

Investor Protection and Investment*

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Abstract

We present a dynamic model of investment and firm valuation under imperfect investor protection. We show that the controlling shareholder's incentives to pursue private benefits in the future lead to socially distorted investment. Distorted investment decision further lowers firm value beyond the direct value reduction effect of cash diversion. Our model implies that investment shall be predicted by cash flow even after controlling for marginal q , because cash flow serves as a proxy for agency costs. Moreover, investment-cash flow sensitivity is stronger under weaker investor protection. Our model also illustrates that outside shareholders' free-rider motives make the controlling shareholder optimally keep his ownership constant over time, consistent with the empirical evidence (La Porta et al. (1999)). In equilibrium, the entrepreneur's ownership is more concentrated under weaker investor protection.

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1 Introduction

In most countries, large publicly traded companies are not widely held as depicted in Berle and Means (1932), but rather have controlling shareholders. These controlling shareholders often are members of firms' founding families and are entrenched (La Porta et al. (1999) and Claessens et al. (2000)). They have power to pursue private benefits of control at the expense of minority shareholders, within the constraints imposed by investor protection including corporate laws and their enforcement. The recent "law and finance" literature following Shleifer and Vishny (1997) and La Porta et al. (1998) argues that the expropriation of minority shareholders by the controlling shareholder is at the core of agency conflicts in most countries and thus the extent of investor protection is an important determinant of corporate finance and governance around the world. Among other empirical findings, this literature documents that under weaker investor protection, (i) private benefits of control are higher (Zingales (1994), Dyck and Zingales (2003), and Nenova (2003)); (ii) dividend payout is smaller (La Porta et al. (2000a)); (iii) firm value is lower (La Porta et al. (2002) and Claessens et al. (2002)); (iv) corporate ownership is more concentrated (La Porta et al. (1999) and Claessens et al. (2000)); and (v) financial markets are smaller and less developed (La Porta et al. (1997) and Demirgüç-Kunt and Maksimovic (1998)).¹

While much empirical evidence in support of the importance and effects of investor protection has been discovered,² there has been limited work focusing on the *intertemporal* implications of investor protection. Particularly, how investor protection affects firm's dynamic investment decisions and thus changes firm value have not been formally analyzed either theoretically or empirically. On the other hand, the enormous amount of work on corporate investment in both corporate finance and macroeconomics argues that firm's investment decision plays the most essential role in the determination of firm value. Although not modeled explicitly nor tested empirically, the importance of dynamic investment as a channel for private benefits has indeed been widely noted in the investor protection literature. For example, La Porta et al. (2000a) state that agency problems manifest themselves primarily through

¹See La Porta et al. (2000b) for a survey on "law and finance" literature. While the "law and finance" literature started with cross-country studies, recently there has been some work analyzing whether within-country variation in corporate governance across firms affect firm values. See Gompers et al. (2003) and Black et al. (2003) for example.

²For example, both *Journal of Financial Economics* (JFE) and *Journal of Financial and Quantitative Analysis* (JFQA) have devoted special issues to international corporate governance. See JFE (2003) volume 58, numbers 1-2, and JFQA (2003) volume 38, number 1. Also see the edited NBER book *Concentrated Corporate Ownership* by Professor Randall Morck. The vast majority of papers in these special issues and the collected volume are empirical.

non-value-maximizing investment choices in some countries, particularly wealthy common law countries, such as the U.S. and the U.K. Because it is very difficult for a third party such as the court to verify that the controlling shareholder has taken sub-optimal investment decisions for the firm in order to pursue his own private benefits, penalizing the controlling shareholder based on his investment decisions is effectively infeasible. This naturally provides the controlling shareholder additional incentives to distort capital accumulation decisions.

We acknowledge the effect of investor protection on investment and firm value in a dynamic environment by integrating the intertemporal neoclassical Tobin's q theory³ with the modern corporate finance literature. In our model, the controlling shareholder, also referred to as the entrepreneur, dynamically chooses his ownership in the firm, the level of private benefits and investment for the firm each period in a capital accumulation model with adjustment costs. In our model, the controlling shareholder's net private benefits of control increase in firm size. Therefore, he naturally has incentives to grow the firm at a rate that is larger than the socially optimal, in order to increase his future private benefits. This gives rise to an empire building outcome (Jensen (1986)).⁴ Empire building in this paper is an outcome of the controlling shareholder's attempt to acquire future private benefits, and is not due to the assumption that the controlling shareholder values investment more than outside shareholders do. The degree of investor protection mitigates the extent to which the entrepreneur has incentives to overinvest. We derive closed-form solutions for the firm's investment decisions and the implied Tobin's q . The analytically convenient framework substantially simplifies our study of the effect of investor protection on ownership structure, intertemporal investment and firm value.

In addition to generating predictions that are consistent with all five empirical findings (i) – (v) mentioned earlier, our model also provides new testable empirical implications on investment. For example, our model predicts that investment is more sensitive to firm's cash flow even after controlling for firm's investment opportunity set using q , when legal investor protection is weaker. The intuition is as follows. Weaker investor protection gives rise to a larger agency costs measured by the difference between the entrepreneur's value function and his share of firm value. Not surprisingly, firm cash flow is correlated with any measures of agency cost. As a result, investment-cash flow sensitivity may simply arise when there is a conflict of interest between the controlling shareholder and outside minority shareholders.

³See Brainard and Tobin (1968) and Tobin (1969) for seminal work on q theory. Abel (1979) and Hayashi (1982) show that the neoclassical model with convex adjustment costs yields a q -model, and thus provides an intertemporal optimization framework supporting Tobin's q theory.

⁴For further development of Jensen's idea on managerial preference of empire building, see Stulz (1990), Harris and Raviv (1990), Hart and Moore (1995), Zwiebel (1996), and Morellec (2003). An important precursor of using debt as a disciplinary device is Grossman and Hart (1982).

Similarly, the incentive alignment argument suggests that investment-cash flow sensitivity is larger when the entrepreneur's ownership is smaller, *ceteris paribus*.

In an influential and pioneering study on firm investment, Fazzari et al. (1988) (FHP) regress firm's investment-capital ratio on Tobin's q and cash flow. They find that the coefficient for cash flow in such a regression is positive and significantly different from zero. They conclude that this empirical result thus rejects the neoclassical investment literature⁵ and argue that costly external financing constraints faced by firms may explain the observed investment-cash flow sensitivity.⁶ An alternative explanation to the empirically observed investment-cash flow sensitivity is the possibility that Tobin's q may be a poor proxy for marginal q ⁷ and even Tobin's q may be poorly measured.⁸ We provide an agency theory-based explanation to the investment-cash flow sensitivity. Love (2003) finds that stronger legal investor protection substantially reduces investment distortions supporting our theory.

In addition to the empirical predictions on investment-cash flow sensitivity, our model also provides an explanation to the empirical finding that the controlling shareholder's ownership in the firm is quite stable over time (La Porta, López-de-Silanes, and Shleifer (1999) and La Porta et al. (2002)). Indeed, our model predicts that the controlling shareholder has no incentives to change his ownership over time due to the free-rider problem of outside shareholders. Grossman and Hart (1980) consider a similar free-rider problem of minority shareholders in the corporate takeover context.⁹ The intuition of our results is as follows. If the controlling shareholder decides to purchase shares from outside shareholders, those outside shareholders anticipate that agency conflicts will be smaller after the controlling shareholder's share purchase due to his better aligned ownership incentive. Anticipating the increase of firm value, outside shareholders will only tender their shares at the *after*-purchase equilibrium price. This implies that the controlling shareholder will have to bear the loss of private benefits

⁵The key underlying assumption of that literature is that firm is a value-maximizing entity following Jorgenson (1963) and Hall and Jorgenson (1967). The Euler equation behind the neoclassical investment literature essentially states that the marginal cost of installing capital is equal to the present discounted value of all future marginal product revenues of the newly installed capital. The modern neoclassical investment theory is synonymous to the theory of Tobin's q , following Brainard and Tobin (1968) and Tobin (1969).

⁶For more on the theoretical foundation and empirical evidence on the relationship between investment-cash flow sensitivity and financing constraints, see Kaplan and Zingales (1997) and the rejoinders Fazzari et al. (2000) and Kaplan and Zingales (2000).

⁷Note that the neoclassical investment theory has predictions on investment-capital ratio and marginal q . However, marginal q is not observed. Therefore, empirical researchers often use Tobin's q as a proxy for marginal q .

⁸Poterba (1988) is the first to point out the potential implications of measurement error on investment-cash flow sensitivity. See Erickson and Whited (2000), Gomes (2001) and Alti (2003) for recent contributions on measurement error.

⁹See Pagano and Roell (1998) for similar intuition.

associated with a higher concentrated ownership without receiving any personal gains from the increase of firm value. As a result, the controlling shareholder has no incentives to increase his ownership. Similar logic shows that he also has no incentives to decrease his ownership in the firm.

Finally, we study the net effects of investor protection on agency costs by taking the endogeneity of ownership into account. We show that there are two offsetting effects of investor protection on agency costs. The relative strength of these two forces depends on the sensitivity of the change in the entrepreneur's endogenous ownership with respect to the change in investor protection, which we may derive explicitly. Weaker investor protection implies higher agency costs for existing firms, holding the entrepreneur's ownership fixed. We dub this channel the "direct" effect of investor protection. However, two technologically identical firms will have different degrees of concentrated ownership under different degrees of investor protection. Weaker investor protection implies that the entrepreneur raises a smaller amount of capital from outside shareholders. This is the underinvestment problem at the initial financing stage. Because outside shareholders earn competitive rates of return on their investments, the entrepreneur receives all the rents generated from the raised funds. Therefore, the entrepreneur contributes all his own wealth into the firm and raises as much capital as possible from outside investors. As a result, weaker investor protection gives rise to more concentrated ownership. A smaller divergence between cash-flow rights and control rights implies lower agency costs, *ceteris paribus* (Jensen and Meckling (1976)). We dub the effect of investor protection via endogenous ownership on agency costs the "indirect" effect. We show that the indirect effect is the strongest for investment and the weakest for direct cash diversion. This is consistent with the observations that outright theft is quite common in countries with weak investor protection (where the direct effect is more dominant), and overinvestment is often observed in wealthy common law countries such as the U.S. (where the indirect effect may be relatively more important).

Our work is most closely related to La Porta et al. (2002), Shleifer and Wolfenzon (2002) and Himmelberg et al. (2002). La Porta et al. (2002) provide a static model to explain their empirical findings of lower firm values in countries with weaker investor protection. Shleifer and Wolfenzon (2002) present a static model of an entrepreneur going public in an environment under imperfect investor protection, by using the "crime and punishment" framework of Becker (1968) to model investor protection in an agency environment of Jensen and Meckling (1976). The driving force of both papers' results is the direct cash diversion by the controlling shareholder for his private benefits. Our model extends La Porta et al. (2002) and Shleifer

and Wolfenzon (2002) by acknowledging that the investment decision is a primary channel for the controlling shareholder to pursue his private benefits (La Porta et al. (2000a)). The controlling shareholder's ability to overinvest intertemporally lowers firm value beyond the direct cash diversion effect as in La Porta et al. (2002) and Shleifer and Wolfenzon (2002). Our model provides an analytically tractable intertemporal framework to study the relationship among investor protection, dynamic investment and firm value. Himmelberg et al. (2002) propose a two-period model with imperfect investor protection in which the cost of capital is determined endogenously. In their model, the risk-averse entrepreneur determines his ownership by trading off the benefit of diversification with the cost of raising capital. A smaller ownership concentration yields a larger diversification benefit for the entrepreneur, but bigger agency costs and thus a higher cost of capital. Unlike Himmelberg et al. (2002), our paper focuses on how investor protection affects firm value via cash diversion and investment in a *dynamic* environment. That is, we study the cash-flow effect, not the discount-factor effect, of investor protection on firm value and endogenous ownership.

The remainder of the paper is organized as follows. Section 2 introduces the setting of our dynamic model. Section 3 provides a natural benchmark of a neoclassical investment model without agency costs for future comparison with our agency model. Section 4 analyzes the effect of investor protection on investment distortions and implied investment-cash flow sensitivity. Section 5 derives the optimal ownership of the controlling shareholder and analyzes the total effect of investor protection on agency costs, taking the endogeneity of ownership into account. Section 6 concludes. Appendices supply related derivations and proofs.

