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AN OPTIMAL INCENTIVE CONTRACT PREVENTING EXCESSIVE RISK-TAKING BY A BANK MANAGER

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The Basel Committee of Banking Supervision initiated a discussion on the most efficient practices to prevent bank managers from excessive risk-taking. This paper proposes a game-theoretical approach, describing the decision-making process by a bank manager who chooses his own level of risk and effort. If the level of risk implies the variability of the future outcome, the amount of effort applied affects the probability of a positive outcome. Although effort is unobserved for the bank's stakeholders, the risk level is under control, and is associated with certain indicators such as capital adequacy ratio or leverage level. The risk-neutral utility function of a bank manager and a binary game outcome of gaining profit or loss for a bank are assumed. Starting from the general incentive contract scheme having the fixed and variable parts of remuneration, it is proposed, that differentiating the variable part of remuneration is sufficient to motivate bank managers to make fewer risky decisions. More precisely, the variable part of remuneration (e.g. the share of the bank's profit) needs to be higher in proportion to the higher variance of outcome for the high -risk outcome case to stimulate a bank manager to opt for lower-risk decisions in place of higher-risk situations.

Keywords: *bank, contract, manager, game-theoretic approach, remuneration.*

JEL Codes: C70, D86, E58.

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Research Objective

Most financial analysts argue that the recent financial crisis was caused by the excessive risks taken by the banks and their managers. It has been particularly noted that incentive contracts might have led to the observed situation, as they proposed high remuneration in case of a profit and zero remuneration in case of losses. To standardize the remuneration practices, the Basel Committee published the document encompassing the most efficient ones (BCBS 2010). Though presented remuneration principles help to solve a range of remuneration-related problems², they fail to deal with some forms of excessive risk-taking that form the subject of the paper.

Thus, the objective of the paper is to propose a contract that would provide incentives for low risk-taking, leading to the financial stabilization of each bank and the financial system in general.

The paper is organized as follows: The “Literature Review” provides a brief coverage of relevant papers dealing with incentive contracts construction in general and bank incentive schemes in particular. A game-theoretic description of a manager’s decision-making process is given in the section entitled “Game-Theoretical Approach of a Bank Manager’s Decision-Making Process”. The section “Incentive Contract as the Optimal Game Strategy” deals with the solution to the game described in the previous section. The “Conclusions” bookend the paper.

The target audience of the paper includes shareholders and regulatory authorities’ representatives interested in offering incentive contracts which favour the stable development of a bank being achieved by avoiding excessive risks taken by the bank management.

Literature Review

The optimal incentive contract construction is a part of the modern institutional theory which focuses on ‘Principal-Agent’ interaction. The *Principal* is the uninformed party which offers the incentive scheme (contract) to the *Agent*

² E.g. remuneration is offered for a multi-period performance to prevent short-term gains and long-term losses.

(the informed party). The Principal aims to make the agent follow the job specification when an undesirable agent's behavior is unlikely to be properly controlled. This is why the literature review will cover the papers on incentive schemes in general and on bank managers' remuneration in particular.

The fundamental principles of incentive contract formation were proposed in the paper completed by Mirrlees in 1975, although they were later published (Mirrlees 1999). An alternative procedure, as well as the characterization of the optimal incentive scheme was provided by Grossman and Hart (1983). Extending the Grossman-Hart model to 10 actions and 10 states, the empirical application of their model was carried out by Haubrich and Popova (1998).

Another approach to dealing with the motivation to work was investigated by Holmstrom and Costa, (1986) when career concerns drove the amount of effort applied by the agent. A further extension of this idea was brought to the paper by Holmstrom and Milgrom (1991). Authors argued that performance depends on agent's efforts and the market environment. The Principal is unable to differentiate the situations when high performance is achieved, as a result of greater amounts of effort or due to a favorable market environment. Authors do model this fact assuming favorable market environment leads to high profits and unfavorable to low ones. Effort applied increases the probability of high outcome earned. Finally, Holmstrom and Milgrom argue that the Optimal Incentive Contract must be directly linked to the observed performance measure (the profit amount), and not to the unobserved effort applied. Extensions to Holmstrom-Milgrom framework and recent findings overview are provided in Gibbons' paper (Gibbons 2005).

