



# Idiosyncratic risk, the private benefits of control and investment timing<sup>☆</sup>



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## HIGHLIGHTS

- We incorporate under-diversification and imperfect investor protection into the standard real options model.
- The firm either over- or under-invests, depending on the magnitude of the agency conflicts.
- Perfecting investor protection does not eliminate inefficient investment decisions by the insider.
- Total social welfare decreases with cash flow ownership of the insider.

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## ABSTRACT

This paper develops an incomplete-markets model of investment timing by a firm's controlling shareholder, who is exposed to idiosyncratic risk and pursues private benefits at the expense of outside shareholders. We show that the timing of investment selected by the controlling shareholder reflects a tradeoff between his incentives to pursue private benefits and the costs of nondiversification. The firm may overinvest or underinvest depending on the magnitude of the agency conflicts. Moreover, our theoretical model predicts that increasing the cash flow ownership of the controlling shareholder will decrease the total social welfare, which provides novel testable empirical implications for investment.

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## 1. Introduction

Most firms around the world, including large, publicly traded companies, are predominantly controlled by a single large shareholder (the insider, e.g., the founder or the founder's heir) due to highly concentrated ownership (La Porta et al., 1999). Moreover, the lack of investor protection and the separation of control rights and cash flow ownership allow the controlling shareholder to pursue private benefits at the expense of outside minority shareholders.<sup>1</sup> Therefore, agency conflicts among shareholders have received considerable attention in the corporate finance literature. For

<sup>1</sup> The controlling shareholder's control rights frequently exceed cash flow ownership via dual-class shares, pyramid ownership structures, and cross-ownership (see Bebchuk et al., 2000).

instance, Claessens et al. (2002), La Porta et al. (2002) and others document how investor protection influences firm value.

Existing studies on investor protection indicate that the controlling shareholder pursues his private benefits in two ways. First, he directly diverts part of the firm's cash flows as private benefits. Second, he distorts the firm's policy choices away from the first-best no-agency level. In particular, La Porta et al. (2000) argue that agency conflicts among shareholders manifest primarily through inefficient investment choices because corporate investment is difficult to verify and contract. Consequently, several studies, such as Lambrecht and Myers (2008) and Morellec and Wang (2004), have begun the task of incorporating imperfect investor protection into the real options model and examine the impact of opportunistic behavior by the insider on corporate policies. Unfortunately, all of these papers assume the insider is well-diversified. In fact, one of fundamental characteristics of the insider is a lack of diversification because active businesses account for a large fraction of his total wealth (Chen et al., 2010). Furthermore, this lack of diversification means that the insider is affected adversely by the firm's idiosyncratic risk (Maug, 1998). This risk decreases the subjective value of the insider's investment, and he may have a stronger incentive to appropriate wealth from outside shareholders. By accounting for the key friction, the insider's lack of diversification, in this paper, we develop a new dynamic model to examine the controlling shareholder's tunneling behavior in a real options framework.

We assume that an all-equity-financed firm consists of assets-in-place and a growth option and is run by a self-interested, risk-averse controlling shareholder who exercises control rights over investment in his own best interest and diverts part of the firm's free cash flows as private benefits under imperfect investor protection. In this framework, we restrict our attention to studying how the conflict of interest between the undiversified inside controlling shareholder and well-diversified outside shareholders affects investment timing and total social value from the perspective of incomplete markets. We have the following findings. First, compared with the first-best benchmark, the firm may overinvest or underinvest depending on the magnitude of the agency conflicts. This differs markedly from the conventional result that agency conflicts among shareholders always lead to overinvestment. Second, even with perfecting investor protection, the risk-averse controlling shareholder's distorted investment incentives cannot be eliminated. Finally, contrary to the standard complete-market model, total social welfare in our setting decreases with cash flow ownership of the controlling shareholder due to the undesirable under-diversification cost.