2 The Model

We introduce the modern agency theory into the neoclassical paradigm of intertemporal investment. While this neoclassical Tobin's q framework serves as the benchmark in studies of dynamic investment (Hubbard (1998)), it ignores the effect of agency conflicts on investment. On the other hand, the corporate finance literature on investment has largely focused on agency conflicts in the static environment (Stein (2001)). While the corporate finance literature has studied both underinvestment and overinvestment problems extensively in the literature, these static models naturally are not capable of analyzing the effect of agency conflicts on intertemporal investment. In reality, firms' investment decisions are dynamic and directly affect firm value. Indeed, the core of the neoclassical investment literature is the link between intertemporal investment and Tobin's q . Furthermore, investment decisions may be

distorted intertemporally when the entrepreneur pursues his private benefits. In this paper, we propose an intertemporal model to study the effect of agency conflicts on dynamic investment and firm value. We focus on the agency conflict between the controlling shareholder and outside minority shareholders, because much empirical work shows that this conflict is the primary one in most countries around the world (La Porta et al. (2000a, 2000b)).

Consider a firm with a single controlling shareholder. Theoretically, there are two offsetting effects of a concentrated ownership on firm value: alignment and entrenchment effects.¹⁰ This paper, like most other papers in the “law and finance” literature, assumes that the entrepreneur faces no control challenge and is fully entrenched, even when his cash-flow ownership in the firm is small.¹¹ Therefore, the entrenchment effect is at the maximum level in our model and increasing the entrepreneur’s ownership only raises firm value, *ceteris paribus*. Empirically, La Porta et al. (1999) document that the control of a firm is often heavily concentrated in the hands of a founding family in many countries. The entrepreneur often controls a higher fraction of votes than of cash flow rights, by owning shares with superior voting rights, ownership pyramids, cross ownership, and controlling the board.¹² Let α denote the entrepreneur’s cash-flow ownership in the firm.¹³ The entrepreneur makes investment decisions for the firm and also chooses the level of private benefits for himself.

We assume that the infinitely-lived entrepreneur may set up a firm by accessing to a constant-return-to-scale technology at time 0. For technical convenience, we cast the model in continuous time. The technology allows the firm to produce gross output at the rate of fK , using the firm’s capital stock K . The capital stock accumulates at the rate of chosen investment I , and depreciates at a constant rate of $\delta > 0$, in that

$$dK_t = (I_t - \delta K_t) dt. \tag{1}$$

The assumption of the adjustment cost is both empirically plausible and widely adopted in the investment literature.¹⁴ Specifically, we assume that the adjustment cost takes the following functional form:

$$\Phi(I, K) = \frac{\theta}{2} \left(\frac{I}{K} \right)^2 K = \frac{\theta}{2} i^2 K, \tag{2}$$

¹⁰See Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990) for the U.S. evidence on both effects on firm value. See Stulz (1988) on managerial control of voting rights and firm value.

¹¹See Zingales (1995), Bebchuk (1999), La Porta et al. (2002) and Shleifer and Wolfenzon (2002).

¹²See Bebchuk, Kraakman, and Triantis (2000) for example.

¹³La Porta et al. (2002) state that the entrepreneur’s ownership is extremely stable over time. Later, we show that keeping the ownership constant is optimal for the entrepreneur.

¹⁴See Mussa (1977), Hayashi (1982), and Abel (1983) for early work on adjustment costs. See Caballero (1999) for a recent survey on aggregate investment and Hubbard (1998) for a survey on empirical investment research.

where $i = I/K$ is investment-capital stock ratio and the parameter $\theta > 0$ measures the magnitude of the adjustment cost. Note that the adjustment cost function given in (2) is homogeneous of degree one in capital stock K and investment I . The homogeneity assumption of the adjustment cost is standard in the investment literature and substantially simplifies our analysis without losing the key economic intuition.¹⁵ Together with the assumption of constant returns to scale, Tobin's marginal q , which contains information about investment decisions, is equal to Tobin's average q , which is the ratio of the firm value to the replacement cost of capital. Our model is an example that meets the condition for the equality between Tobin's average q and marginal q (Hayashi (1982)). Finally, we suppose that an infinitely-lived representative investor has a time rate of preference that is equal to the interest rate $r > 0$.

Because of agency costs, firm profits are not shared on a *pro rata* basis among shareholders. Indeed, the entrepreneur can divert a part of the firm's gross output for his own private benefits. This socially inefficient usage of funds may take a variety of forms such as excessive salary, transfer pricing, employing unqualified relatives and friends, to name just a few.¹⁶ In general, expropriation is costly to both the firm and the entrepreneur.¹⁷ Pursuing private benefits is more costly when investor protection is stronger, *ceteris paribus*. We model the degree of investor protection by using a cost function. If the entrepreneur diverts fraction s of the gross revenue $\Pi = fK$, then he pays a cost $C(s, \Pi)$ given by

$$C(s, \Pi) = \frac{\eta}{2} s^2 \Pi. \quad (3)$$

The above quadratic form of the cost function builds on the cost function of La Porta et al. (2002).¹⁸ The cost function (3) is increasing and convex in the fraction s of gross output that the entrepreneur diverts for private benefits. The cost function (3) captures the intuition that it is more costly to divert a larger fraction for private benefits. Furthermore, the cost of diverting a given fraction s of cash from a larger firm is assumed to be higher, because a larger amount $s\Pi$ of gross output is diverted. That is, we suppose $\partial C(s, \Pi)/\partial \Pi > 0$. Note that the cost function (3) is quite similar to the adjustment cost function (2), in that the cost of diversion $C(s, \Pi)$ is homogeneous of degree one in the diverted amount $s\Pi$ and firm's gross revenue Π before entrepreneur's diversion. We interpret the parameter η as a measure of investor protection following La Porta et al. (2002). A higher η implies a larger marginal

¹⁵See Hayashi (1982), Abel (1983) and Hubbard (1998), for example.

¹⁶See Barclay and Holderness (1989) for early work on the empirical evidence in support of private benefits of control.

¹⁷See Burkart, Gromb, and Panunzi (1998) and La Porta et al. (2002).

¹⁸Shleifer and Wolfenzon (2002) model a stronger investor protection with a larger probability that the manager is caught with diverting cash.

cost $\eta\Pi$ of diverting cash for private benefits. We choose the specific functional form (3) for the cost of diversion and the sequence of diverting and investing in order to capture the intuition behind the entrepreneur's incentive to overinvest in an analytically convenient and plausible way. In the nutshell, the model predicts that the net marginal benefit of capital to the manager is higher than the net marginal benefit to the outside minority shareholders, because the entrepreneur's total private benefits increase in firm size.

When investor protection is imperfect ($\eta < \infty$), the entrepreneur naturally has incentives to divert some cash for his private benefits. Moreover, the entrepreneur's ability to choose the evolution of the size of the firm gives him an additional channel through which to pursue his private benefits. The dividend paid out by the entrepreneur to shareholders is given by

$$Y_t = fK_t - I_t - \Phi(I_t, K_t) - s_t fK_t, \quad (4)$$

where $\Phi(I_t, K_t)$ is the adjustment cost and the last term deducted from (4) is the total amount of output diverted from the firm by the entrepreneur as private benefits. The entrepreneur's total cash flow M is then given by the sum of his entitled dividend and his private benefits of control less the cost of diversion, in that

$$M_t = \alpha Y_t + s_t \Pi_t - C(s_t, \Pi_t). \quad (5)$$

Note that the entrepreneur only benefits from the portion diverted from outside shareholders, not his own portion α of the firm. We may re-write (5) as follows:

$$M_t = (\alpha + (1 - \alpha) s_t) \Pi_t - [\alpha (I_t + \Phi(I_t, K_t)) + C(s_t, \Pi_t)]. \quad (6)$$

The first term on the right-hand side of (6) is the gross cash inflows, from both the entrepreneur's equity ownership and the diverted cash from outside minority shareholders. The second term is the total cost paid by the entrepreneur, including his shares of total investment costs ($I + \Phi(I, K)$) and the cost of diversion $C(s_t, \Pi_t)$. The entrepreneur solves the following optimization problem:

$$\max_{s, I} \int_0^{\infty} e^{-rt} M_t dt, \quad (7)$$

subject to the flow-of-funds equation (6) and a limited capital stock growth condition (8):

$$\lim_{T \rightarrow \infty} e^{-rT} K_T = 0. \quad (8)$$

Let $U(K)$ denote the entrepreneur's value function when the firm's capital stock is K . The entrepreneur's value function $U(K)$ solves the following Bellman equation:

$$rU(K) = \max_{s, I} M + (I - \delta K)U'(K). \quad (9)$$

The left-hand side of (9) is the flow measure of the entrepreneur's utility. The right-hand side includes both the current cash flow M to the entrepreneur and his marginal benefit of net installed capital. The entrepreneur's intertemporal optimality states that he chooses a total fraction s of gross output to divert and investment rate I in his own interest to equate¹⁹ the two sides of (9). While the chosen levels of s and I are optimal from the entrepreneur's perspective, they are not in the interests of outside shareholders.

The following theorem summarizes key results of the optimization problem (7).

Theorem 1 *The entrepreneur's value function is linear in capital stock, in that $U(K) = uK$, where*

$$u = \alpha(1 + \theta i), \quad (10)$$

and the optimal investment-capital ratio $i = I/K$ is given by

$$i = (r + \delta) - \sqrt{(r + \delta)^2 - \frac{2}{\theta} [(1 + \zeta)f - (r + \delta)]}, \quad (11)$$

where

$$\zeta = \frac{(1 - \alpha)^2}{2\eta\alpha}. \quad (12)$$

The optimal fraction s of gross output to be diverted is given by

$$s = \xi \equiv \frac{1 - \alpha}{\eta}. \quad (13)$$

Appendix A contains a detailed proof for the theorem.

Before analyzing the implications of investor protection on investment distortions, we first sketch out the model's predictions when investor protection is perfect.

3 First-Best Benchmark: Perfect Investor Protection

When investor protection is perfect, the entrepreneur does not pursue any private benefits because the marginal cost of diverting any cash is infinity. Thus, the entrepreneur maximizes his utility via his shareholdings in the firm. That is, he behaves in the interest of outside minority shareholders. Appendix A shows that under perfect investor protection, the investment rate is optimal in that $I^* = i^*K$, where the first-best investment-capital ratio i^* is given by

$$i^* = r + \delta - \sqrt{(r + \delta)^2 - 2\frac{f - (r + \delta)}{\theta}}. \quad (14)$$

¹⁹This statement requires an interior solution, which is our case.

Given the investment-capital ratio i^* , the first-best dividend payout level is $Y^* = y^*K$, where

$$y^* = \frac{Y^*}{K} = f - i^* - \frac{\theta}{2}i^{*2}. \quad (15)$$

Therefore, we may write firm value as $Q^*(K) = q^*K$, where

$$q^* = 1 + \theta i^*, \quad (16)$$

and i^* is given in (14). We note that Tobin's marginal q is then equal to Tobin's average q (Hayashi (1982)). For the rest of this paper, we refer to it as Tobin's q without danger of confusion. Tobin's q in excess of unity ($q^* - 1$) is proportional to the optimal investment-capital ratio i^* and measures the firm value per unit of capital stock. A higher productivity f implies a larger level of gross investment, which in turn gives a higher Tobin's q .

Having studied the first-best benchmark, we next turn to the analysis of investment decisions and firm value when investor protection is imperfect.

4 Model Implications under Imperfect Investor Protection

This section studies how investor protection affects agency costs, for example, measured in reduction of firm value. We then use an argument analogous to that of Grossman and Hart (1980) in the corporate control context to show that it is optimal for the entrepreneur to keep his ownership constant over time, consistent with empirical evidence documented in La Porta et al. (1999). Finally, we show that our model generates predictions linking to the investment-cash flow sensitivity literature following Fazzari, Hubbard, and Petersen (1988) (henceforth FHP). Specifically, our model predict that investment-cash flow sensitivity is stronger, in countries with weaker investor protection and lower entrepreneur's ownership, *ceteris paribus*.