The Optimal Incentive Contracts' description for bank managers is available in the³ Basel Committee on Banking Supervision's (BCBS) paper, published in December 2010 (BCBS 2010). The BCBS experts propose to implement long-term incentive contracts, making the remuneration amount dependent on the profit gained over several years. Additionally, experts propose to use the deferral. When a certain amount is deferred, it can be not paid out in case the bank performance had decreased during the period of deferral. It was

³ The research of bank managers' motivation as a result of current remuneration practiced was carried out in Myerson's (2011) working paper "A Model of Moral-Hazard Credit Cycles" available at <http://home.uchicago.edu/~rmyerson/research/bankers.pdf> (accessed on 29.12.2011).

also recommended that a remuneration committee be established, which would be responsible for the Optimal Incentive Contract's formation. The principles above are recommended to be implemented not only for the senior management, but also for all employees that take risks in the course of their day-to-day activity.

Nevertheless, I believe that the issue with the measures proposed by Basel Committee (2010) is that the remuneration is linked to the outcome observed when nothing might be changed. Thus, the intrinsic logic comes to mind that the expectation of zero profits or even losses should de-motivate managers to make high-risk decisions. Still, if the managers rely on expectations of high profits to bring them high remuneration (bonuses), they might prefer high-risk decisions to low-risk ones.

It is important to make a particular mention of the paper by Kivetz (2003), which also attempted to deal with effort and risk as the determinants of the company's performance. Though the research by Kivetz uses the distributions to arrive at the conclusion, the current paper is limited to the binary outcomes of profit and losses for simplicity. Kivetz's paper deals with the agent choice, given the offered incentive scheme. Conversely, current paper aims at searching for an optimal incentive contract to obtain the desired choice of Agent.

The remuneration amount is linked to risk taken, not only to the profit earned. The next section of the paper suggests a method of offering contract which will satisfy the proposed link of risk taken and remuneration received. .

The Game-Theoretical Approach of the Bank Manager Decision-Making Process

To understand the game of bank manager decision-making and remuneration receipt processes it is necessary to list several assumptions introduced.

- The interaction of the Principal (regulator or shareholder) and Agent (bank employee, manager) takes place in two periods of time.
- At the beginning of the first period the following contract is proposed:

$$f + d \cdot \pi, \tag{1}$$

where f - fixed amount of remuneration («insurance part» as Shapiro and Stiglitz (1984) call it, $f \geq 0$), $d \cdot \pi$ - variable amount of remuneration («sharing π profit», $d \geq 0$).

- During the first period the bank manager makes the decision on the level of risk. He might make a low-risk decision (R_L) or a high-risk decision (R_H).
 - When using the term ‘risk’, the measurable indicator is assumed. Such an indicator might be *capital adequacy ratio*, *leverage ratio*, e.g. high risk is associated with a high leverage ratio or low capital adequacy ratio. The Principal carries the responsibility of choosing the value to distinguish high-risk and low-risk cases. This paper does not intend to define these thresholds.
- During the second period, the bank manager decides on the amount of effort to apply. He might apply high effort (e_H) or low effort (e_L). For calculus simplification $e_H = e$ and $e_L = 0$ as did Shapiro and Stiglitz (1984).
 - To provide an example of effort application we must assume that the decision was to choose securities to invest the bank’s liquid funds in. Then high effort corresponds to active trading, which means that positive gains on trading, as well as the mark-to-market revaluation can be registered. Conversely, the revaluation is the only possible outcome when having applied low effort and not trading with the securities.
- In the second period, “Nature” (N) makes its choice of the market environment state. It might be expected to be favorable (F) in $1 \geq p \geq 0$ cases and unfavourable (UF) in $1 \geq 1 - p \geq 0$ cases.
- Consequently, during the second period the bank might make a profit or a loss given the market performance that was favourable (F) or unfavourable (UF). The amount and probability of profit or loss depends on the risk and effort levels in the following manner:

- When having made a high-risk decision (R_H) the profits and losses of a bank are increased by $\theta > 1$ times, i.e. given low-risk decisions (R_L) the bank's profit and loss are equal to (π) and $(-\pi)$, respectively, and given high-risk (R_H) decisions - $(\theta\pi)$ and $(-\theta\pi)$, respectively.
- Following the Holmstrom Milgrom (1991) logic, high levels of effort (e_H) increase the probability of a favorable outcome by $\varepsilon > 0$. Therefore the favorable (F) market environment, given a high level of effort (e_H) might be expected to occur $1 \geq p + \varepsilon \geq 0$ times, and unfavorable (UF) - $1 \geq 1 - p - \varepsilon \geq 0$, respectively.

- At the end of the second period, the remuneration due to the contract (1) is paid out to the bank manager.

Using the assumptions listed above, the game tree is shown on Figure 1. The dotted line corresponds to the uncertainty situation, when the Principal does not know what the market environment chosen by the Nature was. All the Principal might be able to differentiate is whether or not there was a favorable (F) or unfavorable (UF) market environment, and the level of risk that the bank manager has taken: high (R_H) or low (R_L).

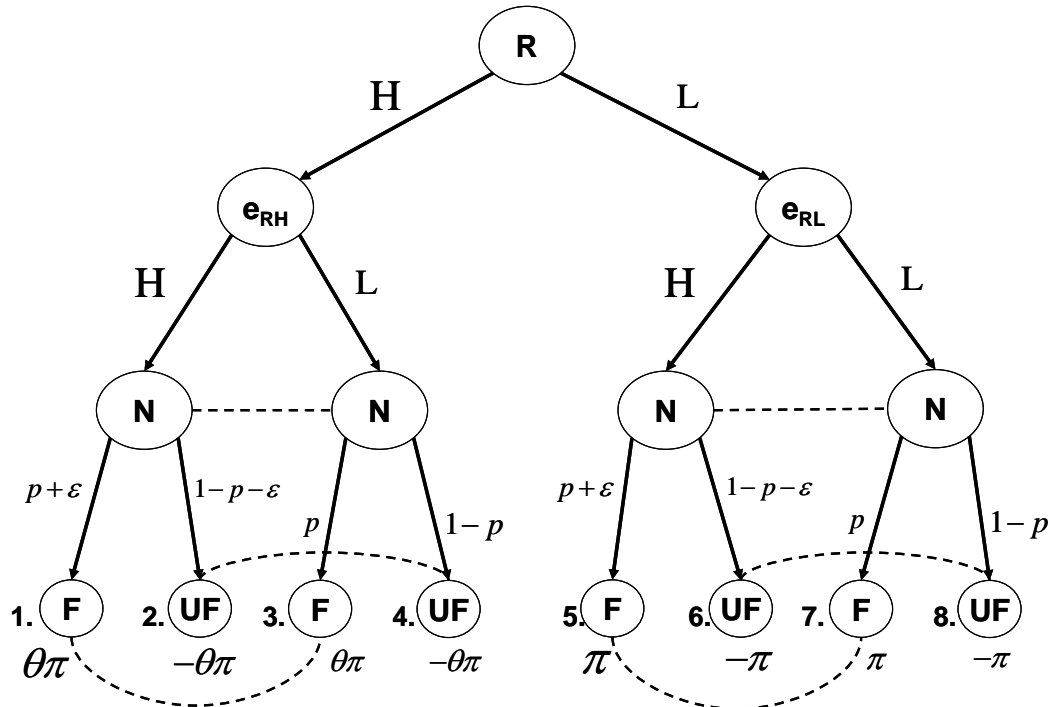


Figure 1. Game Tree of Bank Manager Decision Making.

