Journal of Economic Dynamics & Control 33 (2009) 903–921

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

Investment timing, asymmetric information, and audit structure: A real options framework

Takashi Shibata *

Graduate School of Social Sciences, Tokyo Metropolitan University, 1-1 Minami-osawa, Hachioji, Tokyo 192-0397, Japan

ARTICLE INFO

Article history:
Received 23 April 2006
Accepted 31 October 2008
Available online 18 November 2008

JEL classification:
G13
D82

Keywords:
Real options
Asymmetric information
Agency conflicts
Audit

ABSTRACT

This paper examines investment timing by the manager in a decentralized firm in the presence of asymmetric information. In particular, we incorporate an audit technology in the agency model developed by Grenadier and Wang [2005. Investment timing, agency, and information. Journal of Financial Economics 75, 493–533]. The implied investment trigger in the *agency problem with auditing* is larger than in the *full-information problem*, and smaller than in the *agency problem without auditing*. Nevertheless, the audit technology does *not necessarily* reduce inefficiency in the total social welfare.

© 2008 Elsevier B.V. All rights reserved.

1. Introduction

The standard real options approach examines project value as well as investment timing. The main result obtained in the standard framework is that an increase in the uncertainty increases the project value as well as the trigger to undertake the investment. An implication is that the firm displays greater inertia in its investment behavior for greater uncertainty (see McDonald and Siegel, 1986). An excellent overview of the real options approach is found in Dixit and Pindyck (1994) and Trigeorgis (1996).

In the standard real options model, there are no agency conflicts between owners and managers, because the firm is assumed to be managed by the owner. In most modern corporations, owners delegate the investment decision to managers, taking advantage of managers' special skills and expertise. In this situation, there is likely to be asymmetric information between them. Asymmetric information is a situation where a portion of the underlying state variable is privately observed by managers, while it is not observed by owners. The managers with private information have an incentive to provide a false report and then divert free cash flows to him or herself. Thus, asymmetric information leads to what is called agency conflicts.[1]

Several studies have begun the task of incorporating agency conflicts arising from asymmetric information into the real options model.[2] Bjerksund and Stensland (2000) and Grenadier and Wang (2005) develop models of investment timing in

* Tel.: +81 42 677 2310; fax: +81 42 677 2298.
E-mail address: tshibata@tmu.ac.jp

[1] An excellent overview of the literature on asymmetric information can be found in Fudenberg and Tirole (1991), Laffont and Martimort (2002), and Salanié (2005).

[2] Recently, the standard real options model has been extended in various ways. For example, Weeds (2002), Miltersen and Schwartz (2004), and Kijima and Shibata (2005) consider the investment timing problem by taking into account strategic interactions. Bernardo and Chowdhry (2002), Lambrecht and Perraudin (2003), and Shibata (2008) analyze the investment decisions under incomplete information.

0165-1889/$ - see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.jedc.2008.10.005

the presence of asymmetric information between the owner and the manager.[3] In such a situation, the owner must design a contract to provide incentives for the manager to reveal private information truthfully, in that the owner gives a bonus-incentive that is contingent on the investment timing. The implied investment timings then differ significantly from those in the full-information setting. Although these strategies turn out to be suboptimal strategies, they will reduce the owner's losses because of asymmetric information. Without any incentive mechanism that induces the manager to reveal private information truthfully, the owner suffers further distortions.

No contract other than the bonus-incentive has been examined in the real options model under asymmetric information. The owner may increase his/her own value by designing other mechanisms to induce the manager to reveal private information truthfully. One important way is to use an audit technology that can detect the manager's untruthful report and provide some penalty when a false report is detected.[4] That is, giving the bonus-incentive to the manager can be regarded as the "carrot," while auditing and fining the manager can be regarded as the "stick." Thus, it is natural to design the optimal contract with both the bonus-incentive and audit technology. In most modern corporations, the audit system is set so that the owner may inspect the manager's behavior. Hence, what is of great interest is to investigate how the contract with both the bonus-incentive and audit technology influences investment timing as well as total social welfare.