4.1 Agency costs

First, we briefly discuss the model's implication on cash diversion. The fraction s of gross output diverted by the entrepreneur for private benefits varies with respect to both ownership α and the degree η of investor protection. There is less expropriation of minority shareholders in environments with stronger investor protection, in that $ds/d\eta = -1 - \alpha/\eta^2 = -\xi/\eta < 0$. A larger ownership α discourages the entrepreneur's interest of pursuing private benefits, because a smaller payoff goes to the entrepreneur, for a given fraction s to be diverted for private benefits. This can be seen from $ds/d\alpha = -1/\eta < 0$. The intuition for the determinant of the fraction s of cash diversion is essentially the same as in La Porta et al. (2002).

The next proposition summarizes the implication of Theorem 1 on investment.

Proposition 1 *The entrepreneur overinvests compared with the first-best no-agency level i^* given in (14), in that $i > i^*$. The investment-capital ratio i is decreasing in both the degree η of investor protection and ownership α , in that $di/d\eta < 0$, and $di/d\alpha < 0$.*

We may show the overinvestment result by re-writing the investment-capital ratio i of (11) in terms of the first-best investment-capital ratio i^* of (14) as follows:

$$i = r + \delta - \sqrt{(r + \delta - i^*)^2 - \frac{2\zeta f}{\theta}} > i^*. \quad (17)$$

The intuition for overinvestment is as follows. The private benefits of control not only provide direct incentives for the entrepreneur to divert cash away from the firm's productive usage, but also encourage the entrepreneur to overinvest, because his private benefits increase in firm size. Empire building in this model arises endogenously from the private benefits of controlling the firm (Jensen (1986)). While the entrepreneur has incentives to build a firm larger than the socially optimal, his cash-flow ownership in the firm mitigates his incentive to do so (Jensen and Meckling (1976)). Behaving in his own interest, the entrepreneur trades off benefits with costs of overinvestment.

Allen et al. (2002) argue that China provides a counter example to the predictions of the "law and finance" literature. They note that China has weak investor protection both in terms of the legal system and enforcement, but has grown at a high rate since the open-door reform policy in late 1970s. Proposition 1 shows that a higher degree of agency costs caused by a weaker investor protection may be consistent with a socially suboptimal larger growth rate (Recall that $\partial i/\partial \eta < 0$).

Next, we turn to the properties of dividend payout and firm value. La Porta et al. (2000a, 2002) document that firms pay more dividends and firm values are higher in countries with stronger investor protection. Our model predicts a smaller dividend payout y and a lower Tobin's q for firms under weaker investor protection in an intertemporal setting.

By substituting the investment-capital ratio i of (11) and the fraction s of cash diversion into (4), we have the firm's payout $Y = yK$, where

$$y = (1 - \xi) f - \left(i + \frac{\theta}{2} i^2 \right). \quad (18)$$

In a deterministic environment such as ours, firm value $Q(K)$ is simply given by the present discounted value of all future cash flows, in that

$$Q(K) = \int_0^\infty e^{-rt} Y_t dt = \int_0^\infty e^{-rt} yK(t) dt = \int_0^\infty e^{-rt} y e^{(i-\delta)t} K dt = qK,$$

where

$$q = \frac{y}{r + \delta - i} \quad (19)$$

is both marginal q and Tobin's (average) q . Equation (19) is a version of the Gordon dividend growth model, with endogenous dividend yield y and dividend growth rate $(i - \delta)$.

In La Porta et al. (2002) and Shleifer and Wolfenzon (2002), Tobin's q is given by the one-period rate of return on the project after deducting the amount diverted away from the firm by the entrepreneur for his private benefits. Therefore, firm value reduction only reflects the effect of direct cash diversion, not the distorted effects of investment decisions. Unlike theirs, our model predicts that the fraction of firm value reduction is greater than the fraction of direct cash diversion, because the entrepreneur also distorts the firm's intertemporal investment decision. Formally, we have

$$q = \frac{(1 - \xi)f - i - \theta i^2/2}{r + \delta - i} < (1 - \xi) \frac{f - i - \theta i^2/2}{r + \delta - i} < (1 - \xi) q^*, \quad (20)$$

where the first inequality is obvious and the second inequality follows from the optimality of i^* under perfect investor protection. Therefore, the percentage of firm value reduction $(q^* - q)/q^*$ in an intertemporal setting is larger than the fraction ξ . Intuitively, the entrepreneur can pursue his private benefits not only by directly diverting cash, but also by distorting firm's intertemporal investment decisions. Therefore, firm value is reduced by the effect of direct cash diversion as shown in (20).

The next proposition states comparative static results on the dividend payout y and the Tobin's q .

Proposition 2 *The dividend-capital ratio y is lower than y^* , in that $0 < y < y^*$. Tobin's q is less than q^* of (16). Moreover, both y and Tobin's q are increasing in investor protection η and ownership α .*

Proposition 2 states that the dividend payout is lower when investor protection is weaker. This prediction is consistent with the empirical evidence documented in La Porta et al. (2000a). Proposition 2 also predicts that Tobin's q is higher under stronger investor protection, consistent with the empirical evidence documented in La Porta et al. (2002) and Claessens et al. (2002). A higher entrepreneur's ownership provides a better incentive alignment between the entrepreneur and outside minority shareholders; therefore, it leads to a higher Tobin's q , *ceteris paribus*.

4.2 Investor Protection and Investment-Cash Flow Sensitivity

The neoclassical investment model predicts that the value-maximizing firm equates the marginal cost of adjusting firm's capital stock with marginal q , the present discounted value of all expected future marginal product of capital. With a reasonable parameterization for the adjustment cost and the additional assumption that marginal q may be reasonably well measured without much error, the neoclassical investment model predicts that investment-capital ratio, (which essentially captures marginal adjustment cost), shall only be predicted by marginal q . While the argument behind the neoclassical investment model is logical and theoretically sound, a large empirical investment literature following the pioneering and influential work by FHP finds that investment-capital ratio is predicted by cash flows, even after controlling for firm's investment opportunity set using q . This empirical evidence thus rejects the neoclassical investment model and calls for alternative models of investment.

The most popular explanation of the investment-cash flow sensitivity is financing constraint, originally proposed by FHP. FHP argue that costly external financing may arise if the manager is more informed than outside investors and outside investors are concerned about the lemons problem. Kaplan and Zingales (1997) argue that investment-cash flow sensitivities do not provide useful measures of financing constraints, by showing that investment-cash flow sensitivity does not necessarily increase with the degree of financing constraint even in a static model. Kaplan and Zingales (1997) use quantitative and qualitative information obtained from company annual reports to classify firm's degrees of financing constraint and find that investment decisions of the least financially constrained firms are the most sensitive to the availability of cash flow, contrary to previous literature following FHP.²⁰ An alternative explanation to the investment-cash flow sensitivity is that Tobin's q is poorly measured and may not be a good proxy for marginal q .²¹

We next show that our model has natural implications on the relationship between investment and cash flow. Importantly, our model generates new testable empirical implications across firms under different degrees of investor protection. This is to which we turn next.

Because the entrepreneur's objective is to maximize his own utility, naturally, even in the absence of financing constraint, as in our model, we shall not expect that the neoclassical investment-Euler equation to hold. With the objective of linking the investment decision to

²⁰For more on the debate between FHP and Kaplan-Zingales, see the rejoinders in Kaplan and Zingales (2000) and Fazzari, Hubbard, and Petersen (2000).

²¹Poterba (1988) was the first to point out the potential importance of measurement error in q on investment-cash flow relationship. See Erickson and Whited (2000), Gomes (2001) and Alti (2003) for more on measurement error.

Tobin's q , we may re-write (11) as follows:

$$i = \frac{1}{\theta} (q - 1 + AC). \quad (21)$$

where AC is a measure of agency cost and is given by

$$AC = \frac{1}{\alpha} (u - \alpha q) = \left(\frac{1 - \alpha^2}{2\eta} \right) \frac{f}{r + \delta - i}. \quad (22)$$

When investor protection is perfect, the entrepreneur's utility is simply given by his share of firm value, in that $u^* = \alpha q^*$. This simply reflects that fact that the entrepreneur's decision-making rights do not bring him any private benefits and thus he acts in the interests of outside minority shareholders ($AC = 0$). When investor protection is imperfect, the entrepreneur may divert firm's resource for private benefits, implying $AC > 0$. We may relate investment to cash flow by re-writing (21) as follows:

$$i = \frac{1}{\theta} (q - 1) + \beta \times CF, \quad (23)$$

where $CF = (1 - \xi)f$ is the cash flow and the investment-cash flow sensitivity coefficient β is given by

$$\beta = \left(\frac{1 - \alpha^2}{2\eta\alpha} \right) \frac{1}{(1 - \xi)(r + \delta - i)}. \quad (24)$$

Therefore, our model predicts that investment is sensitive to cash flow, even though firm faces no financing constraint and there is no measurement error for Tobin's q . (Note that by construction, Tobin's q is marginal q in our model.) That is, by construction, our model controls for the two effects mentioned in the extant literature on investment-cash flow sensitivity.

We show theoretically that investment-cash flow sensitivity will naturally arise under weak investor protection. Moreover, our theory has direct empirically testable predictions. Specifically, it predicts that the investment-cash flow sensitivity decreases with the level of investor protection and ownership, in that $d\beta/d\eta < 0$ and $d\beta/d\alpha < 0$, respectively. The intuition is as follows. Under weaker investor protection, the controlling shareholder is able to expropriate more from outside minority shareholders, thus implying a larger degree of agency cost. Similarly, our model also has the empirical implication that a larger concentrated entrepreneur's ownership helps mitigate the agency cost and thus lowers the degree of investment-cash flow sensitivity.²²

In a recent cross-country study, Love (2003) uses the investment Euler equation approach to show that better financial development lowers the distortions of firm investment. She notes

²²However, we remind readers the caveat that ownership is endogenously determined by the legal environment, as shown in Section 5.

that financial development might simply capture the effects of legal investor protection to a large extent, because the legal protection investors receive determines their readiness to finance firms and thus the legal environment has large effects on the level of financial development, as forcefully argued and documented in La Porta et al. (1997, 1998). Not surprisingly, she finds that a stronger investor protection implies a lower degree of investment inefficiency, when she replaces financial development variables with various legal indicators such as the efficiency of the legal system, the rule of law, the risk of expropriation, corruption, and legal origin. Moreover, she finds that the effects of legal indicators on investment are significant at the 1% level, even when both financial development variables and legal indicators are included. In summary, her results provide strong support for our theory on the effect of investor protection on reducing firm investment inefficiency.²³

So far, we have assumed that the entrepreneur’s ownership is exogenously given and does not change over time. However, the entrepreneur and outside shareholders may want to adjust their shareholdings over time. Firm value accordingly changes with the entrepreneur’s ownership in the firm. The next subsection provides a dynamic analysis of ownership structure.

4.3 An Envelope Result and a Free-Rider Problem

La Porta et al. (2002) argue on page 1165 that “ownership patterns are extremely stable, especially outside the United States, and are shaped largely by histories of the companies and their founding facilities.” In this paper, we provide an explanation for this empirically observed stable ownership for the entrepreneur over time.²⁴

The argument in support of a stable entrepreneur’s ownership is quite similar to that of Grossman and Hart (1980) in the corporate control context. Purchasing shares from outside shareholders helps align the entrepreneur’s incentives with outside shareholders’, and thus gives the entrepreneur more incentives to increase firm value. Anticipating this positive cash-flow incentive effect of a higher entrepreneur’s ownership, outside shareholders will only tender their shares at the *higher* equilibrium price *after* the entrepreneur’s purchase of the new shares. Because all outside shareholders are infinitesimal and think the same way, the collective action of outside minority shareholders leads to a free-rider problem that prevents efficiency-improving transaction from happening.

Before formalizing the intuition behind the free-rider argument, we first provide an intuitive and useful result linking the entrepreneur’s utility to Tobin’s q . Specifically, we show that the

²³Her empirical analysis is built on a structural model in which the firm is a value-maximizing entity and faces financing constraints.

