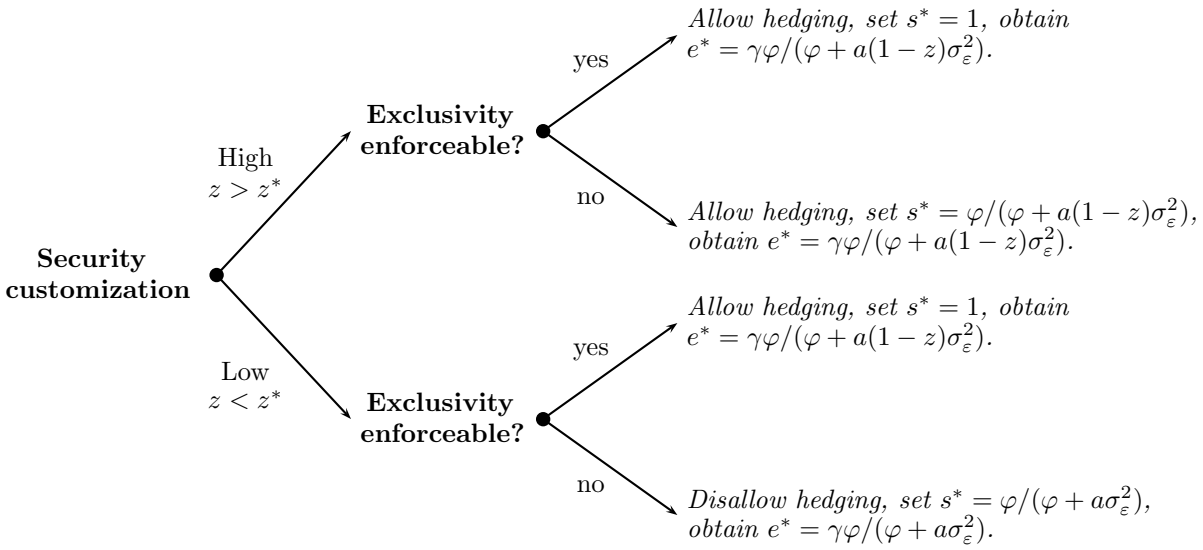
  - with sufficiently high security customization, the manager chooses customized hedging, and does not trade swaps (Corollary 2(i)). A hedge market that provides sufficiently high security customization increases the manager's pay-performance sensitivity and improves incentives, regardless of whether swaps are exclusive or not.

  - with low security customization, the manager completely undoes the incentives in his contract by trading swaps and does not trade the customized hedge security. Therefore, in this case managerial hedging undermines incentive contracting (Corollary 2(ii)).

We illustrate these results in Figure 6.

One implication of the analysis is that, by providing customized portfolio opportunities, a hedge market may introduce efficiency benefits to the contractual relationship between the shareholders and the manager. For these benefits to materialize, the manager has to be choosing to trade customized hedge securities, when swap contracts are also available. With sufficiently high security customization, this is always the case. However, if the hedge market is unable to provide security customization at sufficiently high levels, then contract enforceability becomes important. This follows, because for the manager to trade a hedge security with low customization, his other hedging alternative (equity swaps) must be exclusive, so that he retains exposure to firm value. In that respect, financial development—the ability of securities markets to provide hedging instruments—can be a double-edged sword for incentives if the economy lacks the legal means to enforce exclusivity in certain types

Figure 6: Security Customization and Enforceability



of hedge contracts, in this case, swaps. When the swap contracts are also available, a high degree of contract enforceability in the hedge market is complementary to hedge securities with low customization.[15]

Implication 1 *An executive's hedge market access improves incentives if the hedge market provides high security customization, or—in case of low security customization—if it can enforce exclusivity in swap contracts due to a high degree of legal development.*

The manager's hedge market access hurts the shareholders precisely when the hedge market can only provide low security customization; moreover, it offers swap contracts without being able to enforce exclusivity. It is interesting to note that an executive hedge market has emerged without much shareholder objection in the U.S. where contract enforceability is less of a problem, and the financial intermediaries are able to provide highly customized hedge securities because of a sophisticated derivative securities market. A financial intermediary in the U.S. can also hedge her own exposure from a hedge transaction with a corporate executive at a much lower cost because of more liquid primary and secondary securities markets.