Fig.1 describes the game situation of a bank manager facing the decision-making task. He must first choose the level of risk (R). It might be high (H) or low (L), and it might correspond to a low capital adequacy ratio for a bank or a higher one. Secondly, he must choose the amount of effort to apply. Effort might be high (H) or low (L). Thirdly, the ‘Nature’ makes its move. It means that the market environment changes on its own, without being influenced by the bank manager. The figure is presented from the Principal’s viewpoint. Thus, dotted lines are introduced to highlight the fact that the Principal is unaware as to whether the amount of effort applied by the bank manager (Agent) was high or low. ‘Nature’ ought to have a binary realization: favorable (F) and unfavorable (UF). In the first (favorable) case, the bank scores profit π or $\theta\pi$ depending on the risk taken (low or high, respectively). In the second (unfavorable) case the bank enregisters losses on its ledgers of $-\pi$ or $-\theta\pi$ whether the risk taken was low or high. Numbers 1 to 8 are used to indicate the game outcome. The figure 1 is necessary for the Principal to decide on the optimal incentive contract for the bank manager given the profit (loss) the bank would obtain as a result of risk taken and effort applied by the bank manager (Agent) if they had accepted the optimal incentive contract.

As Figure 1 demonstrates, there are eight possible outcomes after the bank manager has decided on the level of risk and effort and after the Nature had chosen the type of market environment. The Principal is able to distinguish only the outcomes 1-3, 2-4, 5-7, 6-8.

Incentive Contract as the Optimal Game Strategy

The Principal wants to prevent the bank manager from excessive risk taking, in order that he make a low- risk decision (R_L), in accordance with the Basel Committee (2010) document rationale. He also encourages the manager to apply a high amount of effort (e_H), although bearing in mind the fact that he will be unable to monitor it. Subsequently, the following general incentive contract specification is to be offered to the bank manager when his remuneration, or bonus (B), is dependent on the amount of profit gained (cf. Table 1).

Table 1. General Incentive Contract Specification.

Profit or Loss (Market Environment)	Risk	
	High (R_H)	Low (R_L)
Profit (F)	$B_{11} = f_{11} + d_{11} \cdot \pi$	$B_{21} = f_{21} + d_{21} \cdot \pi$
Loss (UF)	$B_{12} = f_{12} + d_{12} \cdot \pi$	$B_{22} = f_{22} + d_{22} \cdot \pi$

Tab. 1 presents the general form of the incentive contract total payout (\mathbf{B}) that comprises fixed (f) and variable ($d \cdot \pi$) remuneration parts. The total payout is conditional upon the indicators observed by the Principal, i.e. risk (e.g. capital adequacy ratio) and bank financial performance. Risk as indicated on Figure 1 might be high or low. Bank financial performance is also treated as binary: it might be profitable in case of a favorable market situation or loss in the opposite case.

The current legislation does not allow employers to impose fines on their employees for poor performance if that performance was not the result of criminal action, and was simply poor market performance. Thus, the variable part of remuneration in case of loss is to be set equal to zero, e.g. $d_{12} = d_{22} = 0$ (cf. Table 2).

Table 2. Adjusted Incentive Contract Specification.

Profit or Loss (Market Environment)	Risk	
	High (R_H)	Low (R_L)
Profit (F)	$\mathbf{B}_{11} = f_{11} + d_{11} \cdot \pi$	$\mathbf{B}_{21} = f_{21} + d_{21} \cdot \pi$
Loss (UF)	$\mathbf{B}_{12} = f_{12}$	$\mathbf{B}_{22} = f_{22}$

Tab. 2 presents the adjusted form of the incentive contract total payout (\mathbf{B}) that was initially introduced in Table 1. The key difference to Table 1 is that the variable part ($d \cdot \pi$) of remuneration is set equal to zero in case of unfavorable market situations. As no restrictions were imposed on the amount of loss, there might have been a situation the bank manager had to pay his own money to the bank, contradicting the current labor legislation.

