



# Agency theory and corporate governance

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## A study of the effectiveness of board in their monitoring of the CEO

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### Abstract

**Purpose** – The effect of corporate governance on firm performance has long been of great interest to financiers, economists, behavioural scientists, legal practitioners and business operators. Yet there is no consensus over what constitutes an effective corporate governance mechanism that induces agents or managers to consistently act in the interest of share value optimisation. The purpose of this study is to develop a model to resolve an on-going issue in financial economics: how can CEOs be effectively monitored by the board of directors?

**Design/methodology/approach** – A survey of the literature on corporate governance and the relationship between board composition and financial performance leads to the development of the proposed model, which is based on a framework which takes into account the probability of success representing a CEO's ability, and the active monitoring function (which is represented by the numbers of control visits) carried-out by the directors.

**Findings** – The design of the model is aimed at identifying an optimal level of monitoring, which will maximise share value, to guide internal and independent directors.

**Research limitations/implications** – The model has limitations: it does not address the input of other directors and it focuses solely on the monitoring function, even though boards also play important roles in providing information and advice to management.

**Originality/value** – The finding of this study contributes to the Agency Theory debate, in essence that the board monitoring of CEO will improve the performance of the CEO and avoid possible conflict of interests.

**Keywords** Corporate governance, Mathematical modelling, Optimization techniques, Chief executives

**Paper type** Research paper

### 1. Introduction

Separation between ownership and control of corporations characterises the existence of a firm. The design of mechanisms for effective corporate control to make managers act in the best interest of shareholders has been a major concern in the area of corporate governance and finance (Allen and Gale, 2001), and continuing research in agency theory attempts to design an appropriate framework for such control. In a corporation, the shareholders are the principals and the managers are the agents working on behalf of, and for the interests of, the principals. In agency theory, a well-developed market for corporate controls is assumed to be non-existent, thus leading to market failures, non-existence of markets, moral hazards, asymmetric information, incomplete contracts and adverse selection among others. Various governance mechanisms have been advocated which include monitoring by financial institutions, prudent market competition, executive



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compensation, debt, developing an effective board of directors, markets for corporate control, and concentrated holdings. Developing an effective board of directors remains an important and feasible option for an optimal corporate governance mechanism.

The limitations of the current literature in this field are the following. Currently, several formal models exist based on the effectiveness of the board of directors in designing efficient control mechanisms for corporate governance. However, for a multi-level decision system such as corporate governance, an improved model including uncertainty in model parameters is necessary to resolve the uncertain nature of the agency problem in corporate governance. In addition, the modelling studies of monitoring CEOs by the board, using empirical data, to resolve the agency problem in a more quantitative form are not well-known in the current literature.

The objectives of this paper are; to provide an improved model for corporate governance based on an effective board of directors and to analyse the results of this model for the effectiveness of boards and their monitoring of the CEO. This study is also expected to enrich the current literature by providing an empirical assessment of CEO performance and monitoring, in precise quantitative terms.

The paper is structured in the following way: Section 2 presents the principal theoretical concepts covered by the selected literature on the agency theory in finance, and on the role and composition of boards. Section 3 presents a model to prescribe optimal monitoring levels, featuring a case study of a director that sits on different boards, and needs to decide how to apportion her monitoring efforts across the different CEOs. A mathematical model is developed to resolve the dilemmas presented in the case study. Section 4 covers a discussion on the algorithm, data, solution and results, as well as their interpretations. Section 5 discusses the implications and findings of the models being proposed. Section 6 discusses the limitations of the model. The conclusion is presented in Section 7.

## **2. Corporate governance: the issues and the role of the board**

### *2.1 The issues*

Agents or managers may not always act in the best interest of shareholders when the control of a company is separate from its ownership. In June 1959, Simon Herbert (quoted in Baysinger and Hoskisson, 1990) proclaimed that managers might be “satisfiers” rather than “maximisers,” that is, they tend to play it safe and seek an acceptable level of growth because they are more concerned with perpetuating their own existence than with maximising the value of the firm to its shareholders. But shareholders delegate decision-making authority to the agent (CEO) with the expectation that the agent will act in their best interest.