²⁴See Holderness and Sheehan (1988) for the U.S. evidence on stable ownership of large shareholders.

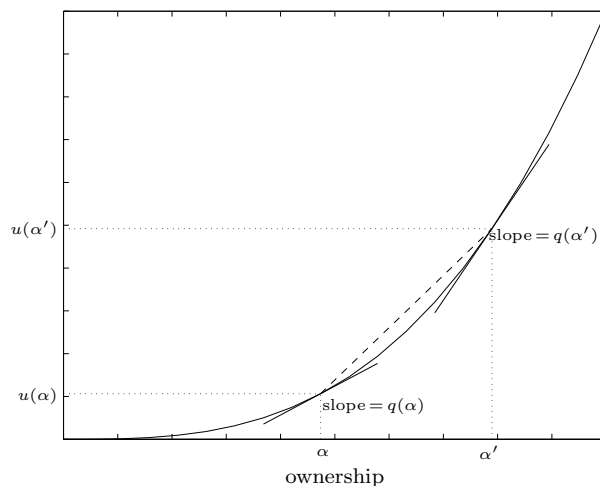


Figure 1: Illustration of the free-rider problem

marginal change of the entrepreneur’s utility-capital ratio with respect to his ownership is equal to the Tobin’s q , in that $u'(\alpha) = q(\alpha)$. With a slight abuse of notation, we use $u(x)$ and $q(x)$ to denote the functional forms of entrepreneur’s utility-capital ratio u and Tobin’s q with respect to the entrepreneur’s ownership x .

Proposition 3 *The entrepreneur’s utility gain with respect to an incremental change of his ownership α is equal to Tobin’s q , in that*

$$u'(\alpha) = \frac{du}{d\alpha} = q(\alpha). \quad (25)$$

The intuition behind Proposition 3 is as follows. Because the entrepreneur chooses the fraction of cash diversion and firm’s investment decisions in his self interest, the reduction of both the fraction of the entrepreneur’s cash diversion and the degree of overinvestment caused by a small change in the entrepreneur’s ownership has no first-order effects on the entrepreneur’s utility. As a result, the “total” change of the entrepreneur’s utility, $u(\alpha + \Delta\alpha) - u(\alpha)$, associated with an incremental increase $\Delta\alpha$ in his ownership, is equal to the “direct” effect, holding s and i fixed at the levels originally chosen by the entrepreneur. The “direct” effect of an increase of the entrepreneur’s ownership from α to $\alpha + \Delta\alpha$ is simply an increase in the amount of $q(\alpha)\Delta\alpha$ for the entrepreneur’s utility-capital ratio u . In summary, the above line of logic implies that approximately $u(\alpha + \Delta\alpha) - u(\alpha) \approx q(\alpha)\Delta\alpha$. Taking the limit of $\Delta\alpha$ to zero gives $u'(\alpha) = q(\alpha)$.

We assume that the entrepreneur can not trade anonymously. This assumption is reasonable, because insiders in general are required to report their trading activities to security regulators in advance. We also assume that market participants have rational expectations

about the effect of the entrepreneur’s trading activities on the share price. Figure 1 plots the entrepreneur’s utility-capital ratio u against his ownership α . Note that the slope of the curve $u(\alpha)$ is equal to Tobin’s $q(\alpha)$ (see Proposition 3). Figure 1 helps illustrate the intuition behind the outside shareholder’s free rider motive. The entrepreneur does not have incentives to change his ownership from α to α' because his payment to outside shareholders $q(\alpha')(\alpha' - \alpha)$ is larger than his utility gain $u(\alpha') - u(\alpha)$. This is a free-rider problem, similar to the one in the corporate takeover context (Grossman and Hart (1980)). The entrepreneur is held up from increasing his ownership because he receives no private rewards (associated with increased share prices) and incurs a partial loss of his private benefits. Similarly, Figure 1 also demonstrates that the entrepreneur will not sell his shares to the market either. This is because the payment he receives is not enough to compensate for his utility loss $u(\alpha') - u(\alpha)$. In summary, the entrepreneur will not change his shareholdings of the firm at all due to minority shareholders’ free-rider problem. This provides one explanation to the empirical observation that the concentration of the entrepreneur’s ownership is quite stable over time (La Porta, López-de-Silanes, and Shleifer (1999) and La Porta et al. (2002)), namely, the entrepreneur is locked up from changing his ownership.

We have analyzed the effects of investor protection on investment, firm value and ownership structure in a *deterministic* setting. The deterministic model allows us to deliver the intuition behind our results in a simplest possible setting. Next, we extend our analyses to incorporate the effect of the business cycle on investment when investor protection is imperfect.

4.4 Investor Protection, Investment and the Business Cycle

We model the business cycle with a regime-switching (RS) model, following Hamilton (1989). For technical convenience, we cast the model in continuous time. Let $S(t)$ denote the regime at time t . Let N be the total number of regimes. Let the current regime $S(t)$ be n . Over a small time interval Δt , the conditional probability of switching from the current regime n to a new regime $m \neq n$ is given by $\lambda_{n,m}\Delta t$.²⁵ The rest of the model specification remains the same as in Section 2 after noting that the productivity shock f is now a function of the current regime. We assume that the entrepreneur observes the underlying regime n , and thus knows the current level of productivity shock level $f(S(t))$, when making investment and cash

²⁵Because the probability of staying in one of the N regimes at any time has to add up to unity, the probability of not changing the regime over the time period Δt is thus given by $(1 - \sum_{m \neq n} \lambda_{n,m}\Delta t)$. We may collect $\lambda_{n,m}$ for all n and m together to form the transition rate matrix Λ , whose (n, m) th element is $\lambda_{n,m}$. Note that the diagonal element is negative and is given by $\lambda_{n,n} = -\sum_{m \neq n} \lambda_{n,m}$. (The sum of each row is equal to zero for transition rate matrix.) The transition rate matrix Λ is the continuous-time counter part of the transition probability matrix in discrete-time models.

diversion decisions.²⁶

Let the entrepreneur's value function be $U(K, n)$. The entrepreneur's optimality implies that the Hamilton-Jacobi-Bellman (HJB) equation for his decisions is given by

$$rU(K, n) = \sup_{s, I} \left\{ M + \mathcal{D}^{(s, I)}U(K, n) \right\}, \quad (26)$$

where

$$\mathcal{D}^{(s, I)}U(K, n) = (I - \delta K)U_K(K, n) + \sum_{m \neq n} \lambda_{nm} (U(K, m) - U(K, n)). \quad (27)$$

The term $\mathcal{D}^{(s, I)}U(K, n)$ captures the expected changes of the entrepreneur's value function per unit of time, induced by both instantaneous changes of capital stock and the expected changes of underlying productivity shocks. The HJB equation (26) states that the flow measure of the entrepreneur's value function ($rU(K, n)$) on the left-hand side is equal to the sum of payments M (including both cash-flow rights and private benefits) received by the entrepreneur and the expected changes of the entrepreneur's value function. Appendix D shows that the entrepreneur's utility is proportional to the level of capital stock K , in that $U(K, n) = u_n K$, where the proportionality coefficient u_n depends on the underlying regime n .

The entrepreneur's optimal level of cash diversion $s_n = \xi$, same as the rule in the deterministic setting. Intuitively, the entrepreneur diverts more when investor protection is weaker or his ownership is less concentrated. The investment-capital ratio choice i_n is given by

$$i_n = \frac{1}{\theta} \left(\frac{u_n}{\alpha} - 1 \right), \quad (28)$$

where u_n is the utility-capital ratio in regime n . We may solve for the utility-capital ratios in all regimes by using (D.4) in Appendix D. As a result, our model may be calibrated to yield empirical predictions on the degree of firm's investment distortions over the business cycle.

So far, we have analyzed the effects of investor protection on investment and firm value in a dynamic setting. In all analyses, we have taken the *initial* ownership concentration as given. However, the entrepreneur's initial ownership is endogenous and depends on the degree of investor protection. Therefore, we naturally need to incorporate the dependence of ownership on investor protection when analyzing the "total" effects of investor protection on agency costs. The next section provides a theory of endogenous ownership. For analytical convenience, we study the determination of the entrepreneur's ownership using the deterministic model.

²⁶See Guo, Miao, and Morellec (2003) for a model of irreversible investment with regime-switching shocks.

5 Endogenous Ownership

La Porta et al. (1999) and Claessens et al. (2000) document that ownership is more concentrated under weaker investor protection. La Porta et al. (1997) and Demirgüç-Kunt and Maksimovic (1998) find that financial markets are smaller and less developed in countries with weaker investor protection. This section provides explanations to these empirical findings by extending the agency model of Section 4 to allow for endogenous ownership. This section's analyses proceed in two steps. Subsection 5.1 shows that there exists an underinvestment problem in that agency conflicts lead to a more concentrated ownership and a smaller size of firm's initial capital stock, consistent with the empirical evidence mentioned above. Subsection 5.2 then analyzes the implications of endogenous ownership. Specifically, we study the "total" effects of investor protection on agency costs, by recognizing that ownership is more concentrated under weaker investor protection.

5.1 Underinvestment

Let X_0 be the initial wealth of the entrepreneur. He chooses amount $K_e \leq X_0$ of his wealth to invest in the firm.²⁷ Following Zingales (1995), Bebchuk (1999), and Shleifer and Wolfenzon (2002), we assume that the entrepreneur retains the control of the firm even after his initial share offering. That is, there is no control challenge from outside shareholders.²⁸ The amount of additional capital K_m that he raises from the external equity market will be determined by the market equilibrium condition. Because outside shareholders receive the competitive rate of return r , we have

$$K_m = (1 - \alpha)q(\alpha)K_0, \quad (29)$$

where K_0 is the firm's initial capital stock and the right-hand side of (29) is the total firm value held by outside shareholders and the left-hand side is the total fund outside shareholders contribute to the firm. Note that K_0 is equal to the sum of K_m and K_e :

$$K_0 = K_m + K_e. \quad (30)$$

The entrepreneur chooses K_e and ownership α to maximize his time-0 utility given by

$$V = X_0 - K_e + u(\alpha)K_0, \quad (31)$$

²⁷In general, the entrepreneur can borrow certain amount from the bank. We shall interpret X_0 as the sum of his own wealth and the amount he can borrow from the bank at rate r .

²⁸A sizable literature deals with optimal ownership structures of firms under different degrees of private benefits of control. See Grossman and Hart (1988), Harris and Raviv (1988), Bebchuk (1999), Wolfenzon (1999), and Bennedsen and Wolfenzon (2000). Stulz (1988) analyzes the effect of managerial control of voting rights on firm value and financing policies.

subject to

$$K_e \leq X_0, \quad (32)$$

$$K_0 = m(\alpha) K_e, \quad (33)$$

where

$$m(\alpha) = \frac{1}{1 - (1 - \alpha)q(\alpha)}. \quad (34)$$

Constraint (32) states that capital contributed by the entrepreneur must be lower than his endowed wealth X_0 . Equation (33) is obtained by substituting (29) into (30). For every unit of capital that the entrepreneur invests in his firm, the outside shareholders contribute $(m(\alpha) - 1) > 0$ units of capital to make total $m(\alpha)$ units of capital in the firm. Naturally, we dub $m(\alpha)$ the capital-stock multiplier. The entrepreneur's ownership α satisfies $(1 - \alpha)q(\alpha) < 1$. Therefore, the capital-stock multiplier is positive and finite. Note that we solve for the entrepreneur's time-0 decisions by backward induction. That is, his optimal cash diversion and investment decisions are already incorporated into the objective function (31). Substituting (33) into (31) gives

$$V = X_0 + (u(\alpha)m(\alpha) - 1)K_e. \quad (35)$$

Taking the derivative of (35) with respect to K_e gives

$$\frac{\partial V}{\partial K_e} = -1 + u(\alpha)m(\alpha) = (w(\alpha) - 1)m(\alpha). \quad (36)$$

Equation (36) implies that $\partial V/\partial K_e > 0$, for $w(\alpha) > 1$. Hence, the entrepreneur invests all his personal wealth X_0 in the firm.²⁹ Therefore, the firm's initial capital stock is given by $K_0 = m(\alpha)X_0$ and the entrepreneur's time-0 utility is given by $V = (w(\alpha) - 1)m(\alpha)X_0$. Intuitively, there are two factors affecting the entrepreneur's utility V : the "quantity" effect, captured by $m(\alpha)$, and the "value" effect, captured by $(w(\alpha) - 1)$. Inequality $w(\alpha) > 1$ ensures that the firm's project is still of sufficiently high quality and the surplus per unit of capital $(w(\alpha) - 1)$ is positive even in the presence of agency costs.³⁰ Because outside minority shareholders break even and the entrepreneur receives all the surplus, the project that will be funded under perfect investor protection (i.e. $q^* > 1$) will also receive outside financing under

²⁹We do not consider diversification benefits due to risk aversion. See Himmelberg et al. (2002) for such an analysis and implications on cost of capital. Also see Castro et al. (2002) for an optimal contracting approach on investor protection and growth with risk-averse agents in an overlapping generations model.

