



Performance-based bonuses for investment and abandonment decisions[☆]



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ABSTRACT

This paper examines whether a performance-based bonus for a manager's investment influences her abandonment decision. First, we derive optimal performance-based bonuses for investment and abandonment decisions. Second, we show that there could be a discrepancy between the managers abandonment timing and that of the shareholders, even though an appropriate performance-based bonus was compensated to mitigate agency conflicts in the investment decision. Third, we also show that as long as the manager is contracted to receive the optimal performance-based bonus for the abandonment decision, only the effort costs that she incurs affect the abandonment timing.

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1. Introduction

In the literature on corporate decision making, researchers tend to pay consistent attention to the latest findings on both investment and abandonment options. The reason for this consistent attention is that these two real options are associated with the beginning and the end of decision-making for a firm's investment (e.g., [Brennan and Schwartz, 1985](#)). Moreover, the identity of the investment and abandonment decision-maker is important to consider. The firm's decision-making is delegated to the manager with a special knowledge of investment projects. However, agency conflicts exist, that is, a manager does not always pursue the interest of the shareholders when making investment and abandonment decisions (e.g., [Jensen, 1986](#); [Berger et al., 1996](#)). To attenuate agency conflicts, the shareholders utilize several mechanisms, for example, an appropriate compensation package.

While much research deals with the impact of the agency problem on the investment decision, there are relatively few studies that examine the influence of agency conflicts on the abandonment decision.¹ Recently, several papers examine this

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¹ Recent examples of research on an abandonment option of a firm include the firm's risk management behavior ([Wong, 2006](#)) and operating leverage ([Wong, 2009](#)) in the presence of abandonment options. However, these papers do not consider agency conflicts between the shareholders and the manager.

subject and draw various results. For instance, [Morellec \(2004\)](#) demonstrates that overinvestment by the manager results in late abandonment when she has the control rights over the abandonment policy. [Lambrecht and Myers \(2007\)](#) show that late abandonment is caused by the manager's reluctance to relinquish her rents.

This paper is motivated by the following question: is compensation for alignment in investment decisions still effective in mitigating agency conflicts when the manager makes the abandonment decision? As stated previously, existing papers show that overinvestment by the manager or unwillingness to relinquish managerial rents is an important factor in affecting the manager's abandonment decision-making. In addition to these factors, we examine whether the manager's abandonment decision is influenced by the compensation for the investment decision. Our examination, as in the [Cardoso and Pereira \(2015\)](#) model, considers a performance-based bonus as compensation dependent on the state of the investment revenue.

In this paper, we show that the performance-based bonus for the manager to induce compliance with the investment timing of the shareholders is not effective in mitigating agency conflicts when the abandonment decision is made. This implies that to align the manager's abandonment timing with that of the shareholders, the performance-based bonus should be adjusted once the investment is made.

The remainder of this paper is organized as follows: the following section presents the model to derive the optimal performance-based bonus as well as the investment and abandonment thresholds. [Section 3](#) examines how executive compensation is related to investment and abandonment timing. [Section 4](#) concludes the paper.

2. The model

To develop a model where the performance-based bonus is linked to the investment and abandonment decisions, we extend a traditional real-options model (e.g., [Dixit and Pindyck, 1994](#)). Consider a firm with both investment and abandonment options. The firm can exercise the investment option by paying a fixed cost of I . After the investment option is exercised, the firm obtains revenue R by incurring a fixed production cost C per unit of time.² Once the investment is made, the firm's revenue evolves as follows:

$$dR = \mu R dt + \sigma R dZ(t), \quad (1)$$

where μ is the growth rate of the revenue, σ is the volatility of the revenue, and $Z(t)$ is a standard Brownian motion at time t . Here, μ and σ are constant. The firm's operating profit, which is the revenue minus the production cost, is taxed at rate τ . Let r be the risk-free rate that is greater than the growth rate of the revenue.

The shareholders hire a manager to invest effectively. However, the investment is not verifiable and so it is likely that the manager will choose the investment timing so as to maximize her wealth. As in [Cardoso and Pereira \(2015\)](#), we assume that the shareholders compensate the manager for implementing the investment with a fixed wage, w per unit of time as well as a performance-based bonus, the payment of which is a proportion ϕ ($0 \leq \phi \leq 1$) of an after-tax operating profit. As in a standard principal-agent model (e.g., [Holmstrom and Milgrom, 1987; 1991](#)), this paper considers the linear contract for the manager. Although we do not consider the general type of the managerial compensation, a linear contract is a good approximation for nonlinear contracts (e.g., [Jin, 2002](#)). Under the linear sharing rule between the manager and the shareholders, this paper focuses on the impact of performance-based bonuses on both the investment and abandonment decisions.

While implementing the investment, the manager incurs an effort cost, e per unit of time, until the abandonment decision is made. Additionally, we assume that the manager leaves or loses her current job and receives severance pay, s , when the abandonment option is exercised. In the next subsection, we first investigate the optimal proportion of the performance-based bonus when the abandonment decision is made.

2.1. Abandonment decision

First, we examine the abandonment threshold chosen by the manager. The wealth of the manager consists of a wage and a performance-based bonus, excluding effort costs. Before the abandonment decision is made, the value of the managerial wealth, $W(R)$, satisfies the following equation:

$$\frac{1}{2} \sigma^2 R^2 \frac{\partial^2 W}{\partial R^2} + \mu R \frac{\partial W}{\partial R} - rW + \phi(R - C)(1 - \tau) + w - e = 0. \quad (2)$$

According to [Dixit and Pindyck \(1994\)](#), we obtain the general solution for the value of the managerial wealth as follows:

$$W(R) = A_1 R^{\beta_1} + A_2 R^{\beta_2} + \phi \left(\frac{R}{r - \mu} - \frac{C}{r} \right) (1 - \tau) + \frac{w - e}{r}, \quad (3)$$

where A_1 and A_2 are constants to be determined, and the constants β_1 and β_2 are as follows:

$$\beta_1 = \frac{1}{2} - \frac{\mu}{\sigma^2} + \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2} \right)^2 + \frac{2r}{\sigma^2}}, \quad (4)$$

² We can consider the revenue subtracted from the production cost as a project value as in [Dixit and Pindyck \(1994\)](#).

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