A second implication of the analysis relates the security customization/contract enforceability in the hedge market to optimal executive pay structures. In our model, the manager's access to hedge securities with sufficiently high customization or exclusive swap contracts

[15]We would like to thank an anonymous referee for pointing out to the complementarity between financial market development and legal development.

increases the manager's pay-performance sensitivity.[16] With exclusive swaps, the shareholders sell the firm to their manager for any positive level of security customization, and leave the provision of insurance to the hedge market. If contract enforceability is poor, and hence swaps are non-exclusive, but security customization is sufficiently high, then the shareholders anticipate that the manager engages only in customized hedging, and they optimally increase the manager's pay-performance sensitivity to elicit more effort.

Implication 2 *An executive hedge market that can offer sufficiently high security customization, or—in case of low security customization—that can enforce exclusivity in swap contracts, increases the manager's pay-performance sensitivity.*

Implication 2 may explain, at least to a certain extent, why higher stock based compensation and hedging instruments have appeared almost simultaneously in the U.S. during the 1990s. For instance, Schizer (2000) argues that the increasing availability of derivative instruments for managerial hedging and the growing importance of stock-based pay in managerial compensation have occurred almost simultaneously.

The relationship between executive pay structures and the hedge market characteristics—namely the degree of security customization and contract enforceability—has not been tested. However, casual comparison of executive pay in the U.S. versus Europe seems to lend some support for Implication 2. The U.S. firms grant compensation packages with considerably higher pay-performance sensitivities than their European counterparts.[17] Implication 2 suggests that some of the cross-country differences in pay-performance sensitivities can be attributed to differences in the customization and enforceability of hedge contracts available to executives. It is more likely, again because of the widespread availability of derivatives securities, that a corporate executive in the U.S. can find highly customized hedge securities to diversify considerably the firm-specific risk exposure from his compensation. Furthermore, large securities firms in the U.S. that trade with executives are likely to take legal action more easily and convincingly to ensure that the executives comply with exclusivity clauses in swap contracts.[18]

[16] We should note that the principal-agent model employed here does not give a prediction for the *expected level* of compensation. The model yields a prediction for the pay-performance sensitivity, i.e., the composition of pay between stock value sensitive and fixed components. Empirical studies (e.g. Aggarwal and Samwick (1999), Jin (2002)) that follow the principal-agent model also convert all compensation into dollar value and then estimate the sensitivity of manager's total pay to firm value.

[17] For example, Conyon and Murphy (2000) provide a comparison between the U.S. and the U.K. using compensation data for 1997. They report that on average, the CEOs in the U.K. receive 59% of their total pay in the form of base salaries, 18% in bonuses, 10% in share options, 9% in restricted shares and 4% other. In the U.S., base salaries comprise a much smaller percentage of total pay (29%), whereas share option grants and restricted shares account for 46% of the total pay.

[18] We should also note that an alternative explanation for the U.S. CEOs having more incentive pay is provided by the 'managerial power approach' (Bebchuk and Fried (2003)). These authors suggest that, compared to their European counterparts, the US executives are able to exercise greater control over their own compensation schemes, especially when ownership is disperse and there is no large shareholder to provide

Customized Hedging and Firm Risk The analysis in Section 4 illustrates that, when they cannot hedge the firm-specific risk in their compensation by trading in the financial markets, managers have an incentive to reduce risk at the firm level by pursuing inefficiently low risk policies. The managers may undertake risk reducing but inefficient mergers (Amihud and Lev (1981) and May (1995)) or engage in excessive corporate cash flow hedging activity (Tufano (1996)) at the shareholders' expense. The availability of customized hedge securities allows the managers to diversify firm-specific risks and mitigates their wasteful risk reduction incentives at the firm level. The implication below follows from Proposition 4.

Implication 3 *Availability of customized hedge securities should promote greater risk taking by managers at the firm level.*

The empirical work on the link between managerial hedging and firm level risk is still nascent due to the difficulty of obtaining reliable data on managerial hedge transactions. The only study that uses direct evidence of managers' use of such derivatives products is by Bettis, Bizjak and Lemmon (2001). They examine hedging transactions by corporate insiders between January 1996 and December 1998 and find that purchases of derivatives products are followed by an increase in the volatility of insiders' stock returns. Consistent with Implication 3, the authors interpret this finding as possible evidence that the managers alter firm strategies towards riskier policies after they hedge.

The shareholders (but not the manager) trade In the model, we implicitly assumed that unlike their manager, the shareholders cannot directly trade with the intermediaries. We now discuss the implications of allowing for this possibility. Let us assume that the shareholders ban the manager to trade with intermediaries all together, yet they can trade with intermediaries themselves. First, note that the risk neutral shareholders have no incentive to trade swap contracts: a swap trade between the shareholders and intermediaries will neither improve the manager's incentives nor will serve any risk sharing benefit. However, the shareholders would benefit from tying the manager's compensation to the customized security payoff, since this serves to reduce the noise and improve incentives. Therefore, they have an incentive to acquire a position θ in the customized security and create a compensation scheme $s\tilde{y} + \theta\tilde{b} + t$ for the manager.

Under this scenario, the customized security again only serves to diversify the firm-specific risk in the manager's contract, and the choice of effort is still determined only by the incentive parameter s. Recall that *without the customized security*, the manager demands a risk premium of $(a/2)\,\mathsf{Var}[s\tilde{y}]$ for a given exposure $s\tilde{y}$. What the shareholders care is how much they can reduce this risk premium by offering a customized security portfolio θ to the manager. For a given s, the shareholders choose θ to minimize $(a/2)\,\mathsf{Var}[s\tilde{y} + \theta\tilde{b}]$. But

discipline. Accordingly, the CEOs in the U.S. have the power to grant themselves favorable stock option plans and earn considerably higher than their reservation wages.

this is exactly how the manager would choose his customized security portfolio, if only the customized security were available. Indeed, it can be shown that the shareholders set the same exact exposure that the manager would choose if the manager could trade *only* the customized hedge security.

Based on this observation, one can also show that in terms of the equilibrium effort and the manager's eventual exposure to $\tilde{b}$ and $\tilde{y}$, the scenario in which the shareholders directly trade with the intermediaries generates the same outcome as the ones where (i) the shareholders allow the manager to trade and swap contracts are *exclusive*, or (ii) the shareholders allow the manager to trade, swaps are *non-exclusive,* but the security customization is sufficiently high ($z > z^*$). The scenario with the shareholders trading is superior for the shareholders precisely when the security customization is low ($z < z^*$) and swaps are non-exclusive: in that case, if the manager could trade, he would swap away all of his shares and not trade the customized security.

6 Conclusion

This paper adopts an optimal contracting framework to analyze the implications of executive hedge markets for shareholder value maximization. The manager can promise the return from his shares to third parties in exchange for a fixed payment—swap contracts—and/or he can trade a customized hedge security whose payoff is correlated with his firm-specific risk. We show that the manager's portfolio choice, and hence the incentive implications of hedging, depend both on the legal structure/contract enforceability—which determines whether swap contracts can be made exclusive—and on the level of security customization, which determines how much firm-specific risk the manager can diversify. The manager's hedge market access improves incentives and increases the manager's pay-performance sensitivity when hedge security customization is sufficiently high or when swap contracts can be made exclusive due to a high degree of contract enforceability. This result indicates that executive hedge markets can provide efficiency benefits to the contractual relationship between the shareholders and the manager. On the other hand, the common concern that the manager's hedge market access will lead him to undo his performance incentives is valid, precisely when the hedge market can only provide low security customization, and it cannot enforce exclusivity in swap contracts.

References

[1] Acharya, V., and A. Bisin, 2005, "Managerial Hedging, Equity Ownership and Firm Value," mimeo, New York University.

[2] Allen, F., 1985, "Repeated Principal-Agent Relationships with Lending and Borrowing," *Economics Letters*, 17, 27-31.

[3] Aggarwal, R., and A. Samwick, 1999, "The other side of the trade-off: the impact of risk on executive compensation," *Journal of Political Economy*, 107, 65-105.

[4] Amihud, Y., and B. Lev, 1981, "Risk Reduction as a Managerial Motive for Conglomerate Mergers," *Bell (Rand) Journal of Economics*, 12, 605-617.

[5] Antle, R., and A. Smith, 1986, "An Empirical Examination of Relative Performance Evaluation of Corporate Executives," *Journal of Accounting Research*, 24, 1-39.

[6] Bank, S.A., 1995, "Devaluing Reform: The Derivatives Market and the Executive Compensation," *DePaul Business Law Journal*, 301-332.

[7] Bebchuk, L.A., and Jesse M. Fried, 2003, "Executive Compensation as an Agency Problem," *Journal of Economic Perspectives*, 17, 71-92.