Our work is closely related to two sets of dynamic models of investment. First, building on Dixit and Pindyck (1994), Henderson (2007), Hugonnier and Morellec (2007) and Miao and Wang (2007) study the impact of nondiversifiable risk on the exercise of real options. However, these papers consider neither the implications of a lack of investor protection nor firms being heterogeneous in their asset composition. Second, Lan et al. (2012) (henceforth, LWY) also develop an incomplete-markets model to study the implications of imperfect investor protection. They adopt the framework of Hayashi's  $q$ -theory and focus on optimal dynamic corporate policies. Furthermore, the investment they describe is partially reversible, in the sense that a firm can buy and sell capital. Unlike LWY, we adopt the standard Dixit and Pindyck (1994) framework and model investment as a growth option, which is irreversible and involves a one-shot lump-sum cost. Importantly, we focus on when the controlling shareholder chooses to invest. In addition, we model the separation of the insider's control rights and cash flow ownership. While realistic, this is ignored by LWY. As will see, this plays an important role in determining the firm's investment policy.

## 2. Model

### 2.1. Setup

Consider an infinitely lived public firm that has assets-in-place and is populated by two types of agents: the controlling shareholder (also called the insider) and outside shareholders. We assume that outside shareholders have access to the perfectly competitive and complete financial market and are thus well-diversified, while the controlling shareholder cannot hedge against the variations in the firm's idiosyncratic risk factor because he is constrained and thus faces incomplete markets.

At every point in time  $t$ , assume that the assets-in-place of the firm generate a stochastic revenue process,  $\{X_t : t \geq 0\}$ , that follows a geometric Brownian motion:

$$dX_t = \mu X_t dt + \sigma X_t (\rho dB_t + \sqrt{1 - \rho^2} dZ_t), \quad X_0 \text{ given}, \quad (1)$$

where  $\mu$  is the expected rate of revenue growth, and  $\sigma$  is the total volatility of revenue growth. All sources of uncertainty arise from two independent components defined on a filtered probability space,  $(\Omega, \mathcal{F}, \{\mathcal{F}_t : t \geq 0\}, \mathbb{P})$ : a market (systematic) shock represented by the standard Brownian motion  $B$  and an idiosyncratic shock represented by the standard Brownian motion  $Z$ . The parameter  $\rho$  is the correlation coefficient between the firm's revenue risk and market risk. Thus,  $\pi = \rho\sigma$  and  $\epsilon = \sqrt{1 - \rho^2}\sigma$  are the systematic and idiosyncratic volatility of revenue growth, respectively.

In addition to its assets-in-place, the firm has an opportunity to expand its scale of operations at any time by a factor of  $\Lambda > 1$  (i.e., revenues will increase from  $X$  to  $\Lambda X$  upon expansion), at a fixed, irreversible investment cost  $I$ . We assume that the expansion is financed by the firm's internal funds (retained earnings).

### 2.2. Imperfect investor protection

Agency conflicts between the controlling shareholder and outside shareholders are introduced by assuming that the firm is run by a self-interested, risk-averse controlling shareholder who has complete control over investment policy and can capture a fraction  $s \in (0, 1)$  of the firm's net revenues as private benefits under imperfect investor protection (as in La Porta et al., 2002; Lambrecht and Myers, 2008). Hence, firm profits are not shared among shareholders on a *pro rata* basis. This socially inefficient tunneling behavior is costly. However, pursuing private benefits is less costly when there is greater separation of the controlling shareholder's cash flow ownership,  $\alpha$ , and control rights,  $\phi$  (Grossman and Hart, 1988), *ceteris paribus*. Consequently, similar to La Porta et al. (2002), we assume that the cost of net income diversion is given by  $\Psi(s, x) = \psi(s)\Phi(x)$ , where  $\Phi(x)$  is the firm's net income, and  $\psi(s)$  satisfies the following quadratic form:

$$\psi(s) = \frac{\kappa s^2}{2\Gamma}. \quad (2)$$

The parameter  $\kappa > 0$  measures the magnitude of investor protection, and a higher  $\kappa$  implies a larger cost of diverting cash for private benefit. The parameter  $\Gamma = \phi/\alpha \geq 1$  is a measure of the degree of separation between control rights and cash flow ownership.

Let  $\theta$  denote the corporate tax rate. The dividend paid out by the controlling shareholder to shareholders is given by

$$N_t = (1 - \theta)(1 - s_t)(1_{t < \tau} + \Lambda 1_{t \geq \tau})X_t, \quad (3)$$

where  $\tau$  is the time at which investment is exercised, and  $1_A$  is the indicator function of event  $A$ . Mathematically, the investment timing is defined as  $\tau = \inf\{t \geq 0 | X_t \geq x_i\}$ , where  $x_i$  denotes the associated investment threshold.

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