A comprehensive theory of the firm under agency arrangements was developed by Jensen and Meckling (1976), who show that the principals (the shareholders) can assure themselves that the agent will make the optimal decisions only if appropriate incentives are given and only if the agent is monitored. Incentives include such things as stock options, bonuses and prerequisites which are directly related to how well the results of management’s decisions serve the interests of shareholders. Monitoring consists of bonding the agent, systematic reviews of management prerequisites, financial audits, and placing specific limits on management decisions. These involve costs, which are an inevitable result of the separation of corporate ownership and control. Such costs are not necessarily bad for shareholders, but the monitoring activity they cover needs to be efficient.

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In contrast, Demesetz (1983) and Fama and Jensen (1983) suggest that the primary monitoring of managers comes not from the owners but from the managerial labour market. It is argued that management control of a large corporation is completely separate from its security ownership. Efficient capital markets provide signals about the value of a company's securities and thus about the performance of its managers. If the managerial labour market is competitive both within and outside the firm, it will tend to discipline the manager. Therefore, the signals given by changes in the total market value of the firm's securities become very important.

Kaplan and Reishus (1990) find evidence consistent with this argument: directors of poorly performing firms, who therefore may be perceived to have done a poor job overseeing management, are less likely to become directors at other firms. On the other hand, reputational concerns do not correct all agency problems and can, in fact, create new ones.

### *2.2 The role of the board*

Garrat (1997) defines the function of the board as a collective responsibility to:

- determine the company's purpose and "ethics";
- decide the direction, that is, the strategy;
- plan;
- monitor and control managers and CEO; and
- report and make recommendations to shareholders.

Individual directors have personal liability if the company can be shown to have been trading "wrongfully" (trading whilst insolvent), continuing to trade when there was no reasonable prospect of its being able to pay its debts, illegally, carrying out activities contrary to laws and regulations, e.g. Emron, AWB.

Independence of thought is demanded of all directors when on a board and this requires that they pursue discriminating questions until they get satisfactory answers that they and other board members understand. Pursuing the company's interests above all else should be their priority. Directors' competence, independence of imagination and thought plus the skill to run an effective enterprise, will determine an organisation's success. The model developed below relates specifically to monitoring and control by the board as a function of attendance at board meetings.

### *2.3 Board composition: directors' independence*

Empirical evidence supports the position that outside directors have been more effective in monitoring managers and protecting the interests of shareholders. Larger numbers of outside directors have been associated with a negative relation between CEO turnover and performance (Weisbach, 1988), a lower probability that the board pays greenmail in a control contest (Kosnik, 1990) and a lower probability that the board adopts a poison pill (Mallette and Fowler, 1992).

Byrd and Hickman (1992) argue that the greater the proportion of outside directors, the better the stock market's reaction to their firm's tender offers for other firms. Weisbach (1988) finds that the sensitivity of CEO turnover to firm performance increases with the number of outside directors on the board. He suggests that outside directors who own a substantial number of shares and who hold more corporate directorships

(presumably measuring the value they place on their reputations) are better at negotiating a favourable deal for shareholders who face a takeover bid. Lastly, Hallock (1997) finds that firms whose boards are interlocked (contain a CEO on whose board the firm's CEO serves) tend to pay their CEOs more. He argues that interlocked directors are less independent and, consequently, give the CEO a larger fraction of the rents than necessary.

#### *2.4 Board composition and CEO performance*

Hermalin and Weisbach (1998) ask how boards can be chosen through a process partially controlled by the CEO, yet, in many instances, still be effective monitors of him. Weisbach (1988) reports that boards with at least 60 percent independent directors are more likely than other boards to fire a poorly performing CEO. This type of firing is likely to add value because boards are generally slow to fire CEOs. The stock price reaction to such firings is hard to interpret because the firing announcement conveys information to the market both about the event and about how the firm performed under the fired CEO, but there is evidence that investors believe that these firings increase firm value. He quotes evidence (Daily and Dalton, 1995) that firm performance improves modestly on average after a CEO is replaced. Weisbach's study suggests that independent directors behave differently to inside directors with respect to retaining or firing a CEO, but it is not clear whether independent directors make better or worse decisions, on average.