³⁰One sufficient, but not necessary condition for $w(\alpha) > 1$ is that firm value (per unit of capital) is larger than unity ($q(\alpha) > 1$), in that $w(\alpha) = u(\alpha) + (1 - \alpha)q(\alpha) \geq \alpha q^* + (1 - \alpha)q(\alpha) \geq q(\alpha) > 1$. However, even if $q(\alpha) < 1$, we may still have $w(\alpha) > 1$, provided that $u(\alpha)$ is large enough. If $w(\alpha) \leq 1$, then the total value added from implementing the project is non-positive, and thus the firm will not be set up.

weaker investor protection.³¹ This is because the endogenous ownership α adjusts to ensure $w(\alpha) > 1$, for the project whose value under the first-best benchmark is larger than unity.³² However, the size of the outside funds naturally depends on investor protection.

In summary, the restrictions on the entrepreneur's optimal ownership are given by $(1 - \alpha)q(\alpha) < 1 < w(\alpha)$. The left inequality states that firm size in equilibrium is finite. The right inequality requires the project to have a positive surplus to the entrepreneur. The entrepreneur's problem now is to choose his ownership α in order to maximize

$$u(\alpha) m(\alpha) X_0 = X_0 + (w(\alpha) - 1) m(\alpha) X_0. \quad (37)$$

First, we present the result that the multiplier $m(\alpha^*)$ must decrease in α^* in the next proposition.

Proposition 4 *The outside capital $(m(\alpha) - 1) K_0$ decreases in the entrepreneur's ownership, in that $m'(\alpha^*) < 0$.*

Proof A higher α implies (i) a mechanically smaller outside ownership $1 - \alpha$; and (ii) a higher Tobin's q . We note that (i) and (ii) have opposite effects on the capital-stock multiplier $m(\alpha)$. At the entrepreneur's chosen level α^* , we claim that (i) dominates (ii) and leads to $m'(\alpha^*) < 0$. We prove this statement by contradiction. If this were not true, then the entrepreneur should increase his chosen ownership a bit from the current level, because doing so yields a higher u for each unit of the firm's capital ($\partial u / \partial \alpha > 0$), and also raises a larger amount of outside equity, (a higher capital-stock multiplier m). Therefore, the entrepreneur's time-0 utility $V = u m X_0$ is larger, *ceteris paribus*. This leads to the contradiction that α^* is optimally chosen by the entrepreneur.

We now return to the entrepreneur's optimization problem (37). The next proposition summarizes the entrepreneur's first-order condition (FOC).

Proposition 5 *At the entrepreneur's chosen level of ownership α^* , we have*

$$\frac{u'(\alpha^*)}{u(\alpha^*)} = -\frac{m'(\alpha^*)}{m(\alpha^*)} = \frac{w'(\alpha^*)}{w(\alpha^*) - 1}. \quad (38)$$

This proposition states that the entrepreneur's optimality implies that the percentage increase of his utility-capital ratio u is equal to the percentage reduction of the capital-stock multiplier

³¹Note that we may use first-best benchmark firm value q^* and f interchangeably as measures of productivity, because q^* is a strictly monotonic function in f .

³²The intuition is as follows. For projects with $q^* = 1$, there will be no outside financing ($\alpha = 1$), because $w(1) = q^*$ and $w'(\alpha) > 0$. For projects with $q^* > 1$, the entrepreneur is able to raise some amount of outside funds and still satisfy $w(\alpha) > 1$ by the monotonicity and continuity of $w(\alpha)$.

m and is also equal to the percentage increase of social surplus $(w - 1)$, associated with an increase of ownership α . Appendix C provides details for the verification of the corresponding second-order condition (SOC).

Our model also predicts that incumbent entrepreneurs oppose improving investor protection, while future entrepreneurs who want to receive financing for their projects support improving investor protection. For incumbent entrepreneurs, a stronger investor protection lowers their private benefits,³³ $(\partial u/\partial \eta < 0)$. Outside minority shareholders gain from improved investor protection, because of smaller distortions in investment and higher firm value. Future entrepreneurs benefit as well from a stronger investor protection, because they are able to (i) raise a larger amount of capital and (ii) generate a higher social surplus $w - 1$ for each unit of capital. Both (i) and (ii) increase their time-0 entrepreneur's value function V . The following proposition formalizes this intuition.

Proposition 6 *The future entrepreneur gains from an improvement of investor protection:*

$$\frac{dV}{d\eta} = \frac{\partial V}{\partial \eta} = \left[\frac{\partial w}{\partial \eta} m + \frac{\partial m}{\partial \eta} (w - 1) \right] X_0 > 0.$$

The next theorem summarizes the underinvestment result. The entrepreneur's endogenous ownership is larger and the amount of equity raised is smaller, when investor protection is weaker. This is consistent with the empirical evidence documented in La Porta et al. (1997), La Porta et al. (1999), Claessens et al. (2000), and Kumar et al. (2001).

Theorem 2 *The optimal entrepreneur's ownership in the firm decreases in the degree η of investor protection, in that $d\alpha^*/d\eta < 0$. Both the firm's external equity market size K_m and the firm's initial size K_0 increase in η , in that $dK_m/d\eta = dK_0/d\eta > 0$.*

In order to highlight the intuition of the results, it is helpful to go through the following arguments. Consider two levels of investor protection η_1 and η_2 , with $\eta_1 < \eta_2$. Let α_1 and α_2 be the corresponding entrepreneur's optimal ownership. Appendix C shows that the marginal effect of ownership α on time-0 value function V is smaller, when investor protection is stronger, in that $V_{\alpha\eta} < 0$. This implies $V_\alpha(\alpha_1; \eta_1) > V_\alpha(\alpha_1; \eta_2)$. Recall that the entrepreneur's optimality implies $V_\alpha(\alpha_1; \eta_1) = V_\alpha(\alpha_2; \eta_2) = 0$. Therefore, we have

$$0 = V_\alpha(\alpha_2; \eta_2) = V_\alpha(\alpha_1; \eta_1) > V_\alpha(\alpha_1; \eta_2). \quad (39)$$

³³Related work includes Bebchuk and Roe (1999), La Porta et al. (2000b), Rajan and Zingales (2003), and Shleifer and Wolfenzon (2002).

Because V_α decreases in ownership α ($V_{\alpha\alpha} < 0$) for a given level of investor protection,³⁴ (39) implies $\alpha_1 > \alpha_2$. This proves that the entrepreneur holds a less concentrated ownership in the firm, under stronger investor protection, *ceteris paribus*. Shleifer and Wolfenzon (2002) prove a similar result in a static model.

5.2 Total Effects of Investor Protection

Recall that Section 4 shows that agency costs decrease in both investor protection and entrepreneur's ownership, *ceteris paribus*. Theorem 2 demonstrates that ownership itself is endogenously determined by the degree of investor protection. Therefore, in order to analyze the *total* effects of investor protection on agency costs, we need to incorporate both the effect of investor protection on agency costs (holding ownership fixed as in Section 4), and the effect of endogenous ownership. Note that (i) ownership is optimally chosen by the entrepreneur as a function of the degree of investor protection; and (ii) ownership concentration also affects agency costs.

For illustrative purposes, let us first analyze the total effects of investor protection on investment i . Taking a total differentiation of investment i with respect to η gives

$$\frac{di}{d\eta} = \frac{\partial i}{\partial \eta} + \frac{\partial i}{\partial \alpha} \frac{d\alpha}{d\eta}, \quad (40)$$

where the first term on the right-hand side may be dubbed the *direct* effect and the second term via ownership the *indirect* effect. The direct effect reflects how investor protection affects investment i , holding ownership α fixed. The indirect effect reflects how ownership is affected by investor protection (Theorem 2) and the subsequent effect of endogenously chosen ownership on investment. We note that the direct and indirect effects work in opposite directions, because $\partial i/\partial \alpha < 0$, $\partial i/\partial \eta < 0$ (Proposition 1), and ownership is less concentrated under stronger investor protection ($d\alpha/d\eta < 0$).

Equation (40) implies that the investment-capital ratio i is smaller under stronger investor protection ($di/d\eta < 0$), if and only if the following holds:

$$\frac{d\alpha}{d\eta} > -\frac{\partial i/\partial \eta}{\partial i/\partial \alpha}. \quad (41)$$

For notational convenience, let ϵ denote the elasticity of outside ownership ($1 - \alpha$) with respect to the degree of investor protection, in that

$$\epsilon = \frac{d \log (1 - \alpha)}{d \log \eta} > 0,$$

³⁴This is the necessary SOC, proved in Appendix C.

where $\epsilon > 0$ follows from Theorem 2. It is straightforward to show that (41) is equivalent to the following statement:

$$\epsilon = \frac{d \log(1 - \alpha)}{d \log \eta} < \frac{\partial i / \partial \eta}{\partial i / \partial \alpha} \left(\frac{\eta}{1 - \alpha} \right) = \frac{\alpha}{1 + \alpha} \equiv \epsilon_i.$$

That is, investment i is smaller under stronger investor protection, if and only if outside ownership elasticity with respect to investor protection is less than $\epsilon_i = \alpha / (1 + \alpha)$. Provided that ownership structure is not too sensitive to investor protection, ($\epsilon < \epsilon_i$), the indirect effect of investor protection mitigates, but does not over-turn, the seemingly intuitive result that stronger investor protection implies less overinvestment. Similar analyses can be done with respect to the total effects of investor protection on cash diversion s , Tobin's q and welfare-capital ratio w . We summarize the main results on “total” effects of investor protection on agency costs in the following proposition.

Proposition 7 *Cash diversion s decreases in η , if and only if $\epsilon < \epsilon_s = 1$. Investment-capital ratio i decreases in η , if and only if $\epsilon < \epsilon_i = \alpha / (1 + \alpha)$. Tobin's q increases in η , if and only if $\epsilon < \epsilon_q$ where ϵ_q is given in (C.29). Welfare-capital ratio w increases in η , if and only if $\epsilon < \epsilon_w$, where ϵ_w is given in (C.31). The order of these threshold elasticities is given by*

$$\epsilon_i < \epsilon_w < \epsilon_q < \epsilon_s = 1. \tag{42}$$

The entrepreneur pursues his private benefits by diverting cash and distorting investment decisions. A higher elasticity ϵ implies that the sensitivity of the firm's equilibrium ownership structure with respect to investor protection is larger, and therefore indicates a bigger “indirect” effect of investor protection on agency costs, *ceteris paribus*. Note that the threshold elasticity ϵ_i for investment i is smaller than the threshold elasticity ϵ_s for cash diversion s . One implication of $\epsilon_i < \epsilon_s$ is the following. Consider two firms A and B with identical production technology under different degrees of investor protection ($\eta_A < \eta_B$). It is conceivable in our model economy to observe that the entrepreneur of Firm B diverts a lower fraction of firm output, but invests more than the entrepreneur of Firm A does, in that $0 < s_B < s_A$ and $i_B > i_A > i^*$. That is, the “indirect” effect of investor protection via ownership is stronger for investment distortions than for direct cash diversion. Our model thus provides one explanation to the anecdotal evidence that large outright theft is more common in countries with weaker investor protection ($s_A > s_B$), however, overinvestment is quite common in countries such as the U.S. with stronger investor protection ($i_B > i_A$).

The Tobin's q and the welfare-capital ratio w capture effects of investor protection on cash diversion and investment in a dynamic environment. For intermediate values of elasticity

($\epsilon_i < \epsilon < \epsilon_s$), stronger investor protection implies less cash diversion ($ds/d\eta < 0$) and a larger degree of overinvestment ($di/d\eta > 0$). Therefore, the signs of $dq/d\eta$ and $dw/d\eta$ are determined by the outcome of the horse race between the effect through i and that through s . Because the Tobin's q and the welfare-capital ratio w are affected by both distortions (direct cash diversion and overinvestment), threshold elasticities ϵ_q and ϵ_w for Tobin's q and welfare w must lie between ϵ_i and ϵ_s , in that $\epsilon_i < \epsilon_q$, $\epsilon_w < \epsilon_s$. That is, $dq/d\eta > 0$ if and only if $\epsilon < \epsilon_q$, and $dw/d\eta > 0$ if and only if $\epsilon < \epsilon_w$. Finally, $\epsilon_w < \epsilon_q$ is attributed to the fact that welfare is a weighted average of the entrepreneur's utility and Tobin's q ; and the entrepreneur's utility decreases in investor protection ($\partial u/\partial \eta < 0$). Therefore, it is easier to have Tobin's q increase in η than to have welfare w increase in η . Recall that the incumbent entrepreneur benefits from the weakness of investor protection.

In summary, our analyses on the “total” effects of investor protection deliver the following two messages: (i) the indirect effect of investor protection via endogenous ownership weakens the direct effect of investor protection on agency costs and can be quite substantial; (ii) and the indirect effect of endogenous ownership has different degrees of impact on different measures of agency costs, such as cash diversion, investment distortion, firm value reduction and the welfare loss.

6 Conclusions

This paper provides a dynamic model of investment, firm value and ownership when investor protection is imperfect. We show that the controlling shareholder pursues his private benefits in two ways: (i) diverting cash away from the firm for his private benefits and (ii) overinvesting today as so to increase his future perquisites. Because the entrepreneur's net private benefits in the future increase in the future size of the firm, the entrepreneur naturally has incentives to distort investment decisions upward from the first-best no-agency level. The firm value is reduced from the first-best no-agency level not only due to the direct cash diversion by the entrepreneur, as captured in La Porta et al. (2002) and Shleifer and Wolfenzon (2002), but also due to the entrepreneur's dynamically inefficient overinvestment decisions. Overinvestment lowers firm value because of mis-allocation of capital over time. Our model further predicts that investment is sensitive to cash flow. However, the investment-cash flow sensitivity is not due to costly external financing as commonly argued in the literature nor to the measurement error of Tobin's q . Investment is sensitive to cash flow, because cash flow is correlated with the degree of the entrepreneur's private benefits. Moreover, our model predicts that investment is

less distorted under stronger investor protection, consistent with empirical evidence.

We also show that the entrepreneur optimally chooses to keep his ownership concentration unchanged over time, because no outside shareholders will tender their shares to the entrepreneur below the after-purchase equilibrium market price. This free-rider problem similar to the one in the corporate control context (Grossman and Hart (1980)) means that the entrepreneur has no incentives to reduce agency costs by increasing his ownership in the firm once the firm is set up. Moreover, the entrepreneur's future cash diversion and overinvestment decisions limit his ability to raise outside equity and thus imply a higher ownership concentration under weaker investor protection. Finally, we analyze the effects of investor protection on investment decisions and firm value by incorporating the effect of endogenous ownership. We show that there are two opposite effects of investor protection on firm value. A stronger investor protection implies a lower cash diversion and a smaller investment distortion. Both lead to higher firm value, holding the entrepreneur's ownership fixed. However, stronger investor protection also leads to a less concentrated ownership and thus implies larger mis-alignments of incentives between the controlling shareholder and outside minority shareholders. The net effect of investor protection on agency costs depends on the magnitude of these two effects. We show that cash diversion is the least sensitive, and the investment decision is the most sensitive to the mitigating indirect effect of investor protection via ownership.

Appendices

A Investment with Agency Costs of Section 4

This appendix provides the proof for the investment-capital ratio given in (11). When investor protection is imperfect, the entrepreneur derives utility from both his shareholdings in the firm and private benefits of controlling the firm.

The following conditions are imposed in order to allow us to focus on economically meaningful cases for the solutions of (9).

Condition 1 *Investor protection is not too weak, in that η has a lower bound given by*

$$\eta > 1 - \alpha.$$

Condition 1 rules out the trivial case in which the cost of pursuing private benefits is so little that it is optimal for the entrepreneur to divert all output and leave outside shareholders with nothing.

Condition 2 *The productivity f of the project is not too high, in that $f < \bar{f}$, where*

$$\bar{f} = \frac{1}{1 + \zeta} \left(r + \delta + \frac{\theta}{2}(r + \delta)^2 \right) = \frac{\bar{f}_1}{1 + \zeta} < \bar{f}_1,$$

ζ is given in (12), and

$$\bar{f}_1 = r + \delta + \frac{\theta}{2} (r + \delta)^2. \quad (\text{A.1})$$

The upper bound \bar{f} of f ensures that the transversality condition is satisfied for firm value under candidate investment policies.

Let the value function for the entrepreneur be $U(K)$. The corresponding Bellman equation for the entrepreneur is

$$rU(K) = \max_{s, I} \{ \alpha Y + sfK - C(s, fK) + (I - \delta K) U'(K) \}, \quad (\text{A.2})$$

where $Y = fK - I - \Phi(I, fK) - sfK$ is the dividend distributed to the shareholder. The FOC with respect to s gives

$$(1 - \alpha)fK = C_s(s, fK) = \eta sfK. \quad (\text{A.3})$$

For quadratic cost of diverting cash for private benefits, fraction s of cash diversion is given in (13). We are interested in the interior solution in which the fraction s of gross output diverted

for private benefits is between zero and one. This holds under Condition 1. The FOC with respect to investment rate I gives

$$\alpha \left(1 + \theta \frac{I}{K} \right) = U'(K). \quad (\text{A.4})$$

We conjecture that utility of the entrepreneur is linear in capital stock, in that

$$U(K) = uK, \quad (\text{A.5})$$

for some constant u . Equations (A.5) and (A.4) together give

$$i = \frac{I}{K} = \frac{u - \alpha}{\theta \alpha}. \quad (\text{A.6})$$

Substituting (13) and (A.6) into the Bellman equation (A.2) gives

$$\frac{\theta}{2} i^2 - (r + \delta) \theta i - (r + \delta) + (1 + \zeta) f = 0, \quad (\text{A.7})$$

where ζ is given in (12). Solving (A.7) gives rise to

$$i = r + \delta \pm \sqrt{(r + \delta)^2 - \frac{2}{\theta} [(1 + \zeta) f - (r + \delta)]}. \quad (\text{A.8})$$

Economically, a firm with higher productivity level f should invest more, in that $\partial i / \partial f > 0$, *ceteris paribus*. This suggests that we shall pick the smaller root of i in (A.8). That gives the expression for the investment rule in (11). Under Condition 2, we have $r + \delta > i$. Thus, the transversality condition (8) is satisfied as shown below:

$$\lim_{T \rightarrow \infty} e^{-rT} K_T = \lim_{T \rightarrow \infty} e^{-rT} e^{(i-\delta)T} K_0 = \lim_{T \rightarrow \infty} e^{-(r+\delta-i)T} K_0 = 0. \quad (\text{A.9})$$

When investor protection is perfect ($\eta = \infty$), investment achieves first best. The corresponding investment-capital ratio i^* is given by (14).

B Proofs of Propositions

This appendix supplies proofs for propositions not proved in the text.

Proof of Proposition 1

Taking the derivative of investment-capital ratio i with respect to η gives

$$\frac{di}{d\eta} = -\frac{(1 - \alpha)^2 f}{2(r + \delta - i)\theta \alpha \eta^2} = \frac{-\xi^2 f}{2(r + \delta - i)\theta \alpha} < 0. \quad (\text{B.1})$$

Taking the derivative of investment-capital ration i with respect to α gives

$$\frac{di}{d\alpha} = -\frac{(1 - \alpha^2) f}{2(r + \delta - i)\eta \alpha^2 \theta} = -\frac{(1 + \alpha) f \xi}{2(r + \delta - i)\alpha^2 \theta} < 0. \quad (\text{B.2})$$

Proof of Proposition 2

The following condition rules out those situations of very high agency costs.

Condition 3 *Overinvestment cannot be too high, in that $i < \bar{i}$, where*

$$\bar{i} = \frac{1}{1 + (r + \delta)\theta} \left[2f - (r + \delta) + \frac{f(1 - \alpha)(1 - 3\alpha)}{2\eta\alpha} \right],$$

and i is investment-capital ratio given in (11).

Taking the derivative of dividend-capital ratio y with respect to η gives

$$\begin{aligned} \frac{dy}{d\eta} &= \frac{\partial y}{\partial s} \frac{ds}{d\eta} + \frac{\partial y}{\partial i} \frac{di}{d\eta}, \\ &= \frac{(1 - \alpha)f}{\eta^2} + \frac{(1 + \theta i)(1 - \alpha)^2 f}{2(r + \delta - i)\theta\alpha\eta^2} > 0. \end{aligned} \quad (\text{B.3})$$

Dividend-capital ratio y increases in entrepreneur's ownership α , in that

$$\frac{dy}{d\alpha} = \frac{f}{\eta} + \frac{(1 + \theta i)(1 - \alpha^2)f}{2(r + \delta - i)\eta\alpha^2\theta} > 0. \quad (\text{B.4})$$

Taking the derivative of Tobin's q with respect to η gives

$$\begin{aligned} \frac{dq}{d\eta} &= \frac{\partial q}{\partial s} \frac{ds}{d\eta} + \frac{\partial q}{\partial i} \frac{di}{d\eta}, \\ &= \frac{\xi f}{\eta(r + \delta - i)} + \frac{(1 + \alpha)f^2\xi^3}{4\alpha^2(r + \delta - i)^3\theta} > 0. \end{aligned}$$

Similarly, Tobin's q increases in entrepreneur's ownership, in that

$$\begin{aligned} \frac{dq}{d\alpha} &= \frac{\partial q}{\partial s} \frac{ds}{d\alpha} + \frac{\partial q}{\partial i} \frac{di}{d\alpha} \\ &= \frac{f}{(r + \delta - i)\eta} + \frac{(1 + \alpha)^2 f^2 \xi^2}{4(r + \delta - i)^3 \alpha^3 \theta} > 0. \end{aligned}$$

Proof of Proposition 3

Optimality of the entrepreneur's decisions implies

$$\frac{\partial u}{\partial i} = 0 \quad \text{and} \quad \frac{\partial u}{\partial s} = 0. \quad (\text{B.5})$$

Total differentiation of $u(\alpha)$ gives

$$\frac{du(\alpha)}{d\alpha} = \frac{\partial u}{\partial i} \frac{di}{d\alpha} + \frac{\partial u}{\partial s} \frac{ds}{d\alpha} + \frac{\partial u(\alpha)}{\partial \alpha} = \frac{\partial u(\alpha)}{\partial \alpha}, \quad (\text{B.6})$$

where the last equality follows from (B.5). We may write the entrepreneur's utility-capital ratio u as follows:

$$u = \frac{1}{r + \delta - i} \left(\alpha y + \xi f - \frac{\eta}{2} \xi^2 \right). \quad (\text{B.7})$$

Then, taking a partial derivative of u given in (B.7) with respect to α gives

$$\frac{\partial u(\alpha)}{\partial \alpha} = \frac{y}{r + \delta - i} = q(\alpha), \quad (\text{B.8})$$

where the last equality follows from (19). Therefore, (B.6) and (B.8) together imply the envelope condition (25) : $u'(\alpha) = q(\alpha)$.

C Proof of Results in Section 5

This appendix documents proofs of key results in Section 5.