In this paper, we investigate investment timing by the manager in a decentralized firm in the presence of asymmetric information by incorporating an audit technology. In particular, we extend the agency model developed by Grenadier and Wang (2005) (hereafter GW) to introduce an audit technology. In the agency problem, the total social value is decomposed into two components: an owner's value and a manager's value. The possibility of an audit technology significantly enlarges the set of incentive-feasible schemes. Thus, the audit technology *always* leads to an increase in the owner's value, and a decrease in the manager's value, compared with in the *agency problem without auditing* (GW model). This is equivalent to the fact that the investment trigger in the *agency problem with auditing* is smaller than in the *agency problem without auditing*, although it is larger than in the *full-information problem*. This implies that the audit technology *always* enables the manager to accelerate investment timing under asymmetric information. Consequently, the audit technology *always* reduces inefficiency in the investment trigger.

Most importantly, however, the audit technology does *not necessarily* lead to an increase in the total social value. The total social value in the *agency problem with auditing* is either larger or smaller than in the *agency problem without auditing*, depending on the auditing cost function. The reason is that the increase in the owner's value is not equal to the decrease in the manager's value by using the audit technology. In particular, when the auditing cost function is relatively inefficient, the increase in the owner's value is relatively small. Then, because the increase in the owner's value is smaller than the decrease in the manager's value, the audit technology leads to a decrease in the total social value. This result implies that the owner's individual rationality does *not necessarily* lead to total social rationality. As a result, the audit technology does *not necessarily* reduce inefficiency in thetotal social welfare, while it *always* reduces inefficiency in investment timing.

The remainder of the paper is organized as follows. Section 2 describes the setup of the model. Section 3 provides the solution to the optimization problem. In Section 4, we analyze the implications of the model in terms of "effects of auditing," "stock price's reaction," and "asset substitution." Section 5 concludes. The appendix contains the derivation of the solution in detail.

2. Model

In this section, we begin with a description of the model. We then, as a benchmark, provide the solution to the *full-information problem*, and the solution to the *agency problem without auditing*. These results are the same as those in the standard model (McDonald and Siegel, 1986), the agency setting with only the bonus-incentive (Grenadier and Wang, 2005), respectively. Finally, we present the *agency problem with auditing* (agency setting with both the bonus-incentive and audit technology), which is our original contribution.

2.1. Setup

The owner of a firm has an option to invest in a single project. We assume that the owner (principal) delegates the investment decision to a manager (agent). Throughout our analysis, we suppose that capital markets are frictionless, agents are risk neutral, and can borrow and lend freely at a constant interest rate, $r>0$.

Let $(X_t)_{t\in\mathbb{R}_+}$ represent the project value. We assume that $(X_t)_{t\in\mathbb{R}_+}$ follows a geometric Brownian motion, i.e.,

$$\mathrm{d}X_t = \mu X_t\,\mathrm{d}t + \sigma X_t\,\mathrm{d}z_t, \quad X_0 = x, \tag{1}$$

where $(z_t)_{t\in\mathbb{R}_+}$ denotes the standard Brownian motion, and where the mean growth rate μ, as well as the volatility σ, are positive constants. For convergence, we assume that $r>\mu$.

[3] While these papers focus on the agency conflicts between owners and managers, a similar problem exists between stockholders and bondholders. Mello and Parsons (1992), Mauer and Triantis (1994), Leland (1998), Mauer and Ott (2000), Morellec (2001), and Mauer and Sarkar (2005) examine the agency problem between stockholders and bondholders using the real options approach.

[4] See Townsend (1979), Baron and Besanko (1984), and Laffont and Tirole (1986).

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
✓ امکان دانلود نسخه ترجمه شده مقالات
✓ پذیرش سفارش ترجمه تخصصی
✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
✓ دانلود فوری مقاله پس از پرداخت آنلاین
✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات