Corporate Governance, the Cross Section of Returns, and Financing Choices: Theory and Empirical Evidence

by

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Curriculum Vitae

The author was born in Nanyang City, Henan Province in the mainland of China on April 26, 1977. She attended Peking University from 1994 to 1998, and graduated with a Bachelor of SCIENCE degree in Physics and a Bachelor of ARTS degree in Economics. She attended University of Massachusetts, Amherst from 1998 to 2002, and graduated with a Doctor of Philosophy degree in Physics. She came to the University of Rochester in the Summer of 2002 and began graduate studies in Finance. She pursued her research in corporate governance under the direction of Professor John B. Long and received the Master of Science degree from the University of Rochester in 2005.

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Abstract

The first part of this thesis develops an investment-based asset pricing model with costly equity and debt financing and agency conflicts between shareholders and managers. In the model, managers seek private benefits proportional to the sizes of their firms and hence tend to overinvest. Corporate governance serves as a mechanism for shareholders to discipline managers. Consistent with recent empirical findings, the model predicts: (1) firms with stronger governance outperform firms with weaker governance in booms and underperform these firms in recessions; (2) firms with stronger governance have higher costs of debt financing and rely more on equity financing than firms with weaker governance.

The second part of this thesis provides two empirical tests on the predictions of the model about the cross section of returns. Both tests are conducted using two measures of the strength of corporate governance: governance index (G-index) and entrenchment index (E-index). First, I identify booms and recessions from September 1990 to December 2005 based on the expected market risk premium. The results show that controlling for market, size, value, and momentum factors, strongly governed firms on average earn higher returns than weakly governed firms during booms and lower returns during recessions. Second, I construct two

investment factors to proxy for the effect of overinvestment on stock returns. Based on these investment factors, data seems to suggest that overinvestment can explain the return differences between strongly and weakly governed firms only when the economy is in good states.

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Chapter 1

Introduction

Gompers, Ishii, and Metrick (2003) shows that firms with stronger corporate governance have higher average stock returns from 1990 to 2000. However, Core, Guay, and Rusticus (2006) finds that this positive relation between governance and stock returns is reversed from 2000 to 2003. This paper proposes an investment-based asset pricing model that can reconcile the findings in the aforementioned two papers and shows that the relation between governance and expected stock returns varies along business cycles.

In addition to the cross section of returns, this paper explores the implications of corporate governance and corporate investment on financing choices. The key ingredients of the model include costly equity and debt financing and managerial expropriations. In particular, corporate governance is modeled as shareholders' control mechanism to discipline managers. The predictions of the model are qualitatively and often quantitatively consistent with recent empirical findings. Firms with stronger governance outperform firms with weaker governance in booms and underperform these firms in recessions. Further, firms with stronger governance have higher costs of debt financing and rely more on equity financing than firms with weaker governance.

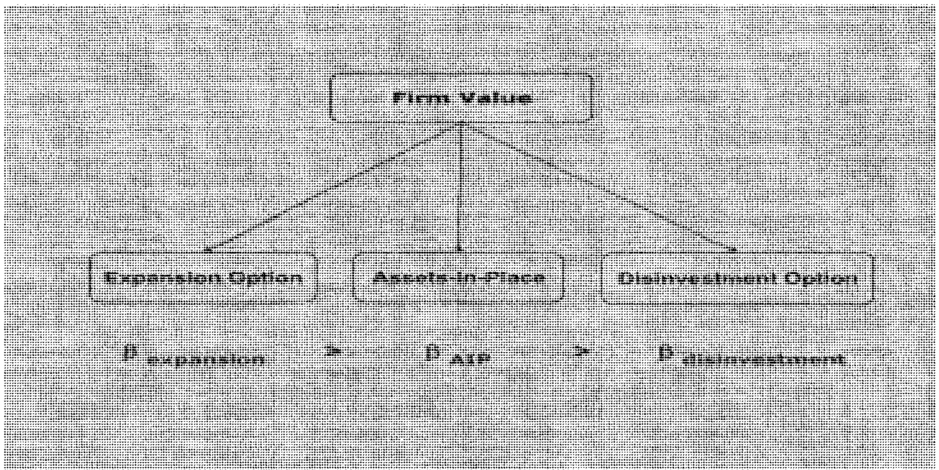
In the model, managers' private benefits increase with the sizes of their firms. Managers make investment decisions based on their private benefits from investment, in addition to the costs of capital and the productivity of investment. Consequently, they tend to overinvest.

Stronger corporate governance makes expropriation more costly to managers. The stronger corporate governance a firm has, the less its manager expropriates and overinvests. Therefore, on average, firms with stronger governance have higher market-to-book ratios, higher profitability, and smaller book assets than firms with weaker governance. These results are supported by the findings in Gompers, Ishii, and Metrick (2003), among others.

Most importantly, corporate governance affects the expected stock returns of a firm through its distorted investment policies, which change the riskiness of the firm in a direction that depends on the aggregate economic conditions. To illustrate the intuition, let's separate the firm value into three parts: assets in place, expansion options, and disinvestment options. Due to empire-building incentives, entrenched managers invest more in booms and disinvest less in recessions. The weaker governance a firm has, the further its investment policy deviates from the equity-value-maximizing choice and the lower the value of both its expansion options and disinvestment options.

Since expansion options give firms the option to expand when the profitability is high enough, they are call options and riskier than the underlying assets. On the

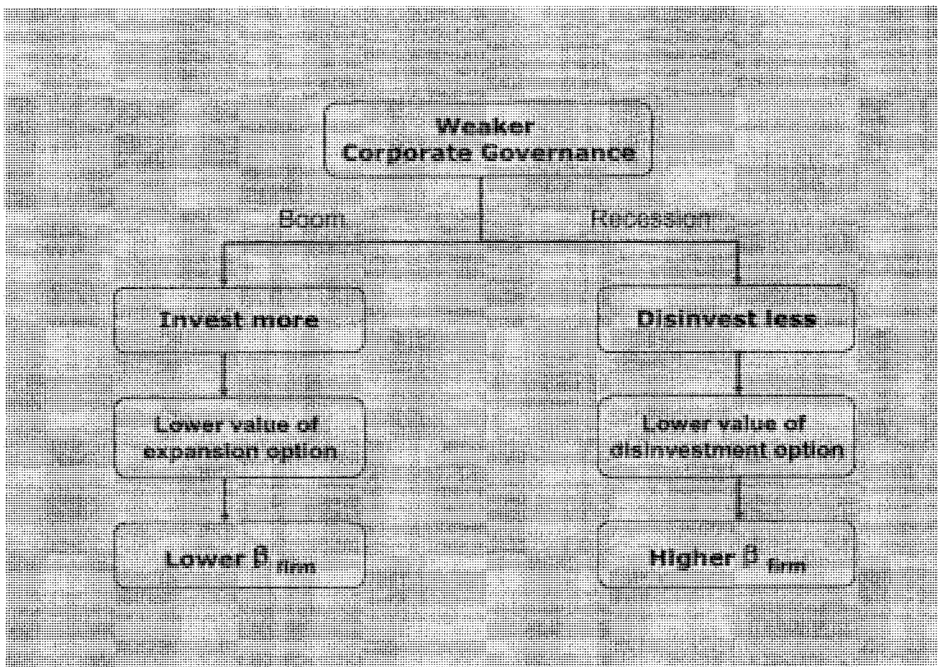
Figure 1.1: **Anatomy of Firm Value and Risk**



contrary, disinvestment options give firms options to scale down production when the productivity is low and not enough to cover the costs, they are put options and less risky than the underlying assets. Therefore, the betas of expansion options, assets in place, and disinvestment options follow an ascending order, as shown in Figure 1.1.

In booms, when the value of a firm is mainly driven by expansion options and assets in place, the firm with stronger governance derives a larger fraction of its value from the expansion options. Accordingly, such a firm is riskier and has a higher expected return. In contrast, in recessions, when the value of a firm is mainly driven by disinvestment options and assets in place, the firm with stronger governance derives a larger fraction of its value from the disinvestment options, leading to a lower expected return. This intuition is illustrated in Figure 1.2.

Figure 1.2: **Return Dynamics along Business Cycles**



Gompers, Ishii, and Metrick (2003) find that the governance portfolio, which buys firms with the strongest governance (democracy firms) and sells firms with the weakest governance (dictatorship firms), earns significantly positive abnormal returns in the 1990s. However, Core, Guay, and Rusticus (2006) finds that the abnormal returns of the governance portfolio become negative between 2000 and 2003. Because most of the 1990s were in economic booms and the period of 2000 to 2003 was in an economic recession, the model provides a coherent explanation for the observed return patterns.[1]

The model also generates implications on the affects of corporate governance on financing policies and credit spreads. It shows that firms with weaker shareholder rights rely more on debt financing and, if controlling for book assets, profitability, and book leverage, have lower credit spreads. Managers generally have greater incentives than shareholders to avoid liquidation since they will lose not only their personal holdings of the firms, but also the associated private benefits of control. The weaker the governance, the stronger the incentives of managers to keep their firms alive. Therefore, the incentives of managers are more aligned with creditors in weakly governed firms than in strongly governed firms.

Specifically, all else equal, managers of weakly governed firms overinvest during the maturity of debt. With greater capital stock, weakly governed firms have higher cash flows, hence higher chance to make the interest payment and lower probability to default. Moreover, even if bankruptcy happen, creditors

[1]Yang (2005) explicitly studies the returns of the governance portfolio during booms and recessions, using default premium, term premium, and the one-month Treasury bill short rate as proxies for business conditions. His findings confirm the predictions of this model.

of weakly governed firms can secure more assets. Effectively, weak governance mitigates the underinvestment problem of debt financing. Therefore, *ceteris paribus*, the expected value to the creditors of weakly governed firms during the maturity of debt is larger and the credit spreads are lower. This prediction is consistent with the empirical findings in both Litov (2005) and Klock, Mansi, and Maxwell (2005).