Hermalin and Weisbach (1998) assume that the board and the CEO negotiate over both the CEO's wage and the identity of new directors. These negotiations could be either explicit or implicit, that is the CEO could nominate new board members subject to a tacit understanding about the set from which they may be chosen. Were the CEO to violate this understanding, the board would refuse to approve his nominees. The CEO's bargaining power in these negotiations comes from his perceived ability relative to a replacement.

These negotiations determine the board's level of independence. Director independence is important because a director's willingness to monitor the CEO increases with his or her independence. Monitoring provides information about the CEO used by the board in deciding whether to retain or to replace him/her.

However, a study conducted by Carver (1997) revealed that the board should evaluate the performance of the CEO based on:

- (1) the final achievement which has been initially defined;
- (2) the compliance of the CEO to a set of executive limitations which were set-out by the board;
- (3) the alignment with the point of CEO's accountability as being set by the board; and
- (4) the regular assessment whether the CEO achieves points (1), (2) and (3).

Evaluation is such a crucial issue to maximize CEO's performance with expected end result to improve the future performance, not to fire the CEO.

### **3. A model to prescribe optimal monitoring levels**

#### *3.1 The need for a model to prescribe optimal monitoring levels*

The debate over the alleged greater propensity of independent directors to perform the monitoring function compared with internal directors, calls for an objective measure of the monitoring requirements that transcends the individual's distaste or propensity for

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monitoring. Different directors put different weights on profits, as directors' concerns for building reputations as competent managers may vary. So, it can be said that directors have a different utility for monitoring. Some inside directors' careers are tied to the CEO's, so they rarely find it in their interest to monitor him/her. Also, directors who value the opportunity to serve on other boards could have an incentive to establish reputations for not "rocking the boat", i.e. for not intensely monitoring the CEO.

The requirement for monitoring changes is based on several factors: the estimated ability of the management team and the CEO; their level of cohesiveness; the leadership skills of the CEO; and the current economic circumstances and risks faced by the company. The model, therefore, should be dynamic and able to accommodate variations in the factors over a period of time. The model that determines an objective level of monitoring based on the variables discussed would provide an unbiased approach for all directors to adopt, and for a chairman to drive and implement, to ensure a CEO has optimal chances to succeed.

The authors are not aware of any other attempt to develop such a model, prior to this paper.

### 3.2 *The case study*

The case study developed here is based upon the following assumptions:

- (1) that a CEO who performs poorly is more likely to be replaced than one who performs well;
- (2) that CEO turnover (firing) is more sensitive to performance when the board is more active in its monitoring function;
- (3) that the director has an incentive to optimize the financial performance of her companies, but that there is a natural tendency to minimize the monitoring costs, often at the expense of results; and
- (4) that 1-3 are a function of director attendance at scheduled board meetings.

Directors of boards often sit on more than one board. Directors are also known to have several commitments and often conflicting requirements. They have time constraints and thus need to carefully manage their efforts for maximum results. The principal function that tests the effectiveness of a board is that of monitoring and control of the CEOs and their performance. The greater the level of monitoring, the greater the probability of success or enhanced financial performance.

A director sitting on multiple boards (six) is trying to determine how to allocate her time and monitoring activity across the six organisations, for the following financial period. She knows that the probability of successful performance of each organisation partly depends on the degree of monitoring she performs, but she can only afford to spend limited time, which is represented as a maximum of a total of 20 visits to the six CEOs.

The Board of Directors has an estimate of the ability of each CEO based on their past performance. If the CEO is new, the estimate of his ability is low. He requires more monitoring than old CEOs, since less is known about his ability. More independent boards have a greater tolerance for this added monitoring, so they can afford to be tougher with an incumbent CEO whose performance is marginal.

When new information about a CEO's performance is observed as, either profits or some signal, the directors update their beliefs about the CEO's ability.

Poor performance lowers the board's assessment of the CEO's ability. Similarly, if a CEO keeps his job, then retaining him must be worth more to the directors than replacing him. A firing reveals that a CEO who was previously seen as better than the expected value of a replacement is now not seen that way.

The CEO's ability is expressed as an estimate of the probability of successful performance, as a function of the degree of monitoring by the director, measured in number of control visits. The probability function is:

$$p_i = \frac{(X_i + 0.1)}{(X_i + k_i)}$$

where  $X$  is the number of director visits, and  $k$  is a constant for each CEO that determines the shape of his ability (probability of success) function.