[8] Bettis, J. Carr, J. Bizjak and M. Lemmon, 2001, "Managerial Ownership, Incentive Contracting and the Use of Zero Cost Collars and Equity Swaps by Corporate Insiders," *Journal of Financial and Quantitative Analysis*, 38, 345-370.

[9] Bisin, A., and D. Guaitoli, 2004, "Moral Hazard and Nonexclusive Contracts," *Rand Journal of Economics*, 35, 306-328.

[10] Bisin, A., and A. Rampini, 2006, "Markets as Beneficial Constraints on the Government," *Journal of Public Economics*, 90, 601-629.

[11] Bisin, A., P. Gottardi and A. Rampini, 2006, "Managerial Hedging and Portfolio Monitoring," mimeo, New York University.

[12] Bizer, D., and Peter DeMarzo, 1999, "Optimal Incentive Contracts When Agents Can Save, Borrow and Default," *Journal of Financial Intermediation*, 8, 241-269.

[13] Bizer, D., and Peter DeMarzo, 1992, "Sequential Banking," *Journal of Political Economy*, 100, 41-61.

[14] Bolster, P., D. Chance and D. Rich, 1996, "Executive Equity Swaps and Corporate Insider Holdings," *Financial Management*, 25, 14-24.

[15] Conyon, M., and K. Murphy, 2000, "The Prince and the Pauper? CEO Pay in the United States and United Kingdom," *Economic Journal*, 110, 640-671.

[16] Easterbrook, F., 2002, Derivatives and Corporate Governance, University of Chicago Law Review Symposium.

[17] The Economist, 1999, "Executive Relief," April 3, 64-66.

[18] Franke, G., R. Stapleton, and M. Subrahmanyam, 1998, "Who Buys and Who Sells Options: The Role of Stock Options in an Economy with Background Risk," *Journal of Economic Theory*, 82, 89-109.

[19] Garvey, G., 1993, "The Principal-Agent Problem When the Agent Has Access to Outside Markets," *Economics Letters*, 73, 183-186.

[20] Garvey, G. and T. Milbourn, 2003, "Incentive Compensation When Executives Can Hedge the Market: Evidence of Relative Performance Evaluation in the Cross-Section," *Journal of Finance*, 58, 1557-1582.

[21] Ip, G., 1997, "Collars Give Insiders Way to Cut Risk, *Wall Street Journal*, April 17.

[22] Jensen, M., and K. Murphy, 1990, "Performance Pay and Top Management Incentives," *Journal of Political Economy*, 98, 225-264.

[23] Kahn, C., and D. Mookherjee, 1995, "Market Failure and Moral Hazard with Side Trading," *Journal of Public Economics*, 58, 159-184.

[24] Kahn, C., and D. Mookherjee, 1998, "Competition and Incentives with Nonexclusive Contracts," *Rand Journal of Economics*, 29, 443-465.

[25] Jensen, M., and K. Murphy, 1990, "Performance Pay and Top Management Incentives," *Journal of Political Economy*, 98, 225-264.

[26] Jin, L., 2002, "CEO Compensation, Diversification and Incentives," *Journal of Financial Economics*, 66, 29-63.

[27] Lambert, R., 1986, "Executive Effort and Selection of Risky Projects," *Rand Journal of Economics*, 17, 77-88.

[28] Lavalle, L., 2001, "Undermining Pay Performance," *Business Week*, 15, 70-71.

[29] May, P., 1995, "Do Managerial Motives Influence Firm Risk Reduction Strategies?" *Journal of Finance*, 50, 1291-1308.

[30] Morgenson, G., 1998, "Stock Options are not a Free Lunch," *Forbes*, 18.

[31] Ofek, E., and D. Yermack, 2000, "Taking Stock: Equity Based Compensation and the Evolution of Managerial Ownership," *Journal of Finance*, 55, 1367-1384.

[32] Ozerturk, S., 2006, "Financial Innovations and Managerial Incentive Contracting," *Canadian Journal of Economics*, 39, 434-454.

[33] Parlour, C., and U. Rajan, 2001, "Competition in Loan Contracts," *American Economic Review*, 91, 1311-1328.

[34] Schizer, D., 2000, "Executives and Hedging: The Fragile Foundations of Incentive Compatibility," *Columbia Law Review*, 100, 440-504.

[35] Stulz, R., 1984, "Optimal Hedging Policies," *Journal of Financial and Quantitative Analysis*, 19, 127-140.

[36] Tufano, P., 1996, "Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry," *Journal of Finance*, 51, 1097-1137.