To derive the optimal contract which would stimulate the bank manager to choose low risk and high effort, according to the Shapiro and Stiglitz's (1984) terminology, the following order of preferences for outcomes can be observed, where the notation « $X \succ Z$ » stands for the case when outcome X is preferred to outcome Z .

- No-shirking condition (NSC) for *low* risk decisions ($5 \succ 7, 6 \succ 8$).
- No-shirking condition (NSC) for *highly* risky decisions ($1 \succ 3, 2 \succ 4$).
- No-shirking condition (NSC) for *low* risk decisions given *high* effort ($5 \succ 1, 6 \succ 2$).

As the choice of the decision strongly depends on the bank manager's preference, it is necessary to introduce the bank manager's utility function U . For

the purpose of this paper, it is assumed that the manager has a risk-neutral utility function. It is given below.

$$U(\mathbf{B}; e_i) = \mathbf{B} - e_i, \quad (2)$$

where $e_i = \{e_H; e_L\}$.

As was assumed earlier, the bank manager is unable to influence the market environment. In this case, he is choosing between the outcomes which depend upon the Neumann-Morgenstern expected utility of favorable and unfavorable market environments and their corresponding outcomes. This means that the outcome preferences subsequently lead to the following system of inequalities:

$$\begin{cases} (p + \varepsilon)U(\mathbf{B}_{21}; e) + (1 - p - \varepsilon)U(\mathbf{B}_{22}; e) \geq pU(\mathbf{B}_{21}; 0) + (1 - p)U(\mathbf{B}_{22}; 0) \\ (p + \varepsilon)U(\mathbf{B}_{11}; e) + (1 - p - \varepsilon)U(\mathbf{B}_{12}; e) \geq pU(\mathbf{B}_{11}; 0) + (1 - p)U(\mathbf{B}_{12}; 0) \\ (p + \varepsilon)U(\mathbf{B}_{21}; e) + (1 - p - \varepsilon)U(\mathbf{B}_{22}; e) \geq (p + \varepsilon)U(\mathbf{B}_{11}; e) + (1 - p - \varepsilon)U(\mathbf{B}_{12}; e) \end{cases} \quad (3)$$

Using the bank manager's risk-neutral utility function introduced in (2), and the adjusted incentive contract scheme from Table 2, the system (3) might be rewritten as follows:

$$\begin{cases} (p + \varepsilon)(f_{21} + d_{21} \cdot \pi - e) + (1 - p - \varepsilon)(f_{22} - e) \geq p(f_{21} + d_{21} \cdot \pi) + (1 - p)(f_{22}) \\ (p + \varepsilon)(f_{11} + d_{11} \cdot \theta\pi - e) + (1 - p - \varepsilon)(f_{12} - e) \geq p(f_{11} + d_{11} \cdot \theta\pi) + (1 - p)(f_{12}) \\ (p + \varepsilon)(f_{21} + d_{21} \cdot \pi - e) + (1 - p - \varepsilon)(f_{12} - e) \geq (p + \varepsilon)(f_{11} + d_{11} \cdot \theta\pi - e) + (1 - p - \varepsilon)(f_{12} - e) \end{cases} \quad (4)$$

After simplification system (4) is transformed to system (5) below:

$$\begin{cases} \varepsilon(f_{21} + d_{21} \cdot \pi) - e(p + \varepsilon) + f_{22}(-\varepsilon) - e(1 - p - \varepsilon) \geq 0 \\ \varepsilon(f_{11} + d_{11} \cdot \theta\pi) - e(p + \varepsilon) + f_{12}(-\varepsilon) - e(1 - p - \varepsilon) \geq 0 \\ (p + \varepsilon)(f_{21} - f_{11} + (d_{21} - \theta d_{11}) \cdot \pi) \geq (1 - p - \varepsilon)(f_{12} - f_{22}) \end{cases} \quad (5)$$

To simplify the system somewhat, the following can be rendered (6):

$$\begin{cases} (f_{21} - f_{22}) + d_{21} \cdot \pi \geq \frac{e}{\varepsilon} \\ (f_{11} - f_{12}) + d_{11} \cdot \theta\pi \geq \frac{e}{\varepsilon} \\ (p + \varepsilon)(f_{21} - f_{11} + (d_{21} - \theta d_{11}) \cdot \pi) \geq (1 - p - \varepsilon)(f_{12} - f_{22}) \end{cases} \quad (6)$$

To identify the Optimal Manager Remuneration Contract parameters, the Principal's viewpoint must be taken into account. A high amount of remuneration amount for the Agent's benefit corresponds to a higher expenditure on the

Principal's part, which decreases his residual profit (π). Thus, it is necessary to solve the profit-optimization problem (7) and (8), given the restrictions from (6) for low and high- risk decisions, respectively.

$$\left\{ \begin{array}{l} \max_{f_{21}, f_{22}, d_{21}} \pi = \max_{f_{21}, f_{22}, d_{21}} \left((p + \varepsilon)(\pi - f_{21} - d_{21} \cdot \pi) + (1 - p - \varepsilon)(-\pi - f_{22}) \right) \\ (f_{21} - f_{22}) + d_{21} \cdot \pi \geq \frac{e}{\varepsilon} \end{array} \right. \quad (7)$$

$$\left\{ \begin{array}{l} \max_{f_{11}, f_{12}, d_{11}} \pi = \max_{f_{11}, f_{12}, d_{11}} \left((p + \varepsilon)(\theta\pi - f_{11} - d_{11} \cdot \theta\pi) + (1 - p - \varepsilon)(-\theta\pi - f_{12}) \right) \\ (f_{11} - f_{12}) + d_{11} \cdot \theta\pi \geq \frac{e}{\varepsilon} \end{array} \right. \quad (8)$$

To solve systems (7) and (8) it is necessary to initially take the partial derivatives of the residual profit (π) function with respect to the contract parameters. Results corresponding to low and high-risk cases are provided in systems (9) and (10).

$$\left\{ \begin{array}{l} \frac{\partial \pi}{\partial f_{21}} = -p - \varepsilon, f_{21} \in [0; \pi] \\ \frac{\partial \pi}{\partial f_{22}} = -1 + p + \varepsilon, f_{22} \in [0; \pi] \\ \frac{\partial \pi}{\partial d_{21}} = -\theta\pi(p + \varepsilon), d_{21} \in [0; 1] \end{array} \right. \quad (9)$$

$$\left\{ \begin{array}{l} \frac{\partial \pi}{\partial f_{11}} = -p - \varepsilon, f_{11} \in [0; \pi] \\ \frac{\partial \pi}{\partial f_{12}} = -1 + p + \varepsilon, f_{12} \in [0; \pi] \\ \frac{\partial \pi}{\partial d_{11}} = -\theta\pi(p + \varepsilon), d_{11} \in [0; 1] \end{array} \right. \quad (10)$$

Looking at the first rows of systems (9) and (10) and accounting for non-positive signs of the respective derivatives, it becomes clear that the fixed remuneration part parameters need to be taken as equal to zero, i.e. $f_{11} = f_{12} = f_{21} = f_{22} = 0$.

Then the system (6) might be simplified to the following.

$$\left\{ \begin{array}{l} d_{21} \cdot \pi \geq \frac{e}{\varepsilon} \\ d_{11} \cdot \theta \pi \geq \frac{e}{\varepsilon} \\ (d_{21} - \theta d_{11}) \cdot \pi \geq 0 \end{array} \right. \quad (11)$$

System (11) implies the final relationship between contract parameters with low and high- risk decisions.

$$1 \geq d_{21} \geq \theta d_{11} \geq \frac{e}{\varepsilon \pi} \quad (12)$$

As it comes from inequality (12), the bank manager would prefer a low-risk decision in case the variable part of his remuneration ($d_{21} \cdot \pi$) would not be less than the variable part of remuneration ($d_{11} \cdot \theta \pi$). Simultaneously, the bank manager would apply high effort in case the expected extra profit ($\varepsilon \pi$) would compensate the financial equivalent of his applied effort (e).

Conclusions

The game-theoretic approach to the bank manager decision-making process was applied. Given the aim of the Principal (bank shareholders or regulatory authorities) to encourage the bank manager to make low-risk decisions and apply high effort, the following final incentive contract specification (cf. table 3) was proposed, which links the amount of managerial bonus to the risk indicator (capital adequacy or leverage ratio) and the bank outcome in terms of profit.

Table 3. Final Incentive Contract Specification.

Profit or Loss (Market Environment)	Risk	
	High (R_H)	Low (R_L)
Profit (F)	$B_{11} = d_{11} \cdot \pi$	$B_{21} = \theta d_{11} \cdot \pi$
Loss (UF)	$B_{12} = 0$	$B_{22} = 0$

Table 3 presents the final form of the incentive contract total payout (B) that was initially introduced in Table 1 and adjusted in Table 2. It was proven that it was insufficient for the

Principal to set a fixed (f) part of the incentive contract equal to zero in all times. In order to motivate the bank manager to not take excessive risks, the only necessary condition to be introduced is the restriction on the value of variable ($d \cdot \pi$) parts of remuneration. In case a low risk was taken, higher share of the profit was offered to the Agent by the Principal. More precisely, the share of profit in the case of a low risk taken is to be $\theta > 1$ times higher than the share of profit offered in the case of a high risk.

The major contribution of the paper is that in order to stimulate the bank manager to take low risk decisions, the variable part of his remuneration must be no less than the amount he would have received having taken a high-risk decision. The variable part of remuneration, when taking low risky decision, must be proportionately higher than the profit that might have been achieved given the high-risk decision.

Further research on this topic is required in the following ways:

- Analyzing the proposed framework by substituting binary outcomes by distributions as Kivetz (2003) did
- Formulating the multi-period incentive contract to model the BCBS (2010) concept of long-term motivation.

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References

- Basel Committee on Banking Supervision (BCBS) (2010). Range of methodologies for risk and performance alignment of remuneration. 2010. BCBS Paper 194. <http://www.bis.org/publ/bcbs194.pdf>. Accessed 29 December 2011.
- Haubrich, J., Popova, I. (1998). Executive compensation: a calibration approach. *Economic Theory*, 12, 561-581.

- Holmstrom, B., Costa, J. (1986). Managerial Incentives and Capital Management. *The Quarterly Journal of Economics*, 101, 835-860.
- Holmstrom, B., Milgrom, P. (1991). Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design. *Journal of Law, Economics and Organization*, 7, 24–52.
- Gibbons, R. (2005). Incentives Between Firms (and Within). *Management Science*, 51, 2–17.
- Grossman, S., Hart, O. (1983). An Analysis of the Principal-Agent Problem. *Econometrica*, 51 (1), 7-46.
- Kivetz, R. (2003). The Effects of Effort and Intrinsic Motivation on Risky Choice. *Marketing Science*, 22 (4), 477-502.
- Mirrlees, J. (1999). The Theory of Moral Hazard and Unobservable Behavior: Part I. *Review of Economic Studies*, 66, 3-21.
- Shapiro, C., Stiglitz, J. (1984). Equilibrium Unemployment as a Worker Discipline Device. *The American Economic Review*, 74 (3), 433-444.

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