The costs and benefits associated with the success or failure of the company's financial performance under the leadership of a CEO are expressed in terms of share value movements. If the company performs well and delivers increased profits, the value of its shares increases. Conversely, if the firm performs badly and the market obtains signals of poor financial performance, the effect is felt in the reduced share price. The share price sensitivity of each firm is illustrated in the data table.

The director's remuneration is based on the share price performance, therefore she has an interest in maximising share value. However, she has limited resources: as an example, she can only afford 20 monitoring visits, and as the location of each CEO is different, each destination takes a different time to reach, plus the time spent meeting with the CEO, checking reports, etc. in hours. She has a total of 80 hours available for the visits.

### 3.3 The model

3.3.1 *Decision variables.* The director must make two separate decisions, which are related:

- (1) Determine whether to keep or fire a CEO. This is a binary decision where:  $Y_i = (1 = \text{retain the CEO})$  or  $(0 = \text{fire the CEO})$ .
- (2) Determine how many monitoring visits to assign to each CEO:  $X = 1, 2, 3, \dots, 20$ .

3.3.2 *Objective function.* The director wants to maximise the expected share value of her decisions, which is, for each respective CEO, the product of the probability of their success by the increase in share value, minus the product of the probability of their failure by the related drop in share value:

max:

$$\begin{aligned} & \left( \frac{A_1 X_1}{(X_1 + p_1)} + \frac{A_2 X_2}{(X_2 + p_2)} + \frac{A_3 X_3}{(X_3 + p_3)} + \frac{A_4 X_4}{(X_4 + p_4)} + \frac{A_5 X_5}{(X_5 + p_5)} + \frac{A_6 X_6}{(X_6 + p_6)} \right) \\ & - \left( \frac{B_1 X_1}{(X_1 + p_1)} + \frac{B_2 X_2}{(X_2 + p_2)} + \frac{B_3 X_3}{(X_3 + p_3)} + \frac{B_4 X_4}{(X_4 + p_4)} + \frac{B_5 X_5}{(X_5 + p_5)} + \frac{B_6 X_6}{(X_6 + p_6)} \right) \end{aligned} \quad (1)$$

where  $A$  is share value increase if successful; and  $B$  is share value decrease if unsuccessful.

3.3.3 *Constraints.* The constraints that apply to this model are the following. The director has a maximum of 80 hours to dedicate towards the monitoring visits. This is measured as follows:

$$5X_1Y_1 + 3X_2Y_2 + 4X_3Y_3 + 6X_4Y_4 + 6X_5Y_5 + 8X_6Y_6 \leq 80 \quad (2)$$

Next, the director must ensure she does not exceed her 20 visit quota. This can be done by the following:

$$X_1 + X_2 + X_3 + X_4 + X_5 + X_6 \leq 20 \quad (3)$$

Also, she needs to ensure that the visits are not wasted on the CEOs that will be fired (new CEOs replacing fired ones will have a new  $k$  value, which is to be entered into the model, and a new solution run again). For simplicity purposes, when a CEO is to be replaced, the model will recommend no visits. It follows that when a replacement is found, and his/her  $k$  value established, the model will provide a revised response. The linking constraints are the following:

$$X_i - 20Y_i \leq 0 \quad \text{where } i = 1, 2, 3, 4, 5, 6 \quad (4)$$

This ensures that an  $X_i$  variable can be greater than zero only if its respective  $Y_i$  is one.

The expected share value ( $V$ ) is the sum of the probability of each CEO succeeding times the respective expected increased share value, minus the probability of failure times the respective expected drop in share value.