Proof of Proposition 5

The definitions of u and w imply

$$u(\alpha; \eta) = w(\alpha; \eta) - (1 - \alpha)q(\alpha; \eta) = w(\alpha; \eta) - 1 + 1 - (1 - \alpha)q(\alpha; \eta). \quad (\text{C.1})$$

Taking the derivative of (C.1) with respect to α gives

$$u'(\alpha; \eta) = w'(\alpha; \eta) + (q(\alpha; \eta) - (1 - \alpha)q'(\alpha; \eta)). \quad (\text{C.2})$$

Recall that the FOC (38) implies

$$\frac{u'(\alpha; \eta)}{u(\alpha; \eta)} = \frac{q(\alpha; \eta) - (1 - \alpha)q'(\alpha; \eta)}{1 - (1 - \alpha)q(\alpha; \eta)}. \quad (\text{C.3})$$

Therefore, (C.2) and (C.3) together show

$$\frac{u'(\alpha)}{u(\alpha)} = -\frac{m'(\alpha)}{m(\alpha)} = \frac{w'(\alpha)}{w(\alpha) - 1}. \quad (\text{C.4})$$

The following argument is used in the proof. If $(A+B)/(C+D) = B/D$, for $A, B, C, D, > 0$, then $A/C = B/D$. We set $A = w'(\alpha; \eta)$, $B = q(\alpha; \eta) - (1 - \alpha)q'(\alpha; \eta)$, $C = w(\alpha; \eta) - 1$, and $D = 1 - (1 - \alpha)q(\alpha; \eta)$. Note that for the chosen A, B, C , and D , they are all positive.

Proof of Proposition 6

The first equality sign is due to the envelope condition, implied by the entrepreneur's optimality condition $dV(\alpha^*)/d\alpha = 0$, and the second equality results from total differentiation of (37). We note that

$$\frac{\partial m}{\partial \eta} = m^2 \left[(1 - \alpha) \frac{\partial q}{\partial \eta} - q(\alpha) \frac{d\alpha}{d\eta} \right] > 0,$$

where the inequality follows from $\partial q/\partial \eta > 0$ (Proposition 2), and $d\alpha/d\eta < 0$ (Theorem 2). Using $\partial w/\partial \eta > 0$ and $\partial m/\partial \eta > 0$, we have $dV/d\eta > 0$.

Verification of the SOC for (37)

Let us denote $F(\alpha, \eta)$ as the left-hand side of the FOC (38):

$$F(\alpha; \eta) = \frac{u'(\alpha)}{u(\alpha)} + \frac{m'(\alpha)}{m(\alpha)}. \quad (\text{C.5})$$

We first prove that entrepreneur's ownership α^* is indeed globally optimal for the entrepreneur. Taking the derivative of the left-hand side of FOC (38) with respect to α again gives the following SOC:

$$\frac{\partial F(\alpha; \eta)}{\partial \alpha} = \frac{u''(\alpha)}{u(\alpha)} - \frac{u'(\alpha)^2}{u(\alpha)^2} - \frac{m'(\alpha)^2}{m(\alpha)^2} + \frac{m''(\alpha)}{m(\alpha)}, \quad (\text{C.6})$$

$$= \frac{q'(\alpha)}{u(\alpha)} - \frac{2m'(\alpha)^2}{m(\alpha)^2} + \frac{m''(\alpha)}{m(\alpha)}, \quad (\text{C.7})$$

$$= \frac{q'(\alpha)}{u(\alpha)} - \frac{m'(\alpha)}{m(\alpha)} \left[-\frac{m''(\alpha)}{m'(\alpha)} + \frac{2m'(\alpha)}{m(\alpha)} \right], \quad (\text{C.8})$$

$$= \frac{q'(\alpha)}{u(\alpha)} + \frac{u'(\alpha)}{u(\alpha)} \left[-\frac{d \log(-m'(\alpha))}{d\alpha} + \frac{2 d \log(m(\alpha))}{d\alpha} \right], \quad (\text{C.9})$$

$$= \frac{q'(\alpha)}{q(\alpha)} \frac{q(\alpha)}{u(\alpha)} + \frac{q(\alpha)}{u(\alpha)} \left[-\frac{d \log(q(\alpha) - (1-\alpha)q'(\alpha))}{d\alpha} \right], \quad (\text{C.10})$$

$$= \frac{q(\alpha)}{u(\alpha)} \times \left[-\frac{d}{d\alpha} \log \left(1 - \frac{(1-\alpha)q'(\alpha)}{q(\alpha)} \right) \right], \quad (\text{C.11})$$

where equality (C.7) follows from FOC (38) and $u'(\alpha) = q(\alpha)$ (Proposition 3); and equality (C.10) uses FOC (38), $u'(\alpha) = q(\alpha)$, and $m'(\alpha) = -(q(\alpha) - (1-\alpha)q'(\alpha))m(\alpha)^2 < 0$.

The monotonicity of logarithmic transformation implies that the sign of the SOC (C.7) is equal to that of

$$\frac{d}{d\alpha} \left[(1-\alpha) \frac{q'(\alpha)}{q(\alpha)} \right] = \frac{q''(\alpha)(1-\alpha) - q'(\alpha)}{q(\alpha)} - (1-\alpha) \left(\frac{q'(\alpha)}{q(\alpha)} \right)^2 < 0. \quad (\text{C.12})$$

The last inequality follows from $q'(\alpha) > 0$ and $q''(\alpha) < 0$ (Details are available upon request.)

Proof of Theorem 2

Applying the implicit function theorem to (C.5) gives

$$\frac{d\alpha}{d\eta} = -\frac{\partial F(\alpha; \eta)/\partial \eta}{\partial F(\alpha; \eta)/\partial \alpha}, \quad (\text{C.13})$$

where

$$\frac{\partial F(\alpha; \eta)}{\partial \eta} = \frac{1}{u} \frac{\partial u'}{\partial \eta} - \frac{u'}{u^2} \frac{\partial u}{\partial \eta} + \frac{1}{m} \frac{\partial m'}{\partial \eta} - \frac{m'}{m^2} \frac{\partial m}{\partial \eta}, \quad (\text{C.14})$$

$$= \frac{q}{u} \frac{\partial \log q}{\partial \eta} - \frac{q}{u} \frac{\partial \log u}{\partial \eta} + \frac{m'}{m} \frac{\partial \log(-m')}{\partial \eta} - \frac{m'}{m} \frac{\partial \log m}{\partial \eta}, \quad (\text{C.15})$$

$$= \frac{q}{u} \left[\frac{\partial \log q}{\partial \eta} - \frac{\partial \log u}{\partial \eta} - \frac{\partial}{\partial \eta} \log [(q - (1 - \alpha)q') m^2] + \frac{\partial \log m}{\partial \eta} \right], \quad (\text{C.16})$$

$$= \frac{q}{u} \left[\frac{\partial \log q}{\partial \eta} - \frac{\partial \log u}{\partial \eta} - \frac{\partial \log m}{\partial \eta} - \frac{\partial \log(q - (1 - \alpha)q')}{\partial \eta} \right], \quad (\text{C.17})$$

$$= \frac{q}{u} \left[-\frac{\partial}{\partial \eta} \log \left(1 - \frac{(1 - \alpha)q'}{q} \right) - \frac{\partial \log(um)}{\partial \eta} \right]. \quad (\text{C.18})$$

Note that we use u' to denote for $\partial u/\partial \alpha$ and use m' to denote $\partial m/\partial \alpha$. The equality (C.15) follows from envelope condition $u' = q$, and the equality (C.16) uses the FOC (38) and $m'(\alpha) = -(q(\alpha) - (1 - \alpha)q'(\alpha)) m^2 < 0$.

The monotonicity of logarithmic transformation implies that

$$\text{Sign} \left(-\frac{\partial}{\partial \eta} \log \left(1 - \frac{(1 - \alpha)q'}{q} \right) \right) = \text{Sign} \left(\frac{\partial}{\partial \eta} \frac{(1 - \alpha)q'}{q} \right), \quad (\text{C.19})$$

where

$$\frac{\partial}{\partial \eta} \frac{(1 - \alpha)q'}{q} = \frac{(1 - \alpha)}{q} \frac{\partial^2 q}{\partial \alpha \partial \eta} - \frac{(1 - \alpha)}{q^2} \frac{\partial q}{\partial \alpha} \frac{\partial q}{\partial \eta} < 0, \quad (\text{C.20})$$

using $\partial q/\partial \alpha > 0$, $\partial q/\partial \eta > 0$ and $\partial^2 q/\partial \eta \partial \alpha < 0$. Together with $\partial(um)/\partial \eta > 0$ of Proposition 6, we have $\partial F(\alpha; \eta)/\partial \eta < 0$.

The SOC and the above result ($\partial F(\alpha; \eta)/\partial \eta < 0$) together imply

$$\frac{d\alpha}{d\eta} = -\frac{\partial F(\alpha; \eta)/\partial \eta}{\partial F(\alpha; \eta)/\partial \alpha} < 0. \quad (\text{C.21})$$

That is, the optimal ownership concentration decreases with the level of investor protection.

For the chosen level of entrepreneur's ownership, the firm's raised capital is given by $K_m = K_0 - X_0$, where K_0 is firm's initial capital stock and is given by

$$K_0 = \frac{X_0}{1 - (1 - \alpha)q(\alpha)}. \quad (\text{C.22})$$

The marginal change of initial capital stock associated with a marginal increase in degree of investor protection is given by

$$\frac{dK_0}{d\eta} = \frac{\partial K}{\partial \alpha} \frac{d\alpha^*}{d\eta}, \quad (\text{C.23})$$

where

$$\frac{\partial K_0}{\partial \alpha} = X_0 m'(\alpha^*) < 0, \quad (\text{C.24})$$

using the fact that multiplier decreases in ownership α . Therefore, a higher investor protection leads to a higher level of external equity market and larger initial capital stock, in that

$$\frac{dK_m}{d\eta} = \frac{dK_0}{d\eta} > 0. \quad (\text{C.25})$$

Proof of Proposition 7

The total effect of investor protection on investment-capital ratio is given by

$$\frac{di}{d\eta} = \frac{\partial i}{\partial \eta} + \frac{\partial i}{\partial \alpha} \frac{d\alpha}{d\eta}. \quad (\text{C.26})$$

Therefore, i decreases in η if and only if

$$\frac{d\alpha}{d\eta} > -\frac{\partial i/\partial \eta}{\partial i/\partial \alpha}. \quad (\text{C.27})$$

Using the definition of elasticity of outside equity $(1 - \alpha)$ with respect to η implies that inequality (C.27) is equivalent to the following inequality:

$$\epsilon = \frac{d \log(1 - \alpha)}{d \log \eta} < \frac{\partial i/\partial \eta}{\partial i/\partial \alpha} \left(\frac{\eta}{1 - \alpha} \right) = \frac{\alpha}{1 + \alpha} \equiv \epsilon_i. \quad (\text{C.28})$$

Similarly, Tobin's q increases in η (taking endogeneity of ownership into account), if and only if $\epsilon < \epsilon_q$, where

$$\epsilon_q = \frac{\partial q/\partial \eta}{\partial q/\partial \alpha} \left(\frac{\eta}{1 - \alpha} \right) = \frac{1}{f + A\eta} \left(f + \frac{A\alpha}{1 + \alpha} \eta \right), \quad (\text{C.29})$$

and

$$A = \frac{(1 + \alpha)^2 f^2 \xi^2}{4(r + \delta - i)^2 \alpha^3 \theta}. \quad (\text{C.30})$$

Similarly, $dw/d\eta > 0$ (taking endogeneity of ownership into account), if and only if $\epsilon < \epsilon_w$, where

$$\epsilon_w = \frac{\partial w/\partial \eta}{\partial w/\partial \alpha} \left(\frac{\eta}{1 - \alpha} \right) = \frac{1}{f + A\eta} \left(\frac{f}{2} + \frac{A\alpha}{1 + \alpha} \eta \right), \quad (\text{C.31})$$

where A is given in (C.30).