Although debt financing is cheaper for firms with weaker governance, equity financing is relatively more expensive for them because managerial expropriations and suboptimal investment policies lower the equity values of such firms, *ceteris paribus*. It is then optimal for firms with weaker governance to rely more on debt financing than on equity financing, leading to their higher leverage ratios.

I calibrate the model and solve it numerically. One contribution of this paper is a new method to solve for the debt market equilibrium in a dynamic programming framework. Instead of using the level of debt, I use the liability of a firm, defined as the principal and interest payment on debt net the interest tax shield, as a state variable and an endogenous choice variable. The approach employed decreases the dimensionality of the problem without imposing any constraint on the model setup. In addition, it avoids computationally expensive iterations on the risky bond rate, which is potentially useful for the study of dynamic capital structure.

Following the same empirical procedures in the literature, I analyze the relations between corporate governance and a firm's average Tobin's Q, investment policies, choices of external financing, and costs of debt and the relation between corporate governance and the cross section of returns using simulated panel data. The results are qualitatively, and quantitatively in some cases, consistent with the previous empirical findings.

In the second part of this thesis, I conduct two empirical tests on the predictions of the model. For both tests, I use two measures of the strength of corporate governance. The first measure is the governance index (G-index) developed by Gompers et. al. and the second measure is the entrenchment index (E-index) developed by Bebchuk, Cohen, and Ferrell (2005). Chapter 6 gives detailed description for the construction of both measures.

The first empirical test is on the procyclical returns of the governance portfolio. I identify months when economy is in good states (booms) and months when economy is in bad states (recessions) during September 1990 to December 2005, based on the expected market risk premium. I estimate the expected market risk premium using four macroeconomic indicators: default premium, term premium, dividend yield, and short term Treasury bill. In theory, the expected market risk premium is low during booms and high during recessions. Therefore, I classify booms as the months with the expected risk premiums in the lowest 20% quentile based on the historical data, and recessions as the months with the expected risk premiums in the highest 20% quentile. I then regress the returns of the governance portfolio on the market, size, value, and momentum factors, i.e., the Carhart four-factor model, for booms and recessions, respectively.

The average monthly abnormal return of the governance portfolio, i.e., the intercept of the regression, is 0.74% during booms and −0.99% during recessions with t-statistics being 1.14 and −2.27, using G-index. The average monthly abnormal returns during booms and recessions are 1.18% and −0.18% respectively with t-statistics being 2.70 and -0.70, using E-index. The results are largely consistent with the prediction of the model. The return differences of the governance portfolio between booms and recessions, 12% to 21% annually, are economically significant. The lack of statistical significance in some cases might be due to the limited sample size.

The second test focuses on the role of overinvestment in explaining the return differences between strongly and weakly governed firms. I construct two investment factors to capture the effect of overinvestment on stock returns. I then augment the Carhart four-factor model with the two investment factors, respectively, and test whether the abnormal return of the government portfolio disappears.

The first investment factor is the same as the one in Lyandres, Sun, and Zhang (2005), defined as the return difference between firms with the highest 30% investment-to-assets ratios and firms with the lowest 30% investment-to-assets ratios, controlling for size and book-to-market. The second investment factor is similar to the first one, except that the investment-to-assets ratios are subtracted by the industry means to control for industry effects. The test results from the two investment factors are nearly identical, suggesting that size and book-to-market contain most of the industry effects.

Assuming that size, book-to-market, and industry means can control for the investment opportunity sets, firms with higher investment-to-assets ratios are more likely to be overinvesting, and *vice versa*. If overinvestment indeed contributes to the abnormal returns of the Governance portfolio, we would expect that the abnormal returns disappear after introducing the investment factor to the

Carhart four-factor model. Moreover, the regression coefficient of the investment factor is expected to be negative because the model predicts that democracy firms are more likely to be in the low investment-to-assets ratio decile and dictatorship firms are more likely to be in the high investment-to-assets ratio decile.

I apply the investment augmented Carhart four-factor model to the full data sample, booms, and recessions, respectively. The loadings on the investment factor in all the cases are negative, meaning that weakly governed firms do invest more than strongly governed firms. However, not all of these loadings are significant. Specifically, investment factors have explanatory power only during economic booms. The loadings on investment factors are five to ten times larger during booms than those during recessions. The magnitudes of the abnormal returns decrease during booms for all the tests. Especially, for the governance portfolio using G-index, the annual abnormal return decreases from 9% to 1% and loses its significance. However, investment factors have no effect on the abnormal returns of the governance portfolios during recessions in all the tests. The results suggest that overinvestment crucially contributes to the return differences between strongly and weakly governed firms only during booms.

1.1 Literature Review

The literature has provided some explanations of the underperformance of dictatorship firms in the 1990s. Gompers, Ishii, and Metrick (2003) posit that investors underreact to the information embedded in corporate governance at the beginning of the 1990s. However, Core, Guay, and Rusticus (2006) find that analysts' forecast errors and earnings announcement returns show no evidence that the underperformance of badly governed firms surprises the market. Cremers, Nair, and John (2005) propose a theory explaining the underperformance of dictatorship firms in the 1990s. They argue that takeover activity proxies for a state variable in the pricing kernel that relates to the time variation in risk premium. Firms with stronger shareholder rights, hence higher exposure to takeovers, have higher exposure to this state variable and have higher risk premium. In addition to the underperformance of dictatorship firms in the 1990s, this thesis can also explain their outperformance from 2000 to 2003.

This thesis belongs to the literature that uses dynamic models to understand the dynamics of the cross section of returns (Berk, Green, and Naik (1999), Gomes, Kogan, and Zhang (2003), Carlson, Fisher, and Giammarino (2004), Zhang (2005), Li, Livdan, and Zhang (2006)) and to study corporate activities, such as capital structure choices and investment policies (Hennessy and Whited (2005), Hennessy and Whited (2006), Moyen (2004), Moyen (2006), and Strebulaev (2007)). I contribute by introducing agency conflicts between shareholders and managers and an efficient method to solve for the debt market equilibrium.

This thesis is related to the law and finance literature. Shleifer and Wolfenzon (2002), Lan and Wang (2003), Albuquerque and Wang (2007), Himmelberg, Hubbard, and Love (2006) make the same assumption about the expropriation of dispersed shareholders by managers. While these papers study the effects of investor protection at the national level on firm value, ownership structure, investment cash-flow sensitivity, expected market returns, and risk diversification, the paper focuses on the effects of the firm level difference in corporate governance within a country on the cross section of stock returns and a firm's financing choices. Durnev and Kim (2005) empirically investigates the interaction between national level legal environment and firm level governance, and how firm attributes affect the choices of corporate governance.

The rest of the thesis is organized as follows. Chapter 2 solves a simple real options model to illustrate the effects of corporate governance on expected stock returns. Chapter 3 solves and simulates a dynamic neoclassical model to study the effects of corporate governance on stock returns and firms' financing choices. Chapter 4 provides empirical evidence on the return predictions of the model. Chapter 5 concludes. Chapter 6 describes the construction of the two governance measures. Chapter 7 provides the details about how to numerically solve the dynamic model and how to generate panel data through simulations. Chapter 8 gives the proofs of the lemmas and propositions.

Chapter 2

A Simple Real Options Model

In this chapter, I use a real options model to illustrate the impacts of corporate governance on expected stock returns. Consider a firm with N units of capital that generate the amount of cash flow, Ny, in each period. N is a constant and y follows a Geometric Brownian motion

$$d\,y_t = \pi\,y_t\,d\,t + \sigma\,y_t\,d\,z_t\,,$$

where $d\,z$ is the increment of a standard Wiener process, π is the constant drift, and σ is the variance parameter. The manager of the firm is entrenched and owns α shares of the firm. The total number of shares is normalized as one. The objective function of the manager is given by

$$\max_{\{s\}} \quad \alpha(1-s)Ny + sNy - \frac{1}{2}\eta s^2 Ny,$$

where s is the fraction of gross output that the manager diverts for private benefits. The third term is the cost that the manager pays for expropriation. Following La Porta, Lopez-de Silanes, Shleifer, and Vishney (2002), I assume that this cost function is quadratic in s, implying that the marginal cost of expropriation increases as the manager diverts a larger fraction of output. The magnitude of parameter η represents the strength of shareholder protection. A higher η implies a larger marginal cost of diverting one unit of the profits and hence a better shareholder protection. The first-order condition gives us the optimal fraction to divert:

$$s^* = \frac{1-\alpha}{\eta}. \tag{2.1}$$

η is assumed to be greater than one to guarantee a nontrivial solution. The result is intuitive. The more shares the manager owns and the stronger the shareholder rights are, the fewer profits he diverts as private benefits. The amount of cash flows received by outside shareholders is thus given by

$$(1-\alpha)(1-s^*)Ny.$$

Also assume that in addition to the assets in place, the firm has an option to increase its cash flow to $(N+1)y$ by making a fixed amount of investment I. The investment costs are shared among shareholders according to their holdings of the firm.

Proposition 1 *The value of the firm V consists of the value of assets in place*

$$V_a = \frac{(1-s^*)Ny}{\mu} \tag{2.2}$$

and the value of the expansion option

$$V_e = A_1^s(\eta)\, y^{\beta_1}\,; \tag{2.3}$$

the investment threshold selected by the manager is

$$y^* = \frac{\beta_1 I \mu}{(\beta_1 - 1)\theta(\eta)}\,. \tag{2.4}$$

Define the average Tobin's Q of the firm as

$$Q = \frac{V_a + V_e}{V_a}\,, \tag{2.5}$$

then the expected return of the firm is

$$r^s = r_f + \phi\sigma\rho_{ym}\left[1 + (\beta_1 - 1)(1 - \frac{1}{Q})\right]\,. \tag{2.6}$$

Firm value V, investment threshold y^*, average Tobin's Q, and expected return r^s are lower for firms with weaker governance, ceteris paribus.