#### 4. Algorithm, data, solution, and results

##### 4.1 Algorithm

The expected share value is:

$$\sum_6^1 \{(\text{If } p_i = 0, \text{ then zero, otherwise, } p_i A_i + (1 - p_i) B_i)\} \quad (5)$$

The model for CEO monitoring optimisation is illustrated in the Table I. In essence, it is:

maximise the expected share value:

$$\sum_6^1 \{(\text{If } p_i = 0, \text{ then zero, otherwise, } p_i A_i + (1 - p_i) B_i)\} \quad (6)$$

subject to:

$$5X_1Y_1 + 3X_2Y_2 + 4X_3Y_3 + 6X_4Y_4 + 4X_5Y_5 + 8X_6Y_6 \leq 80$$

$$X_1 + X_2 + X_3 + X_4 + X_5 + X_6 \leq 20$$

$$X_i - 20Y_i \leq 0 \quad \text{where } i = 1, 2, 3, 4, 5, 6$$

$$X_i \geq 0 \text{ and integer}$$

$$Y_i \text{ binary}$$

##### 4.2 Data

The data used in the model (reported below) is illustrative only but based on a realistic scenario. For this case study, the data were determined as follows:

- number of boards/CEOs: 6;
- total available number of monitoring visits: 20;

**Table I.**  
Solution to the CEO  
monitoring optimisation  
problem

CEO	Y Fire CEO? (1 = keep, 0 = fire)	X No. of monitoring visits	Linking constraints	$k$ Probability parameter	P Prob. of success (percent)	A Share value increase if successful (\$)	B Share value decrease if un-successful (\$)	V Expected share movement (\$)	Hours required per visit
1	1	8	-12	4.2	66.4	8,000	-2,000	4,639	5
2	0	0	0	18.0	0.6	2,000	-4,400	N/A	3
3	1	2	-18	3.6	37.5	1,000	-1,500	-563	4
4	1	5	-15	1.2	82.3	7,800	-6,000	5,352	6
5	0	0	0	5.0	2.0	2,000	-7,000	N/A	6
6	0	0	0	6.8	1.5	7,600	-1,500	N/A	8
	Total used	15	0				Total	9,428	78
	Total available	20						Maximum hours available	80



- total available hours spent on visits: 80;
- time involved in monitoring each CEO (Table II);
- ability factor, “*k*” Factor for each CEO (Table III); and
- expected share movement due to success/failure of CEO (Table IV).

#### 4.3 Solution and results

The Excel Function Solver provides a series of optimal solutions based on specific variables given. Given the parameters in Section 4.2 data, the solution is represented in Table I.

The model recommends to fire and replace three CEOs, and distribute the time available across the remaining CEOs so that 78 hours are spent on a total of 15 monitoring visits. This behaviour will optimise the value of the shares and generate an aggregate increase of \$9,428 million.

The variables can easily be modified by the director to reflect current information about market reactions and signals on the ability of each CEO. The model will continue to provide an optimal solution upon each round of updated variables.

### 5. Implications and findings

Consistent with the widely held belief that entrenched CEOs or CEOs who have cultivated personal loyalty (and whose ability is therefore more likely to be

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CEO1	5h
CEO2	3h
CEO3	4h
CEO4	6h
CEO5	6h
CEO6	8h

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**Table II.**

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CEO1	4.2
CEO2	18.0
CEO3	3.6
CEO4	1.2
CEO5	5.0
CEO6	6.8

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**Table III.**

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CEO (company)	Increase if success (\$m)	Decrease if failed (\$m)
Company 1	8,000	2,000
Company 2	2,000	4,400
Company 3	1,000	1,500
Company 4	7,800	6,000
Company 5	2,000	7,000
Company 6	7,600	1,500

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**Table IV.**

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overestimated), are less scrutinized and face lower standards, the research finding reveals that, all other things being equal, the more the board values the incumbent CEO, that is, the lower the  $k$  factor, the less intensely he will be monitored by the board.

As revealed by Carver (1997), this study also implies that the evaluation of the CEO is to improve CEO's performance in the future, not to fire the CEO. However, once the decision to fire a CEO needs to be made, such decision is also contingent upon the potential risk and magnitude of loss or gain in share value, which is a firm specific variable. If the magnitude of loss due to market signals of poor performance is very large, compared to the magnitude of share value increase if the financial performance is positive, even where the probability of failure is low, the expected benefit might still be negative. This situation requires a very capable CEO whose  $k$  factor approaches zero.

The model addresses both sides of the equation by determining the optimal intensity with which to monitor a CEO based upon the interrelation of the board's perception of the ability of a CEO (measured as the  $k$  factor) and the expected market reaction to the CEO's performance (expected share movement).