D Appendix to Section 4.4

Taking the derivative of equation (26) on both sides with respect to investment gives:

$$\alpha \left(1 + \theta \frac{I}{K} \right) = U_K(K, n). \quad (\text{D.1})$$

We conjecture that the entrepreneur's value function in regime n is linearly dependent on capital stock, in that $U(K, n) = u_n K$, where u_n summarizes the effect of the productivity level in regime n on the entrepreneur's value function $U(K, n)$.

The optimal levels of cash diversion is the same as the one in a deterministic setting. The investment-capital ratio is given in (28), respectively. Therefore, the entrepreneur's cash flow is given by

$$M = \alpha Y + \frac{1 - \alpha^2}{2\eta} f_n K = \alpha \left[(1 + \zeta) f_n - \frac{1}{2\theta} \left(\left(\frac{u_n}{\alpha} \right)^2 - 1 \right) \right] K, \quad (\text{D.2})$$

where $Y = y_n K$ and the dividend-capital ratio y_n is given by

$$y_n = (1 - \xi) f_n - \frac{1}{2\theta} \left(\left(\frac{u_n}{\alpha} \right)^2 - 1 \right). \quad (\text{D.3})$$

Plugging $s_n = \xi$ and (28) into the HJB equation (26) gives

$$0 = \alpha \left[(1 + \zeta) f_n - \frac{1}{2\theta} \left(\left(\frac{u_n}{\alpha} \right)^2 - 1 \right) \right] - r u_n + (i_n - \delta) u_n + \sum_{m \neq n} \lambda_{nm} (u_m - u_n). \quad (\text{D.4})$$

Using the entrepreneur's chosen level of investment-capital ratio, we may solve for Tobin's q as follows:

$$\begin{pmatrix} q_1 \\ q_2 \\ \vdots \\ q_n \end{pmatrix} = \left[\begin{pmatrix} r + \delta - i_1 & 0 & \cdots & 0 \\ 0 & r + \delta - i_2 & 0 & \cdots \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & r + \delta - i_n \end{pmatrix} - \Lambda \right]^{-1} \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix}, \quad (\text{D.5})$$

where the transition rate matrix Λ is

$$\Lambda = \begin{pmatrix} \lambda_{11} & \lambda_{12} & \cdots & \lambda_{1n} \\ \lambda_{21} & \lambda_{22} & \cdots & \lambda_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \lambda_{n1} & \lambda_{n2} & \cdots & \lambda_{nn} \end{pmatrix}, \quad (\text{D.6})$$

and its diagonal element is given by $\lambda_{nn} = -\sum_{m \neq n} \lambda_{nm}$.

References

- Abel, A. B. (1979). *Investment and the Value of Capital*. New York: Garland Publishing.
- Abel, A. B. (1983). Optimal investment under uncertainty. *American Economic Review* 73(1), 228–233.
- Allen, F., J. Qian, and M. Qian (2002). Law, finance, and economic growth in China. manuscript, Wharton School.
- Alti, A. (2003). How sensitive is investment to cash flow when financing is frictionless? *Journal of Political Economy* 58(2), 707–22.
- Barclay, M. and C. Holderness (1989). Private benefits of control of public corporations. *Journal of Financial Economics* 25, 371–395.
- Bebchuk, L. A. (1999). The rent protection theory of corporate ownership and control. manuscript, Harvard Law School.
- Bebchuk, L. A., R. Kraakman, and G. G. Triantis (2000). Stock pyramids, cross-ownership, and dual class equity. In R. K. Morck (Ed.), *Concentrated Corporate Ownership*, pp. 295–318. Chicago: The University of Chicago Press.
- Bebchuk, L. A. and M. J. Roe (1999). A theory of path dependence in corporate ownership and governance. *Stanford Law Review* 52, 127–170.
- Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy* 76, 169–217.
- Bennedsen, M. and D. Wolfenzon (2000). The balance of power in closely held corporations. *Journal of Financial Economics* 58, 113–140.
- Berle, A. and G. Means (1932). *The Modern Corporation and Private Property*. New York: McMillan.
- Black, B., H. Jang, and W. Kim (2003). Does corporate governance affect firms’ market values? Evidence from Korea. Manuscript, Stanford Law School.
- Brainard, W. and J. Tobin (1968). Pitfalls in financial model building. *American Economic Review* 58(2), 99–122.
- Burkart, M., D. Gromb, and F. Panunzi (1998). Why higher takeover premia protect minority shareholders. *Journal of Political Economy* 106, 172–204.
- Caballero, R. J. (1999). Aggregate investment. In J. B. Taylor and M. Woodford (Eds.), *Handbook of Macroeconomics*, Volume 1B, pp. 813–862. Amsterdam: North-Holland.

- Castro, R., G. L. Clementi, and G. MacDonald (2002). Investor protection, optimal incentives, and economic growth. manuscript, Washington University.
- Claessens, S., S. Djankov, J. Fan, and L. Lang (2002). Disentangling the incentive and entrenchment effects of large shareholdings. *Journal of Finance* 57, 2741–2771.
- Claessens, S., S. Djankov, and L. Lang (2000). The separation of ownership and control in East Asian corporations. *Journal of Financial Economics* 58, 81–112.
- Demirgüç-Kunt, A. and V. Maksimovic (1998). Law, finance, and firm growth. *Journal of Finance* 53, 2107–2137.
- Dyck, A. and L. Zingales (2003). Private benefits of control: An international comparison. Manuscript, University of Chicago, forthcoming, *Journal of Finance*.
- Erickson, T. and T. M. Whited (2000). Measurement error and the relationship between investment and Q . *Journal of Political Economy* 108, 1027–57.
- Fazzari, S. M., R. G. Hubbard, and B. C. Petersen (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, 141–195.
- Fazzari, S. M., R. G. Hubbard, and B. C. Petersen (2000). Investment-cash flow sensitivities are useful: A comment on kaplan and zingales. *Quarterly Journal of Economics* 115, 695–705.
- Gomes, J. F. (2001). Financing investment. *American Economic Review* 91, 1263–85.
- Gompers, P., J. Ishii, and A. Metrick (2003). Corporate governance and equity prices. *Quarterly Journal of Economics* 118, 107–155.
- Grossman, S. J. and O. D. Hart (1980). Takeover bids, the free-rider problem, and the theory of the corporation. *The Bell Journal of Economics* 11(1), 42–64.
- Grossman, S. J. and O. D. Hart (1982). Corporate financial structure and managerial incentives. In J. J. McCall (Ed.), *The Economics of Information and Uncertainty*, pp. 123–155. Chicago: The University of Chicago Press.
- Grossman, S. J. and O. D. Hart (1988). One-share-one-vote and the market for corporate control. *Journal of Financial Economics* 20, 175–202.
- Guo, X., J. Miao, and E. Morellec (2003). Irreversible investments with regime shifts. Manuscript, University of Rochester.
- Hall, R. E. and D. W. Jorgenson (1967). Tax policy and investment behavior. *American Economic Review* 57, 391–414.

- Hamilton, J. D. (1989). A new approach to the economic analysis of nonstationary time series and business cycle. *Econometrica* 57, 357–384.
- Harris, M. and A. Raviv (1988). Corporate governance: Voting rights and majority rules. *Journal of Financial Economics* 20, 203–236.
- Harris, M. and A. Raviv (1990). Capital structure and the informational role of debt. *Journal of Finance* 45, 321–350.
- Hart, O. and J. Moore (1995). Debt and seniority: An analysis of the role of hard claims in constraining management. *American Economic Review* 85, 567–85.
- Hayashi, F. (1982). Tobin’s marginal q and average q : A neoclassical interpretation. *Econometrica* 50, 213–224.
- Himmelberg, C. P., R. G. Hubbard, and I. Love (2002). Investor protection, ownership, and the cost of capital. manuscript, Columbia University.
- Holderness, C. and D. P. Sheehan (1988). The role of majority shareholders in publicly held corporations. *Journal of Financial Economics* 20, 317–346.
- Hubbard, R. G. (1998). Capital-market imperfections and investment. *Journal of Economic Literature* 36(1), 193–225.
- Jensen, M. (1986). Agency cost of free cash flow, corporate finance, and takeovers. *American Economic Review* 76, 323–329.
- Jensen, M. and W. Meckling (1976). Theory of the firm: Managerial behavior, agency costs, and capital structure. *Journal of Financial Economics* 3, 305–360.
- Jorgenson, D. W. (1963). Capital theory and investment behavior. *American Economic Review* 53(2), 247–259.
- Kaplan, S. and L. Zingales (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics* 112.
- Kaplan, S. and L. Zingales (2000). Investment-cash flow sensitivities are not valid measures of financing constraints. *Quarterly Journal of Economics* 115.
- Kumar, K., R. G. Rajan, and L. Zingales (2001). What determines firm size? Manuscript, University of Chicago.
- La Porta, R., F. López-de-Silanes, and A. Shleifer (1999). Corporate ownership around the world. *Journal of Finance* 54(2), 471–517.

- La Porta, R., F. López-de-Silanes, A. Shleifer, and R. W. Vishny (1997). Legal determinants of external finance. *Journal of Finance* 52(3), 1131–1150.
- La Porta, R., F. López-de-Silanes, A. Shleifer, and R. W. Vishny (1998). Law and finance. *Journal of Political Economy* 106, 1113–1155.
- La Porta, R., F. López-de-Silanes, A. Shleifer, and R. W. Vishny (2000a). Agency problems and dividend policies around the world. *Journal of Finance* 55(1), 1–33.
- La Porta, R., F. López-de-Silanes, A. Shleifer, and R. W. Vishny (2000b). Investor protection and corporate governance. *Journal of Financial Economics* 58, 3–27.
- La Porta, R., F. López-de-Silanes, A. Shleifer, and R. W. Vishny (2002). Investor protection and corporate valuation. *Journal of Finance* 57(3), 1147–1170.
- Love, I. (2003). Financial development and financing constraints: International evidence from the structural investment model. *Review of Financial Studies* 16(3), 765–91.
- McConnell, J. and H. Servaes (1990). Additional evidence on equity ownership and corporate value. *Journal of Financial Economics* 27, 595–612.
- Morck, R., A. Shleifer, and R. W. Vishny (1988). Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics* 20, 293–315.
- Morellec, E. (2003). Can managerial discretion explain observed leverage ratios? Manuscript, University of Rochester, forthcoming, *Review of Finance Studies*.
- Mussa, M. (1977). External and internal adjustment costs and the theory of aggregate and firm investment. *Economica* 44, 163–178.
- Nenova, T. (2003). The value of corporate voting rights and control: A cross-country analysis. *Journal of Financial Economics* 68, 325–351.
- Pagano, M. and A. Roell (1998). The choice of stock ownership structure: Agency costs, monitoring, and the decision to go public. *Quarterly Journal of Economics* 113, 187–225.
- Poterba, J. M. (1988). Comment on “financing constraints and corporate investment”. *Brookings Papers on Economic Activity*, 200–4.
- Rajan, R. G. and L. Zingales (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics* 69(1), 5–50.
- Shleifer, A. and R. W. Vishny (1997). A survey of corporate governance. *Journal of Finance* 52(2), 737–783.

- Shleifer, A. and D. Wolfenzon (2002). Investor protection and equity markets. *Journal of Financial Economics* 66, 3–27.
- Stein, J. C. (2001). Agency, information and corporate investment. Manuscript, Harvard University.
- Stulz, R. M. (1988). Managerial control of voting rights: Financing policies and the market for corporate control. *Journal of Financial Economics* 20, 25–54.
- Stulz, R. M. (1990). Managerial discretion and optimal financing policies. *Journal of Financial Economics* 26, 3–27.
- Tobin, J. (1969). A general equilibrium approach to monetary theory. *Journal of Money, Credit, and Banking* 1, 15–29.
- Wolfenzon, D. (1999). A theory of pyramidal structures. Manuscript, Harvard University.
- Zingales, L. (1994). The value of the voting right: A study of the milan stock exchange. *Review of Financial Studies* 7, 125–148.
- Zingales, L. (1995). Inside ownership and the decision to go public. *Review of Economic Studies* 62, 425–448.
- Zwiebel, J. (1996). Dynamic capital structure under managerial entrenchment. *American Economic Review* 86, 1197–1215.