In the solution shown in the Appendix (Tables AI and AII and Figure A1), out of six CEOs, only numbers 1, 3 and 4 shall be retained, as they are likely to provide the best returns, with the right amount of monitoring. The director will need to replace the other CEOs, estimate their respective  $k$  factor, and re-enter the new variables in the model to achieve the new optimal distribution of monitoring resources.

Although this model has been developed in relation to boards of directors, its application is fairly general. It can be extended to job-matching problems where some workers are recognized to be more valuable than others.

It can also be used by a director to decide whether to keep a particular board assignment, or to resign, based on the risk which is expressed as the number of monitoring visits required to achieve a positive result.

The model is consistent with both realities observed by the literature: active monitoring in some firms and CEO dominance in others. A company has a crisis induced by poor profits and the board is forced to act. The new CEO has no bargaining power, a high  $k$  factor, and, thus, has to contend with an active board. None of this would happen if the previous managers performed better; they would maintain their jobs and their control over the board.

The model is consistent with a number of empirical regularities: CEO turnover is negatively related to performance and this relation is stronger when the board is more independent, that is, monitors more actively. The probability that stronger independent directors are added to the board increases following poor corporate performance. And boards tend to become less scrutinising over the course of the CEO's career.

## 6. Limitations of the model

The model being proposed in this study has a limitation where the focus is solely on the monitoring of boards. The institutional literature (Mace, 1971; Vance, 1978) emphasizes that boards also play important roles in providing information and advice to management, and serving as a training ground for future CEOs. A richer model of boards should take into account these roles as well.

More research is also required in devising objective measures to assess the ability of potential directors to discern and address tough company situations, to know when

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painful decisions are called for, to nurture their own independent opinions, and to decipher the conceptual errors of corporate officers. In fact, more work is required in the area of pre-board selection tests, and an accreditation system that guarantees at least some fundamental levels of skill, knowledge and experience.

The model does not address the input of other directors, and it assumes that each director will act in a similar fashion, with respect to their own portfolios of board positions. However, the issue of free-riding does arise and some directors might perceive that the monitoring carried out by their fellow directors is adequate and choose to decrease their share of monitoring. The literature reviewed highlights that this behaviour is usually observed in non-independent directors, as internal directors have an incentive to ingratiate themselves with the CEO, to ensure continuing support as board members. This explains why some CEOs are able to avoid scrutiny. Corporate policy should address this problem, and some commentators suggest smaller boards (to reduce free-riding), for outside directors, more meetings, director pay linked to stock performance, and appointment of a lead director (if not the chairman) who is separate from the CEO. These policies would lead to better monitoring of the CEO.

The model represents a practical, quick solution to a simple question: “As a Director on several boards, how do I apportion my time across the different boards?”. However, it does not fully address possible complications such as the extra time involved in replacing non-performing CEOs, or lobbying other directors to make the right decisions. It may, however, assist a director who is considering resigning from a board, by providing improved objective insight into the financial outcomes following such decision.

## 7. Conclusion

Reputed literature on the agency costs associated with the separation of ownership and management in corporate governance has been reviewed in this study. A model has been developed that determines the optimal level of monitoring of CEOs by directors, which is considered a crucial function in determining the financial performance of the firm. In the scenario illustrating the model, the optimal value of monitoring is represented by 15 monitoring visits across three CEOs for a total of 78 hours and the replacement of three CEOs. The expected share value movement is an increase of \$9,428 million.

The above-mentioned optimal level monitoring model also incorporates the premise that it is important for the board to evaluate CEO's performance by defining the final achievement as well as setting the executive limitations and point of accountability of the CEO. Such a monitoring needs to be conducted on a regular basis to maintain an optimal level of expected CEO performance.

Even though corporate law outlines that shareholders choose the board of directors, in practice, shareholders almost always vote for the slate proposed by management. Moreover, this slate is approved by, if not chosen by, the very CEO these directors are supposed to monitor. The resulting governance system has been criticized as ineffective in controlling management.

Consistent with the continuing research in agency theory, the finding of this study contributes to resolve the agency problem, in essence that the board

monitoring of CEO will improve the performance of the CEO and avoid possible conflict of interests.

In addition, an area of research that might draw light on the determinants of firm performance is the role of social connections in determining who is chosen to fill board seats, whether they are classified as independent or otherwise. A study on meritocracy would inevitably need to measure the individual value of each director within the function they are appointed to cover, the collective contribution of the board as a whole, and the relationship between these measures and financial performance. Managing corporate governance based on social business ethics is also essential (see arguments in Islam, 2002). The next challenge is to structure a model which measures all variables.

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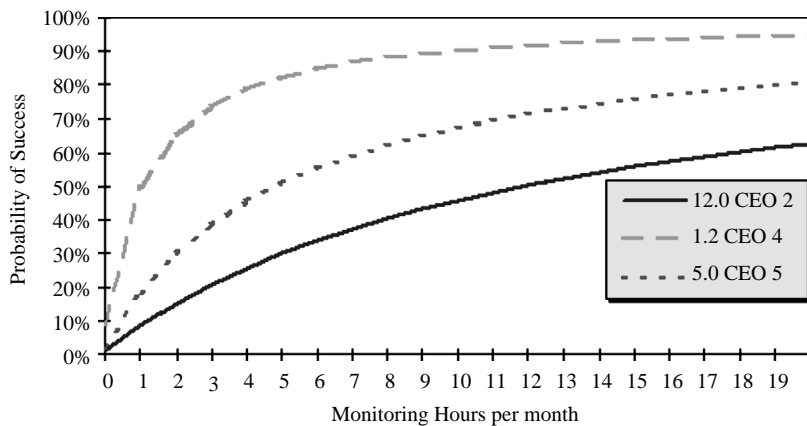
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CEO	Fire CEO? (1 = keep, 0 = fire)	No. of monitoring visits	Linking constraints	Probability parameter	Probability of success (percent)	Share value increase if successful (\$)	Share value decrease if unsuccessful (\$)	Expected share movement (\$)	Hours required per visit
1	1	8	-12	4.2	66.4	8,000	-2,000	4,639	5
2	0	0	0	18.0	0.6	2,000	-4,400	N/A	3
3	1	2	-18	3.6	37.5	1,000	-1,500	-563	4
4	1	5	-15	1.2	82.3	7,800	-6,000	5,352	6
5	0	0	0	5.0	2.0	2,000	-7,000	N/A	6
6	0	0	0	6.8	1.5	7,600	-1,500	N/A	8
	Total used	15				Total		9,428.46	78
Total available	20							Maximum hours available	80

**Table AI.**  
CEO monitoring  
optimisation model

Monitoring Visits	4.2 CEO 1 (percent)	12.0 CEO 2 (percent)	3.6 CEO 3 (percent)	1.2 CEO 4 (percent)	5.0 CEO 5 (percent)	6.8 CEO 6 (percent)
0	2.38	0.83	2.78	8.33	2.00	1.47
1	21.15	8.46	23.91	50.00	18.33	14.10
2	33.87	15.00	37.50	65.63	30.00	23.86
3	43.06	20.67	46.97	73.81	38.75	31.63
4	50.00	25.63	53.95	78.85	45.56	37.96
5	55.43	30.00	59.30	82.26	51.00	43.22
6	59.80	33.89	63.54	84.72	55.45	47.66
7	63.39	37.37	66.98	86.59	59.17	51.45
8	66.39	40.50	69.83	88.04	62.31	54.73
9	68.94	43.33	72.22	89.22	65.00	57.59
10	71.13	45.91	74.26	90.18	67.33	60.12
11	73.03	48.26	76.03	90.98	69.38	62.36
12	74.69	50.42	77.56	91.67	71.18	64.36
13	76.16	52.40	78.92	92.25	72.78	66.16
14	77.47	54.23	80.11	92.76	74.21	67.79
15	78.65	55.93	81.18	93.21	75.50	69.27
16	79.70	57.50	82.14	93.60	76.67	70.61
17	80.66	58.97	83.01	93.96	77.73	71.85
18	81.53	60.33	83.80	94.27	78.70	72.98
19	82.33	61.61	84.51	94.55	79.58	74.03
20	83.06	62.81	85.17	94.81	80.40	75.00

**Table AII.**  
Probability parameter  
(success factor)



**Figure A1.**  
Selected probability  
functions

**About the authors**

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