$A_1^s(\eta)$ and $\theta(\eta)$ are functions of the governance level η and given by

$$\begin{aligned}
\theta(\eta) &= 1 + \frac{(1-\alpha)^2}{2\alpha\eta} > 1 \\
A_1^s(\eta) &= \left(\frac{\beta_1\mu}{\beta_1 - 1}\right)^{-\beta_1} I^{1-\beta_1}\left[\frac{\beta_1(1-s^*)}{\beta_1 - 1}\theta(\eta)^{\beta_1 - 1} - \theta(\eta)^{\beta_1}\right].
\end{aligned}$$

r_f is the risk free rate, μ is the risk adjusted discount factor less the growth rate

of the cash flow, β_1 is a constant larger than 1, ϕ is the price of risk, and ρ_{ym} is the coefficient of correlation between cash flow y and the market portfolio. ρ_{ym} is assumed to be positive.

Proposition 1 shows that, *ceteris paribus*, firms with weaker corporate governance have a lower investment threshold. Since the cost of expansion is fixed at I, a lower threshold price implies that the project is less profitable at the time the option is being exercised. The motivation behind this sub-optimal behavior is that managers want to collect more private benefits earlier.

Managers expropriate part of the cash flows generated by assets in place and expansion options (after them being exercised). The value of expansion options is further decreased by managers' suboptimal investment decisions. Therefore, weak governance lowers the value of both assets in place and expansion options, with the latter being hurt the most. As a result, for firms with weaker governance, expansion options constitute a smaller part of the firm value, suggesting a smaller average Tobin's Q.

Proposition 1 shows that the expected return of the firm with weaker corporate governance is lower.[1] Expansion option is a call option. It is riskier than the underlying asset because it adds value only when the economic condition is good. Therefore, the expected return is lower if a smaller portion of the firm value comes from its expansion option, i.e., the firm has a smaller average Tobin's Q.

Now consider that the same firm, instead of having an option to expand, has an option to sell one unit of its installed capital at price I, reducing the cash flow

[1] Positive correlation between cash flow y and the market portfolio is a necessary condition for this result, which holds for almost all the publicly traded stocks. $beta_1$ and the price of risk ϕ are independent of individual firm's governance level η. η only affects the average Tobin's Q of the firm.

of the firm to $(N-1)y$. The proceeds are split among shareholders according to their share holdings.

Proposition 2 *The value of the firm V consists of the value of assets in place*

$$V_a = \frac{(1-s^*)Ny}{\mu} \tag{2.7}$$

and the value of the disinvestment option

$$V_d = A_2^s(\eta)\, y^{\beta_2}\,; \tag{2.8}$$

the disinvestment threshold selected by the manager is

$$y^* = \frac{-\beta_2 I \mu}{(1-\beta_2)\theta(\eta)}\,; \tag{2.9}$$

Define the average Tobin's Q of the firm as

$$Q = \frac{V_a + V_d}{V_a}\,, \tag{2.10}$$

then the expected return of the firm is given by

$$r^s = r_f + \phi\sigma\rho_{ym}\left[1 - (1-\beta_2)(1-\frac{1}{Q})\right]\,. \tag{2.11}$$

The disinvestment threshold y^* is always lower for firms with weaker governance. Firm value V, average Tobin's Q, and the expected return r^s are *lower for firms with weaker governance, under the sufficient condition that*

$$\beta_2 < -\frac{[2\alpha + (1-\alpha)s^*]^2}{s^*(1-s^*)(1-\alpha^2)}\,. \tag{2.12}$$

$A_2^s(\eta)$ is a function of the governance level η given in Chapter 8, β_2 is a negative constant, and ρ_{ym} is assumed to be positive.

Proposition 2 shows that the threshold price of disinvestment increases with the governance level η. Hence, the manager of the firm with weaker governance will keep the excess level of capital when he should disinvest, again consistent with the empire-building behavior.

Although the value of assets in place is always smaller with weaker governance due to more expropriation, the effect of governance on the value of the disinvestment option is not straightforward. The manager of the weakly governed firm disinvests sub-optimally, which lowers the value of the disinvestment option. However, this option is more likely to be in the money due to lower after-expropriation cash flows, suggesting a higher option value. Under condition (2.12), the first effect dominates the second and the value of the disinvestment option is smaller under weaker governance.

The effect of the disinvestment option on the expected return is the opposite of the expansion option. Disinvestment option is a put option. It is less risky than the underlying asset because it pays cash flows in bad states. Therefore, if a firm has a smaller fraction of its value from the disinvestment option, i.e., a lower average Tobin's Q, its expected return is lower. Proposition 2 shows that a firm with weaker governance has a lower average Tobin's Q and hence a higher expected return under condition (2.12).

To evaluate how restrictive condition (2.12) is, I need to pin down the set of parameters (α, s^*, r_f, σ, μ). Core, Holthausen, and Larker (1999) show that the mean and median of CEO percentage stock ownership are 1.5 and 0.1, respectively. I use 0.1 to 2 as the range for α. Barclay and Holderness (1989) estimate the private benefits of control from the difference between the market share of stock price and the block-purchase price. The average premium paid by the block purchasers is 4% of the firm value, and this number is likely to understate the amount of private benefits as argued by the authors. Doidge (2004) and Nenova (2003) estimate the average private benefits in the U.S at 2% and 3.7%, respectively, using the difference in the prices of shares with different voting rights. Therefore, the reasonable range for s^* is likely to be from 2% to 4%. To evaluate the value of β_2, I follow Morellec (2004) to set the risk-free rate $r_f = 0.06$ and the volatility of return $\sigma = 0.25$ to match the historical data. μ is the difference between the risk-free rate r_f and the risk-neutral growth rate of the cash flows $\pi - \phi\sigma\rho_{ym}$. To avoid bubbles,[2] the risk-neutral cash flow growth rate has to be positive and less than the risk-free rate. Therefore, the value of μ should lie between zero and r_f, from which we can find the range of β_2. Figure 2.1 shows that the right hand side of condition (2.12) ranges from -0.18 to -0.2, while the value of β_2 ranges roughly from -1 to -2. Therefore, condition (2.12) is satisfied under a wide range of reasonable parameter values.

Firms with stronger governance are empirically shown to have higher Tobin's Q than firms with weaker governance, e.g., Gompers, Ishii, and Metrick (2003).

[2] See detailed arguments in Dixit and Pindyck (1994).

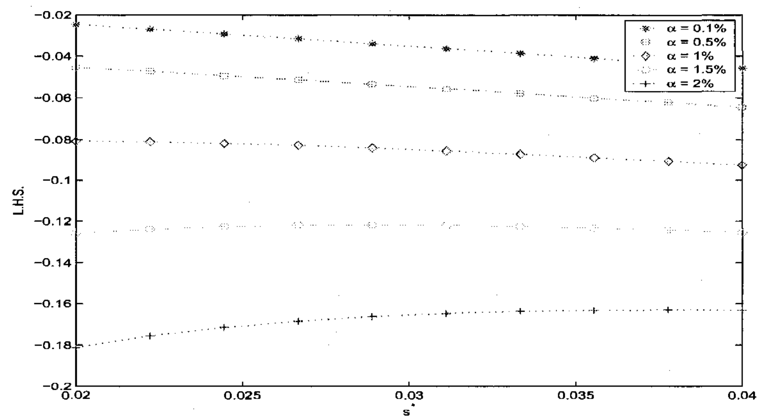
Figure 2.1: **Condition for Decreasing Relation between Expected Return and Governance During Recessions**

The figure shows under a wide range of parameter values that match the real data, how restrictive the condition

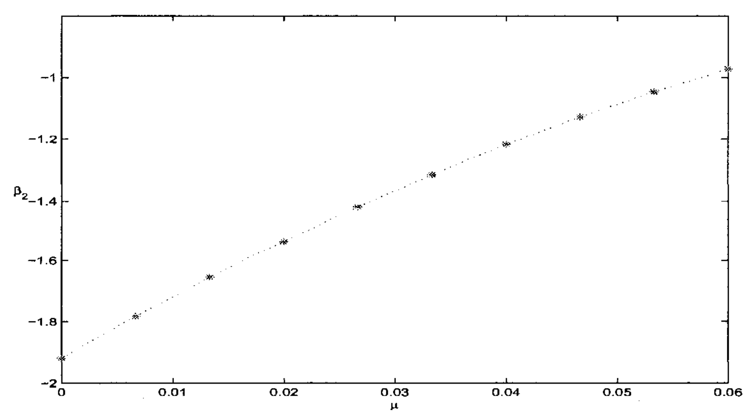
$$\beta_2 < -\frac{[2\alpha + (1-\alpha)s^*]^2}{s^*(1-s^*)(1-\alpha^2)}$$

is. Panel A plots the R.H.S. of the above condition for different combinations of managerial ownership and expropriation rate (α, s^*). Panel B plots the value of β_2 for all possible values of the discount factor μ.

Panel A



Panel B



Propositions 1 and 2 imply that the latter would earn lower expected returns in good times when the value of a firm is mainly driven by expansion options and earn higher expected returns in bad times when the value of a firm is mainly driven by disinvestment options. Gompers, Ishii, and Metrick (2003) find that democracy firms outperform dictatorship firms during the 1990s, while Core, Guay, and Rusticus (2006) show that the relation is reversed during 2000 to 2003. Because most of the 1990s were in booms and the economy entered recession after 2000, this model provides an overinvestment-based economic mechanism for the aforementioned evidence.

Chapter 3

Dynamic Model

In this chapter, I investigate the quantitative importance of the proposed economic mechanism. The real options model has an analytical solution, which is useful for illustrating the basic intuition. However, to match the empirical data, the model needs more realistic ingredients, e.g., a capital structure and a stationary process for the productivity shocks to study firm's investment, financing, and stock returns over business cycles. The neoclassical dynamic model is specially suitable to carry out the quantitative analysis of a complex economic environment. In this chapter, I set up a dynamic model to study a levered firm with managerial entrenchment in a stationary economy. I show in chapter 3.5 that the real options model and the dynamic model are fundamentally similar and the results are driven by the same economic mechanisms.

The model is in discrete time. The time line of the activities of a levered firm is as follows. At the beginning of date t, firm j engages in production using capital stock k_{jt} as the sole input and learns about the aggregate productivity shock x_t and its idiosyncratic productivity shock z_{jt}. At the end of period t, firm j invests i_{jt} in capital and issues new debt or retires (part of) the existing debt to generate a new debt level d_{t+1}. The investment and financing decisions are made before the firm learns about the values of both the aggregate and idiosyncratic productivity shocks at date $t+1$. The positive net cash flows after investment and financing activities are distributed to shareholders, and negative net cash flows are regarded as equity issuance. To simplify the model, I assume that the manager's ownership of the firm, α, and the strength of the firm's corporate governance, η, are chosen independently and stay unchanged over time. I justify this assumption in section 3.4.5.

3.1 Economic Environment

The production function of firm j at date t is given by

$$y_{jt} = e^{x_t + z_{jt}} k_{jt}^{\gamma}, \tag{3.1}$$

where y_{jt} is the operating profits. γ is between 0 and 1 so that the production exhibits decreasing return to scale with respect to capital stock. The aggregate shock, x_t, has a stationary and monotone Markov transition function, $Q_x(x_{t+1}|x_t)$, and is given by:

$$x_{t+1} = \overline{x}\left(1 - \rho_x\right) + \rho_x x_t + \sigma_x \varepsilon_{t+1}^{x}, \tag{3.2}$$

where $\overline{x}$ is the long-run average, ρ_x is the level of persistence, and ε_{t+1}^{x} is an i.i.d. standard normal variable. The aggregate shock is the unique source of systematic risk.

In the model, the firm-specific shock is the unique source of firm heterogeneity. The firm-specific shock, z_{jt}, is uncorrelated across firms and has a common stationary and monotone Markov transition function, $Q_z(z_{jt+1}|z_{jt})$, given by:

$$z_{jt+1} = \rho_z z_{jt} + \sigma_z \varepsilon^z_{jt+1}, \tag{3.3}$$

where ρ_z is the autocorrelation coefficient and ε^z_{jt+1} is an i.i.d. standard normal variable. ε^z_{jt+1} and ε^z_{it+1} are uncorrelated for any pair (i, j) with $i \neq j$. Moreover, ε^x_{t+1} is independent of ε^z_{jt+1} for all j.

Following Berk, Green, and Naik (1999) and Zhang (2005), I parameterize directly the stochastic discount factor M_{t+1} and assume that

$$\log M_{t+1} = \log \beta + \gamma_t (x_t - x_{t+1}) \, ; \tag{3.4}$$

$$\gamma_t = \gamma_0 + \gamma_1 (x_t - \overline{x}) \, , \tag{3.5}$$

where $1 > \beta > 0$, $\gamma_0 > 0$, and $\gamma_1 < 0$ are constant parameters. The dynamics of γ_t are introduced to capture the time-varying price of risk.

Since I study the behavior of a representative firm, the index j will be dropped when no confusion is caused to simplify notations. Each period, the manager makes decisions on the investment and financing policies. On the investment side, the capital accumulation follows:

$$k_{t+1} = i_t + (1 - \delta) k_t \, , \tag{3.6}$$

where δ is the rate of capital depreciation. Investment also incurs quadratic adjustment costs, defined as

$$C_a(i,k) = \frac{g}{2}\left(\frac{i}{k}\right)^2 k\,, \tag{3.7}$$

where g is a positive constant.

3.2 Defaultable Debt

I assume that firms issue one-period defaultable debt that can be rolled over each period. Denote d_{t+1} as the face value of the debt issued at the end of date t, r_{t+1} as the interest rate on the newly issued debt d_{t+1}, R_{t+1} as the residual value to the creditors if the firm goes bankrupt, E_{t+1} as the equity value of the firm at date $t+1$, and $\mathbf{1}_{E_{t+1}>0}$ as the indicator that equals one if the firm is solvent at date $t+1$ and equals zero otherwise. Under the assumption of perfect competition in the banking industry, the price of the debt is determined by the fair-pricing equation:

$$d_{t+1} = \mathbb{E}_t\left[M_{t+1}\left\{(1+r_{t+1})d_{t+1}\mathbf{1}_{E_{t+1}>0} + R_{t+1}(1-\mathbf{1}_{E_{t+1}>0})\right\}\right]\,, \tag{3.8}$$

Based on the evidence in Warner (1977), I assume that there are fixed bankruptcy costs, ξ_0, and variable bankruptcy costs, which are $1-\xi_1$ shares of the assets of the firm. Therefore, the residual value for creditors in bankruptcy is written as

$$R_{t+1}(k_{t+1}, x_{t+1}, z_{t+1}) = (1-\tau_c)(y_{t+1}-f) + \tau_c\delta k_{t+1} + \xi_1(1-\delta)k_{t+1} - \xi_0\,, \tag{3.9}$$

where τ_c is the corporate tax rate and f refers to the fixed operating costs. Under the absolute priority rule, shareholders get nothing if the firm goes bankrupt.

For the manager to choose the optimal capital stock k^*_{t+1} and the optimal debt d^*_{t+1}, the interest rate r_{t+1} has to be solved for any given values of d_{t+1} and k_{t+1}, using the fair-pricing equation (3.8). However, r_{t+1} cannot be expressed as an explicit function of d_{t+1} and k_{t+1} because the indicator $\mathbf{1}_{E_{t+1}>0}$ depends on the values of r_{t+1}, d_{t+1}, and k_{t+1}. There are two existing methods used to solve for the interest rate r_{t+1} in the literature. Hennessy and Whited (2006) use an iteration method. They introduce a novel way to decrease the dimension of the state space. However, their method is not applicable for models with investment adjustment costs. Moyen (2006) uses the projection method to solve Eq. (3.8) together with the Euler equations. This method requires a good initial guess of the solution and a differentiable value function. Due to the existence of the equity issuance costs, the equity value of the firm and the objective function of the manager are not differentiable in the model. Therefore, I introduce a new method to solve for the debt market equilibrium.

Instead of using the debt level d_{t+1}, the capital level k_{t+1}, and the interest rate of the debt r_{t+1} as the state variables and using the first two variables as the policy variables, I use firm's total liability, l_{t+1}, defined as

$$l_{t+1} = d_{t+1} + (1 - \tau_c) r_{t+1} d_{t+1} \,, \tag{3.10}$$

and capital level k_{t+1} as both state variables and control variables. The benefits are twofold. The first benefit is that we can decrease the number of state variables by one. The fact that the cash flows of the firm only depend on the total liability, instead of the debt principal and the interest payment separately, guarantees that we have enough state variables to pin down the value of the firm. The second benefit is that we do not need to solve Eq. (3.8) to get the interest rate of debt, which is computationally expensive. Instead, we can write the value of debt d_{t+1} as an explicit function of the liability l_{t+1} and the capital stock k_{t+1}. To see how it works, I first define the sum of principal and interest payment for the creditors if the firm is solvent at date $t+1$ as

$$p_{t+1} = d_{t+1}(1 + r_{t+1})\,. \tag{3.11}$$

The relation between the liability l_{t+1} and the debt repayment p_{t+1} is given by

$$\begin{aligned} l_{t+1} &= [1 + r_{t+1}(1 - \tau_c)]d_{t+1} \\ &= \left[1 + \left(\frac{p_{t+1}}{d_{t+1}} - 1\right)(1 - \tau_c)\right] d_{t+1} \\ &= p_{t+1}(1 - \tau_c) + \tau_c d_{t+1}\,. \end{aligned} \tag{3.12}$$

I then rewrite the total payment from a solvent firm to the creditors as a function of the liability l_{t+1} and the debt principal d_{t+1},

$$p_{t+1} = \frac{l_{t+1}}{1 - \tau_c} - \frac{\tau_c}{1 - \tau_c} d_{t+1}\,. \tag{3.13}$$

Substitute p_{t+1} into equation (3.8) and rearrange to get

$$d_{t+1} = \frac{\mathbb{E}_t\left[M_{t+1}\left\{\frac{l_{t+1}}{1-\tau_c}\mathbf{1}_{E_{t+1}>0} + R_{t+1}(1-\mathbf{1}_{E_{t+1}>0})\right\}\right]}{1+\frac{\tau_c}{1-\tau_c}\mathbb{E}_t[M_{t+1}\mathbf{1}_{E_{t+1}>0}]} \equiv \mathbb{D}(l_{t+1}, k_{t+1}, x_t, z_t)\,. \tag{3.14}$$

Notice that the indictor of solvency $\mathbf{1}_{E_{t+1}>0}$ does not involve the value of d_{t+1} because the firm value at date $t+1$ only depends on the state variables $(l_{t+1}, k_{t+1}, x_{t+1}, z_{t+1})$. Therefore, the iteration method can be avoided. The new debt level can be easily calculated given the choices of next period's liability and capital stock. Once we know the value of the debt principal d_{t+1}, the value of the credit spread is easily calculated by

$$\Delta_{t+1} \equiv \frac{p_{t+1}}{d_{t+1}} - r_{ft+1} = \frac{l_{t+1}/d_{t+1} - 1}{1-\tau_c} - r_{ft+1}\,, \tag{3.15}$$

where r_{ft+1} is the risk-free rate from date t to $t+1$.

The amount of debt that a firm can borrow has an inverse U-shape relation with the level of liability, *ceteris paribus*. As the liability goes up, the amount of debt issuance increases because creditors get a higher payment if the firm is solvent at the maturity date. However, the probability of bankruptcy also goes up. If bankruptcy happens, creditors get paid less, thus reducing the amount of debt that the firm can raise. When the liability is low and the first effect dominates, debt issuance increases with the liability. As the liability gets large enough and the second effect starts to dominate, debt issuance decreases. Value maximizing means that the optimal liability is chosen from the increasing regime of the relation between debt issuance and liability.

The amount of debt that a firm can borrow monotonically increases with its capital stock, *ceteris paribus.* Larger capital stock leads to more profits, a lower probability of bankruptcy, and a higher residual value for creditors in bankruptcy. Both effects raise the amount of debt that the firm can borrow given the level of liability.

Finally, the amount of debt that a firm can raise increases with the strength of its corporate governance, given the liability l_{t+1} and capital stock k_{t+1}. With a stronger governance, the manager expropriates less and makes investment and financing decisions closer to the first best ones that maximize the equity value of the firm. Consequently, the firm has a higher equity value and a lower probability of bankruptcy at date $t+1$. The debt level d_{t+1} is therefore higher. Lemma 1 summarizes these results.

Lemma 1 *The amount of debt d_{t+1} that a firm can borrow at date t: (1) has an inverse U-shape relation with the liability l_{t+1} associated with the debt, due at date $t+1$; (2) increases monotonically with the capital stock k_{t+1} at date $t+1$; (3) increases monotonically with the strength of the corporate governance, ceteris paribus.*

The third prediction of Lemma 1 is not necessarily inconsistent with the findings in Klock, Mansi, and Maxwell (2005), who show that credit spreads are lower for firms with weaker shareholder rights, controlling for the value of book assets, profitability, and the value of book leverage. The credit spreads would be higher for weakly governed firms if, in the empirical study, one controls for the value of book assets at the maturity date of the debt. However, one can only control for the value of book assets at the time that the debt is issued or before the debt maturity date, although the price of the debt depends on the capital stock at the maturity date. I show later that weakly governed firms tend to overinvest and hence have larger values of assets in the future, *ceteris paribus.* This indirect effect of corporate governance raises the value of the debt as implied by the second prediction of Lemma 1.

3.3 Financing Costs

I assume that equity financing incurs both fixed costs and variable costs:

$$C_e(\pi) = [\lambda_0 + \lambda_1(-\pi)] \, \mathbf{1}_{\pi<0} \, , \tag{3.16}$$

where λ_0 and λ_1 are constants, $-\pi$ is the negative dividend, i.e., the amount of external equity issuance, and $\mathbf{1}_{\pi<0}$ is an indicator that equals one when the firm raises equity and equals zero otherwise. Hennessy and Whited (2006) estimate the cost function with an extra quadratic term and find that the coefficient of this term is small and insignificant.

Following Hennessy and Whited (2006), I assume no flotation cost of issuing debt. It is widely documented that the costs of issuing debt are much smaller than the costs of issuing equity. The choice between equity and debt financing depends on the difference in issuing costs. Although ignoring the flotation costs for debt can affect the frequency of debt issuance, it does not alter the capital structure of the firm if the calibrated flotation costs of equity reflects the difference between the costs of equity and debt financing.

3.4 Optimal Policies

In this section, I formulate the manager's decision problem. In the first best situation with no managerial expropriation, the manager of the firm maximizes the value of the shareholders. The net cash flow of the firm is then given by

$$\pi_t^{FB} = (1-\tau_c)(y_t - f) + \tau_c \delta k_t - l_t - i_t - C_a(i_t, k_t) + d_{t+1}\,. \tag{3.17}$$

The first-best equity value of the firm can be calculated through the iteration of the following Bellman equation:

$$\begin{aligned} E^{FB}(l_t, k_t, x_t, z_t) &= \Big[\max_{\{l_{t+1}, k_{t+1}\}} \{\pi_t^{FB} - C_e(\pi_t) + \\ &\quad \mathbb{E}_t[M_{t+1} E^{FB}(l_{t+1}, k_{t+1}, x_{t+1}, z_{t+1})]\}\Big]^+ \,, \end{aligned} \tag{3.18}$$

where the value of investment follows the capital accumulation equation (3.6) and the value of debt is given by the fair pricing equation (3.14).

As in chapter 2, I assume that the entrenched manager can extract private benefits at a cost. The amount of the private benefits depends on the size of the firm, and the cost depends on the strength of the corporate governance. Assume that the manager extracts a fraction s of the gross output and bears a cost that is quadratic in s and linear in the output and the strength of corporate governance η. Moreover, the manager owns α shares of the firm. The per share cash flows to outside shareholders are given by

$$\pi_t^s = (1-\tau_c)[(1-s_t)y_t - f] + \tau_c \delta k_t - l_t - i_t - C_a(i_t, k_t) + d_{t+1}\,. \tag{3.19}$$

In addition to the cash flow π_t^s, the manager also gets the private benefits. The per share cash flows to the manager are given by

$$\pi_t^m = \pi_t^s + \left(\frac{s_t - \frac{\eta}{2} s_t^2}{\alpha} \right) y_t \,, \tag{3.20}$$

where the second term in equation (3.20) refers to the private benefits.

In the model, the manager has decision rights over investment and financing policies, while shareholders decide when to default. And the manager can not extract private benefits should bankruptcy happen. Following Morellec (2004) and Hennessy and Whited (2006), I assume that shareholders default when the value of equity is zero. Define the value function of the manager as $V(l_t, k_t, x_t, z_t)$. The maximization problem faced by the manager can thus be written as:

$$\begin{aligned} V(l_t, k_t, x_t, z_t) &= \max_{\{l_{t+1}, k_{t+1}, s_t\}} \{ \pi_t^m - C_e(\pi_t^s) + \\ & \quad \mathbb{E}_t[M_{t+1} V(l_{t+1}, k_{t+1}, x_{t+1}, z_{t+1}) \mathbf{1}_{E_{t+1}>0}] \} \end{aligned} \tag{3.21}$$

subject to the capital accumulation constraint equation (3.6) and the fair pricing constraint of debt equation (3.14). The investment decision and financing decision are chosen by the manager along with the expropriation rate to maximize the present value of all his future cash flows. The indicator of solvency $\mathbf{1}_{t+1}$ depends on the equity value of the firm, which is given by

$$\begin{aligned} E(l_t, k_t, x_t, z_t \mid l_{t+1}^*, k_{t+1}^*) &= [\mathbb{E}_t[M_{t+1} E(l_{t+1}^*, k_{t+1}^*, x_{t+1}, z_{t+1} \mid l_{t+2}^*, k_{t+2}^*)] + \\ & \quad \pi_t^s - C_e(\pi_t^s)]^+ \,, \end{aligned} \tag{3.22}$$

where l^* and k^* are the optimal choices of the investment and financing policies made by the manager.

Next, I study the decision problem faced by the manager and study the optimal expropriation, investment, and financing decisions. Because the external equity financing incurs fixed cost, the value function of the manager is not differentiable at the point where the firm switches from dividend-paying regime to equity-issuing regime. However, for the purpose of demonstrating the economic forces behind the manager's decisions, I assume an interior solution of the manager's decision problem and study the Euler equations for expropriation, investment, and financing, respectively.

3.4.1 Optimal Expropriation

The Euler equation with respect to the expropriation ratio s_t is given by:

$$\alpha(1 + \lambda_1 \mathbf{1}_{\pi_t < 0})(1 - \tau_c)y_t + \eta s_t y_t = y_t \, . \tag{3.23}$$

The left hand side of the equation is the marginal cost of expropriation and the right hand side is the marginal benefit. The first term in the left hand side is the loss in the dividend payout received by the manager as a shareholder. The lower is the managerial ownership α, the lower is the loss. $\mathbf{1}_{\pi_t<0}$ is the indicator for equity financing, which equals one when the firm raises equity and zero when the firm pays out dividends. Expropriation reduces the internally generated funds and increases the need for costly external financing. Therefore, when the firm is financially constrained, expropriation is more costly, indicated by the λ_1 term. This result captures the benefit of debt in controlling for the "free cash flow" problem in Jensen (1986). Debt repayment reduces the amount of internal funds and hence suppresses the expropriation. However, due to the availability of external funds, this benefit of debt is limited.

The second term in the left hand side is the cost of expropriation imposed by the corporate governance. The stronger the governance or the higher the value of η, the higher the cost of expropriation. The right hand side of the Euler equation is the marginal benefit of expropriation. Proposition 3 formulates the optimal expropriation ratio and summarizes the results.

Proposition 3 *The optimal expropriation rate is given by*

$$s_t^* = \frac{1 - (1 + \lambda_1 \mathbf{1}_{\pi_t < 0})(1 - \tau_c)\alpha}{\eta}. \tag{3.24}$$

s_t^* decreases as η increases, i.e., as the corporate governance of the firm becomes stronger; s_t^* is smaller when the firm is financially constrained, i.e., when the net cash flow π_t is negative.

Proposition 3 shows that the interior solutions of the optimal expropriation rate are independent of the investment and financing decisions. However, as noted, the value function of the manager is not differentiable at the point where the firm switches from dividend-paying regime to equity-issuing regime. The expropriation rate at this point, defined as $\tilde{s}_t$, does depend on the investment and financing decisions and satisfies the following equality:

$$\pi_t^s(\tilde{s}_t) = (1 - \tau_c)[(1 - \tilde{s}_t)y_t - f] + \tau_c \delta k_t - l_t - i_t - C_a(i_t, k_t) + d_{t+1} = 0\,.$$

The appendix 8 gives the relation between s_t^* and $\tilde{s}_t$.

3.4.2 Optimal Investment

In this section, I study the interior solution for the optimal investment. The Euler equation for investment is:

$$\begin{aligned}&\left[1 + g\frac{k_{t+1}^* - (1-\delta)k_t}{k_t}\right](1 + \lambda_1 \mathbf{1}_{\pi_t<0}) = \frac{\partial d_{t+1}}{\partial k_{t+1}}(1 + \lambda_1 \mathbf{1}_{\pi_t<0}) \\ &+\mathbb{E}_t\left[M_{t+1}V_k(l_{t+1}, k_{t+1}^*, x_{t+1}, z_{t+1})\mathbf{1}_{E_{t+1}>0}\right]\end{aligned} \tag{3.25}$$

where V_k is the partial derivative of the value function with respect to the capital stock and k_{t+1}^* is the optimal capital stock associated with the optimal investment decision. Envelope Theorem implies:

$$\begin{aligned}V_k &= \left[\theta_t(1-\tau_c)e^{x_{t+1}+z_{t+1}}\gamma k_{t+1}^{\gamma-1} + \tau_c\delta + (1-\delta) + \frac{g}{2}\left(\frac{k_{t+2}^2}{k_{t+1}^2} - (1-\delta)^2\right)\right] \\ &\quad (1 + \lambda_1 \mathbf{1}_{\pi_{t+1}<0})\end{aligned} \tag{3.26}$$

where

$$\theta_{t+1} = 1 + \left[\frac{s_{t+1}^* - \eta s_{t+1}^{*2}/2}{\alpha(1-\tau_c)(1 + \lambda_1 \mathbf{1}_{\pi_{t+1}<0})} - s_{t+1}^*\right]. \tag{3.27}$$

The marginal costs of investment, i.e., the left hand side of the equation (3.25), include the costs of purchasing the capital and the costs of adjusting the capital level, represented by the first and the second term, respectively. The price of capital is always one in the model. The marginal adjustment costs decrease with the current level of capital. Investment is more costly if financed by external funds due to the costs of equity issuance, which are given by the λ_1 term.

The right hand side of the equation (3.25) represents the marginal benefits of investment. The first term captures the marginal increase in debt capacity due to higher capital level, implied by Lemma 1. The increase in debt is more valuable if the firm is financially constrained, represented by the extra λ_1 term. The second part of the marginal benefits come from the increase in the expected future value of the firm. With a larger capital stock at date $t+1$, the firm has: (1) higher output, denoted by the first term in the bracket of equation (3.26); (2) higher amount of tax shield from depreciation, denoted by the second term; (3) larger capital stock after depreciation, denoted by the third term, which leads to less investment at date $t+1$; (4) lower adjustment cost at date $t+1$, denoted by the third term. The aforementioned benefits of a larger capital stock increase the internally generated funds and are more valuable if the firm is expected to be financially constrained at date $t+1$, denoted by the λ_1 term in equation (3.26).

Note that the coefficient θ_{t+1} would be one in the first best case when there is no expropriation. Chapter 8 shows that θ_{t+1} is larger than one with nonzero expropriation and decreases with the strength of the corporate governance. The intuition seems clear. Weak governance allows the manager to expropriate a larger fraction of the output. Therefore, investment generates larger benefits to the manager of the firm under weaker governance, giving him a greater incentive to invest.

To summarize, corporate governance affects the marginal benefits of investment through three channels. Under weaker governance, (1) an increase in capital stock brings more private benefits to the managers; (2) firms are more likely to be financially constrained at date $t+1$, in which case the marginal benefits of investment are larger; (3) firms are more likely to be financially constrained at date t, in which case the marginal costs of investment are higher, *ceteris paribus.* The first two channels raise the incentive to invest and the third channel reduces the incentive. The total effect of governance on investment is thus ambiguous. Most of the empirical work uses the profitability at date t as a control variable. It is useful to look at two firms that are either both financially constrained or both unconstrained at date t. Under such circumstances, only the first two channels are relevant. Proposition 4 summarizes the results.

Proposition 4 *For firms in the same financial regime (financially constrained or unconstrained), investment-to-assets ratio decreases with the strength of corporate governance, ceteris paribus.*

The level of the current liability affects the choice of investment through both direct and indirect channels. The repayment of the liability makes the firm more likely to be financially constrained, raising the costs of financing. The indirect channel works through the new issuance of debt. The next section shows that the optimal choice of liability for the next period increases with the current liability. Higher liability makes the firm more prone to bankruptcy, which drives the future benefits of investment for shareholders (the second term in the right hand side of the Euler equation) down to zero. In summary, the existence of liability lowers investment both directly and indirectly.

Notice that the conflict between shareholders and creditors is absent in the model because investment and financing decisions are made simultaneously. The suppressive effect of debt on investment is not the underinvestment problem of debt in Myers (1977), where investment decision is made after the money is borrowed. The negative effect of debt on investment in this setting is less severe because the manager takes into account the beneficial effect of investment on the costs of the debt.[1]

3.4.3 Optimal Financing

In this section, I study the interior solution for the optimal financing choices. The Euler equation with respect to liability l_{t+1} is:

$$\frac{\partial d_{t+1}}{\partial l_{t+1}}(1+\lambda_1 \mathbf{1}_{\pi_t<0}) = -\mathbb{E}_t\left[M_{t+1}V_l(l^*_{t+1}, k_{t+1}, x_{t+1}, z_{t+1})\mathbf{1}_{E_{t+1}>0}\right], \tag{3.28}$$

where l^*_{t+1} is the optimal liability level chosen by the manager and V_l is the derivative of the value function with respect to liability, given by

$$V_l = -(1+\lambda_1 \mathbf{1}_{\pi_{t+1}<0}). \tag{3.29}$$

The left hand side of the Euler equation (3.28) refers to the marginal benefits of liability. By promising a higher payment to the creditors at date $t+1$, the firm is able to issue more debt at date t. However, as indicated in Lemma 1, the increase in debt level from taking on one more unit of liability diminishes as the probability of bankruptcy gets larger. The right hand side of the Euler equation is the present value of the marginal costs of repaying debt at date $t+1$.

Firms tend to issue more debt when the current liability is higher, *ceteris paribus.* Debt is more valuable when substituted for the more expensive equity

[1]The same argument is made in Hennessy and Whited (2006) for a similar model set-up.

financing, captured by the λ_1 term in equation (3.28). With higher current liability, the firm is more likely to be financially constrained and therefore issues more debt.

The effect of capital stock on debt issuance is ambiguous. On the one hand, larger capital stock generates more internal funds and alleviates the firm's external financing needs, including both equity and debt. On the other hand, with higher capital stocks, firms are able to borrow more debt without incurring bankruptcy or borrow the same amount of debt at a lower price, making debt financing more desirable. Moreover, the existence of fixed bankruptcy costs makes debt financing less costly for firms with larger capital stock. The total effect of capital on debt issuance is thus unclear.

The direct effect of governance on debt issuance is also ambiguous as well. Due to the lower profitability and higher investment, firms with weaker governance are more likely to be financially constrained both at date t and at date $t+1$. Weaker governance thus raises both the marginal benefits and the marginal costs of liability. Consequently, the combined direct effect of governance on the choice of liability is ambiguous and likely to be weak.

The tax benefit of interest payment is seemingly absent in the Euler equation (3.28) due to the unusual choice of liability as a state variable instead of the debt principal. The tax benefit of debt is implicitly embedded in equation (3.14). Given the level of liability, higher tax rate leads to larger amount of debt firms can borrow. Moreover, the proof of Lemma 1 shows that the marginal benefits of the liability, are increasing in the level of the tax rate.

3.4.4 Credit Spread

In this section, I study whether the costs of debt are lower for firms with weaker governance, given the value of book assets, profitability, and the value of book leverage (Klock, Mansi, and Maxwell (2005)). Within the model, the question becomes for two firms with the same capital k_t, profit π_t^s, and current debt level d_{t+1}, but different expropriation rate s_t, which one has a higher credit spread. From equation (3.15) in Section 3.2, the credit spread only depends on the ratio of liability l_{t+1} to debt principal d_{t+1}. Dividing both sides of equation (3.14) by d_{t+1}, one obtains

$$1 = \frac{\mathbb{E}_t[M_{t+1}\mathbf{1}_{E_{t+1}>0}]}{1-\tau_c+\tau_c\mathbb{E}_t[M_{t+1}\mathbf{1}_{E_{t+1}>0}]}\left(\frac{l_{t+1}}{d_{t+1}}\right) + \frac{\mathbb{E}_t\left[M_{t+1}\left\{R_{t+1}(1-\mathbf{1}_{E_{t+1}>0})/d_{t+1}\right\}\right]}{1+\frac{\tau_c}{1-\tau_c}\mathbb{E}_t[M_{t+1}\mathbf{1}_{E_{t+1}>0}]}. \tag{3.30}$$

Rearrange terms and get

$$\frac{l_{t+1}}{d_{t+1}} = \frac{1-\tau_c}{\mathbb{E}_t[M_{t+1}\mathbf{1}_{E_{t+1}>0}]} + \tau_c - \frac{(1-\tau_c)\mathbb{E}_t\left[M_{t+1}\left\{R_{t+1}(1-\mathbf{1}_{E_{t+1}>0})/d_{t+1}\right\}\right]}{\mathbb{E}_t[M_{t+1}\mathbf{1}_{E_{t+1}>0}]}. \tag{3.31}$$

Suppose firm 1 has weaker governance than firm 2 does. Proposition 4 implies that the capital level at date $t+1$ is higher for firm 1. By the definition of R_{t+1}, the residual value to the creditors at the time of bankruptcy is thus higher, leading to a lower credit spread. The other factor that affects the credit spread is the default probability, determined by the indicator of solvency $\mathbf{1}_{E_{t+1}>0}$. However, the effect of governance on default probability is ambiguous here. On the one hand, weak governance lowers the value of firm 1 and raises its default probability. On the other hand, to have the same profitability, firm 1 must have a higher idiosyncratic productivity shock at date t. Because the productivity shocks are positively correlated, firm 1 will on average be more productive at date $t+1$, leading to a lower default probability and a larger residual value to creditors in bankruptcy. The higher level of capital stock further lowers the default probability. Therefore, the effect of governance on the default probability in this case is unclear and likely to be weak.

3.4.5 Discussion

Due to the complexity of the model, there is no analytical solution to the model. I thus solve the model numerically and conduct quantitative experiments. In the numerical solution, I fix the managerial ownership α and the strength of corporate governance η for each firm, assuming that α and η are chosen independently and stay unchanged over time. There are two potential concerns with this model setup. First, η and α can change over time. Second, the choice of η and α is likely to be endogenous and correlated.

For the first concern, La Porta et al. (2002) and Holderness and Sheehan (1988) document that the ownership patterns of large shareholders, both inside and outside the United States, are extremely stable. Both Gompers, Ishii, and Metrick (2003) and Philippon (2004) document that corporate governance level is very stable for individual firms. Moreover, the focus of this paper is the effect of corporate governance on a firm's investment and financing decisions. Both activities happen in a much higher frequency than the change in corporate governance. Even if η and α do change, the prediction of the model would still be valid as long as investment decision is the consequence but not the cause of the changes. Richardson (2005) finds little evidence that governance mechanisms are designed in response to overinvestment-related agency costs. Instead, he finds strong evidence that strong governance mitigates overinvestment.

The second concern is that outside shareholders may grant managers more equity shares to offset the weaker corporate governance, which is the incentive substitution hypothesis. Under this hypothesis, the prediction of the model will become ambiguous because a higher managerial ownership α and a weaker governance (lower η) have opposite effects on the manager's investment decisions. However, an entrenched manager can influence his compensation package in his favor and choose to have a compensation package less sensitive to the stock price fluctuation, which is the managerial entrenchment hypothesis. If the latter is true on average, the results from my model can be reinforced and we can safely ignore the correlation between managerial ownership and corporate governance. Fahlenbrach (2003) tests the above two hypotheses and his empirical evidence supports the managerial entrenchment hypothesis. He finds that CEOs of firms with weaker shareholder rights receive higher total compensation, higher annual increase in compensation, and have smaller fractional ownership. In addition, Ofek and Yermack (2000) show that managers often negate the increased equity compensation by selling previously owned stocks. It implies that managerial ownership is not fully under the control of shareholders and is heavily influenced by managers. Based on the evidence, it seems reasonable to assume that both the strength of corporate governance η and managerial ownership α are stable over time and are chosen independently.

3.5 Connection between the Real Options Model and the Neoclassical Model

Before moving on to the solution of the model, I first discuss the connection between the real options model and the neoclassical model. I show that the prediction on return dynamics derived in Section 2 is still valid in the neoclassical model.

The value of growth options in the real options model can be calculated separately from the value of assets in place. On the contrary, in the neoclassical model, the Bellman equation, e.g., equation (3.18), only gives the total value of the firm. Nevertheless, the idea illustrated using the real options model can be carried over in the neoclassical model. Suppose that a firm is only allowed to operate at a fixed level of capital stock and there is no investment.[2] We define the value of the firm with the investment constraint as the value of assets in place. However, this zero-investment policy is rarely optimal. Alternatively, a firm can change its capital stock each period to maximize the total firm value. The incremental value due to the flexible investment policies corresponds to the value of growth options in the real options model. Although named as "growth" options, the incremental value is derived from the flexibility of both investment and disinvestment.

Despite the absence of an analytical solution, the economic intuition about how investment decisions affect stock returns is the same for the neoclassical model. Firms tend to invest when the aggregate productivity shock is high

[2] Assume zero depreciation for simplicity for the moment. Nonzero depreciation does not change the economic intuitions.

(economic boom), and disinvest when the aggregate productivity shock is low (economic recession). Adding values in booms makes the value of the firm covary more with the market, and the expected return is higher with the flexibility to invest. On the contrary, adding values in recessions makes the value of the firm covary less with the market, and the expected return is lower with the flexibility to disinvest. The same conclusion can thus be reached from the neoclassical model that the option to invest during booms raises risk and the option to disinvest during recessions lowers risk. In summary, both models capture the same economic fundamentals that determine risk.

3.6 The Model Solution

The model is solved numerically. Adding capital structure to the model increases both the degree of the state space and the number of the endogenous control variables. As a consequence, the computation time increases exponentially and the traditional value function iteration method is not applicable. To solve the problem, I use the Evolutionary Programming (EP), which belongs to the family of population-based metaheuristic optimization algorithms. Gomme (1997) and Allen and Karjalainen (1999) are the early applications in economics and finance. Chapter 7 provides detailed description of the algorithm. In this section, I describe the calibration of the model and the properties of the model solution.

3.6.1 Calibration

To solve the model, I need to calibrate 14 parameters (γ, $\bar{x}$, ρ_x, σ_x, ρ_z, σ_z, δ, β, g, γ_0, γ_1, f, α, ξ_0, ξ_1, λ_0, λ_1). All parameters are calibrated in monthly frequency. (γ, ρ_x, σ_x, ρ_z, σ_z, δ) are standard technology parameters and I take their values directly from the literature. Following Zhang (2005), the adjustment cost parameter g is chosen to match the average estimates in the investment literature. (β, γ_0, γ_1) are calibrated to match the mean and volatility of the real interest rate and the average Sharpe Ratio.[3] The long-run average level of the aggregate productivity $\bar{x}$ is purely a scaling variable. I choose its numerical value to be -3.3134 such that the long-run average of a unlevered firm's asset value is approximately one. The corporate tax rate is fixed at $\tau_c = 35\%$. Hennessy and Whited (2005) show that 90.1% of the firms in the 2001 COMPUSTAT sample had income high enough to qualify them for the marginal tax rate 34% or higher.

The fixed equity issuance cost λ_0 is calibrated at 10^{-4} so that the ratio of the fixed cost to the mean level of proceeds from equity issuance is around 0.3%. The proportional cost of equity issuance λ_1 is set at 4%. Altinkilic and Hansen (2000) estimate that the fixed cost for equity issuance ranges from 0.35% to 0.36% of the proceeds and the variable cost counts for 5% on average. For public bond offering, the numbers are 0.11% and 1%, respectively. Because I do not model issuance costs for debt issuance, I set the costs of equity offering as the difference between equity and bond offering so that the choice between debt and equity is

[3]Specifically, the log pricing kernel in equations (3.4) and (3.5) implies that the real interest rate is $1/\mathrm{E}_t[M_{t+1}] = (1/\beta)\exp(-\mu_m - (1/2)\sigma_m^2)$ and the maximum Sharpe Ratio is $\sigma_t[M_{t+1}]/\mathrm{E}_t[M_{t+1}] = \sqrt{\exp(\sigma_m^2(\exp(\sigma_m^2) - 1))}/\exp(\sigma_m^2/2)$, where $\mu_m \equiv [\gamma_0 + \gamma_1(x_t - \bar{x})](1 - \rho_x)(x_t - \bar{x})$ and $\sigma_m \equiv \sigma_x[\gamma_0 + \gamma_1(x_t - \bar{x})]$.

not affected.

Warner (1977) and Altman (1984) estimate that the direct cost of bankruptcy is 5.3% to 6% of the market value of the firm just prior to bankruptcy. Warner also documents a substantial fixed cost. I set the liquidation value ξ_1 at 95% of the asset value. The fixed cost ξ_0 is calibrated at 0.30 to match the average book leverage ratio of dictatorship firms with the empirical value.

For the governance environment, I calibrate two categories of firms. One category of firms has perfect corporate governance (infinite η) and corresponds to democracy firms in Gompers, Ishii, and Metrick (2003). The other category of firms has a weaker governance level gauged by the value of η and corresponds to matched with dictatorship firms in Gompers, Ishii, and Metrick (2003). Following the literature, I refer these two categories of firms in my model as democracy firms and dictatorship firms, respectively. In the calibration, I choose the value of the fixed cost f to match the average market-to-book value of the perfectly governed firms to that of democracy firms. The value of η is chosen to match the market-to-book value of the weakly governed firms with that of dictatorship firms. In the simulation, firms are randomly chosen to be either perfectly governed or weakly governed. The governance level of each firm stays unchanged once determined. Core, Holthausen, and Larker (1999) show that the mean and median of CEO percentage stock ownership are 1.5 and 0.1, respectively. I then fix the managerial ownership α at 1% for every firm.

Table 3.1 reports the calibration of parameter values. I simulate the model using the value function and optimal policy functions to create an artificial panel of 4000 firms with 480 monthly observations for each firm. I then run various empirical tests using the simulated data. The procedure is repeated for 100 times.

3.6.2 Basic properties of the model solution

Panel A and B of Figure 3.1 plot the market-to-book ratio (average Tobin's Q), defined as $\frac{E_{jt}+l_{jt}}{k_{jt}}$, against the level of capital stock with fixed level of liability $\bar{l}$. In Panel A, I fix the value of firm-specific productivity shock z at its unconditional mean $\bar{z}$ and plot the curves corresponding to different values of aggregate productivity shock x. The same curves are then plotted for different values of z with x fixed at $\bar{x}$ in Panel B. The market-to-book equity ratio increases with both the aggregate and firm-specific productivity shocks and decreases with the capital stock. Consistent with Fama and French (1992) and Fama and French (1993), the model thus predicts that small and profitable firms have higher market-to-book ratios. Moreover, the model predicts that firms have higher market-to-book ratios during economic booms, consistent with Kothari and Shanken (1997) and Pontiff and Schall (1999).

Panel C and D of Figure 3.1 plot the market-to-book ratio, defined as $\frac{E_{jt}+l_{jt}}{k_{jt}}$, against the level of liability with fixed level of capital stock $\bar{k}$. Similarly, I plot the curves corresponding to different values of x with z fixed at $\bar{z}$ in Panel C and to different values of z with x fixed at $\bar{x}$ in Panel D. The figures show that the market value of the firm decreases as the liability increases, *ceteris paribus*. Increase in liability raises the expected direct costs of bankruptcy and reduces the future benefits of investment. Notice that as the level of liability increases, the difference in Tobin's Q among firms with different productivity shocks diminishes. A large part of the benefits from a higher productivity shock are derived from

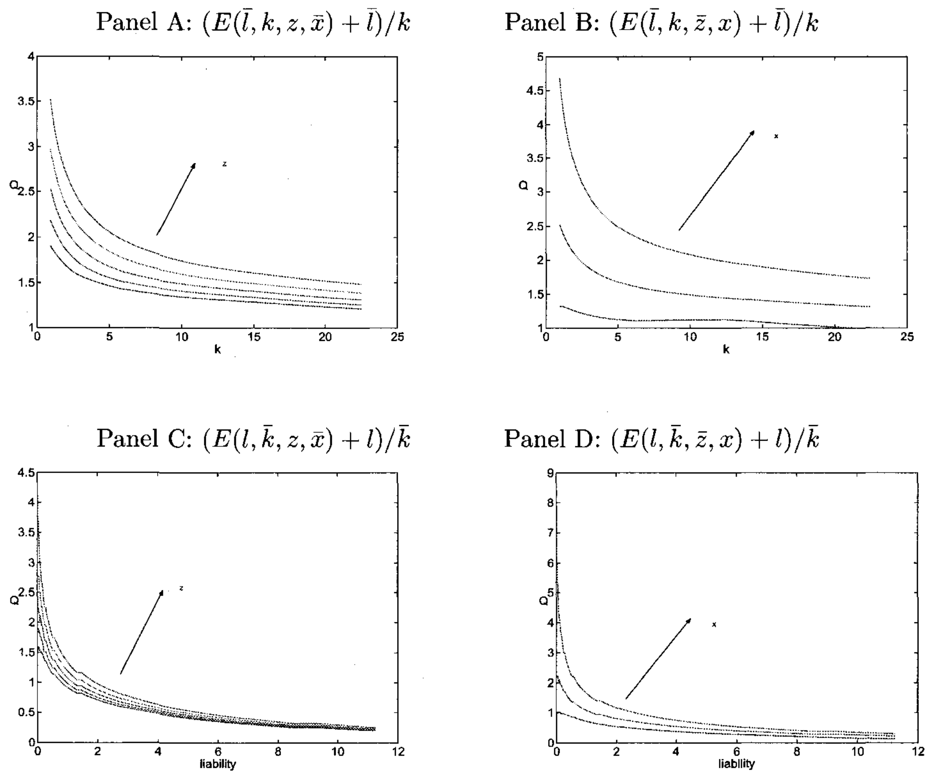
Table 3.1: **Parameter Values**

This table lists the parameter values used to solve and simulate the model. Panel A reports the technology parameters of the economy, Panel B reports the parameters of both the debt and the equity markets, and Panel C reports the governance parameters.

Notation	Parameter Value	Description
		Panel A: Technology Parameters
γ	0.60	Capital share in production
δ	0.01	Monthly rate of capital depreciation
$\bar{x}$	-3.3134	Long-run average of the aggregate productivity
ρ_x	$0.95^{1/3}$	Persistence coefficient of aggregate productivity
σ_x	0.007/3	Conditional volatility of aggregate productivity
β	0.994	Time-preference coefficient
γ_0	50	Constant price of risk parameter
γ_1	-1000	Time-varying price of risk parameter
a	15	Adjustment-cost parameter
ρ_z	0.96	Persistence coefficient of firm-specific productivity
σ_z	0.10	Conditional volatility of firm-specific productivity
f	0.012	Fixed cost of production
		Panel B: Financial Markets Parameters
ξ_0	0.30	Fixed bankruptcy cost
ξ_1	0.95	Liquation value per unit of capital
λ_0	1e-4	Fixed equity issuance cost
λ_1	0.04	Proportional equity issuance cost
		Panel C: Governance Parameters
α	0.01	Managerial ownership
η	400	Cost parameter of managerial expropriation

Figure 3.1: **The Market-to-book Against Underlying State Variables**

This figure plots the market-to-book ratio $((E_{jt}+l_{jt})/k_{jt})$ as functions of the state variables. Panels A and C plot the market-to-book ratio as functions of capital stock k_{jt} and liability l_{jt}, respectively, while fixing the aggregate productivity x_t at its long-run average level $\bar{x}$. Both Panels A and C have a class of curves corresponding to different values of the firm-specific productivity z_{jt}, and the arrow in each panel indicates the direction along which z_{jt} increases. Panels B and D plot the market-to-book ratio as functions of capital stock k_{jt} and and liability l_{jt}, while fixing the firm-specific productivity z_{jt} at its average level $\bar{z}_j = 0$. Panels B and D have a class of curves corresponding to different values of the aggregate productivity x_t, and the arrows indicate the direction along which x increases.



the higher value of growth options, which is lost in bankruptcy.

Figure 3.2 plots the investment-to-assets ratio against the level of capital stock in Panel A and B and the investment-to-assets ratio against the liability in Panel C and D. Consistent with Fama and French (1995), firms with relatively low capital and high productivity shock (both aggregate and firm-specific) invest more. Moreover, Panel C and D show that the investment-to-assets ratio decreases as the liability goes up.

Panel A of Figure 3.3 plots the average invest-to-asset ratios of both democracy firms and dictatorship firms. As predicted in Proposition 4, dictatorship firms have higher investment-to-assets ratios on average. Panel B of Figure 3.3 compares the market-to-book ratios of both democracy firms and dictatorship firms. Due to the expropriation and the suboptimal investment decisions, democracy firms have higher market-to-book ratios.

3.7 Quantitative Results

In this section, I investigate to what extent the model can quantitatively reproduce the return dynamics of the governance portfolio, the negative relation between governance strength and cost of debt financing, and the positive relation between governance strength and the firm's reliance on equity financing.

Table 3.2 gives the summary statistics of the simulated data. Except for the frequency of equity issuance, all other moments are matched fairly well. It seems that firms in the model issue equity much more frequently than firms in the data. However, Fama and French (2005) document that, in addition to the seasoned

Figure 3.2: **The Investment-to-assets Ratio Against Underlying State Variables**

This figure plots the investment-to-assets ratio as functions of the state variables. Panels A and C plot the variables as functions of capital stock k_{jt} and the aggregate productivity x_t, while fixing the firm-specific productivity z_{jt} at its average level $\bar{z}_j = 0$. Panels A and C have a class of curves corresponding to different values of x_t, and the arrows indicate the direction along which x increases. Panels B and D plot the investment-to-assets ratio as functions of capital stock k_{jt} and firm-specific productivity z_{jt}, while fixing the aggregate productivity x_t at its long run average level $\bar{x}$. Both Panels B and D have a class of curves corresponding to different values of z_{jt}, and the arrow in each panel indicates the direction along which z_{jt} increases.

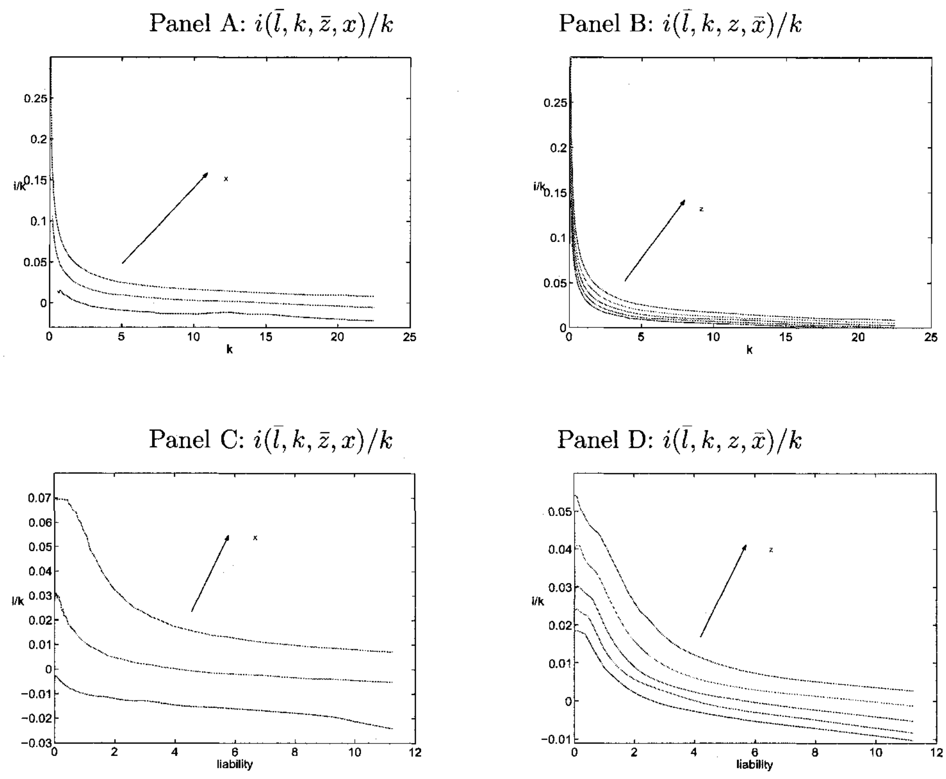
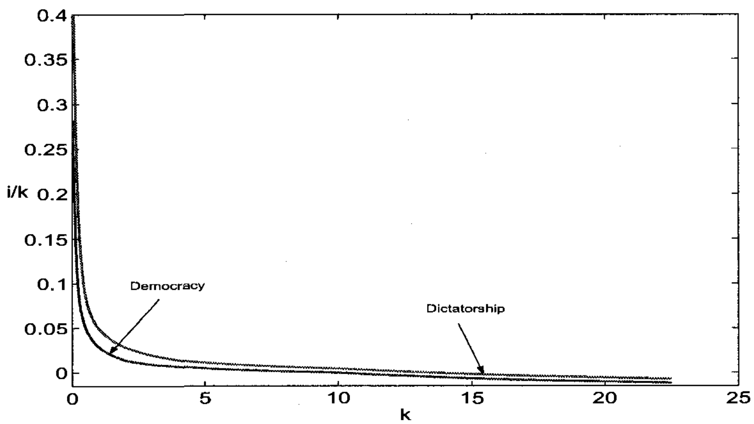


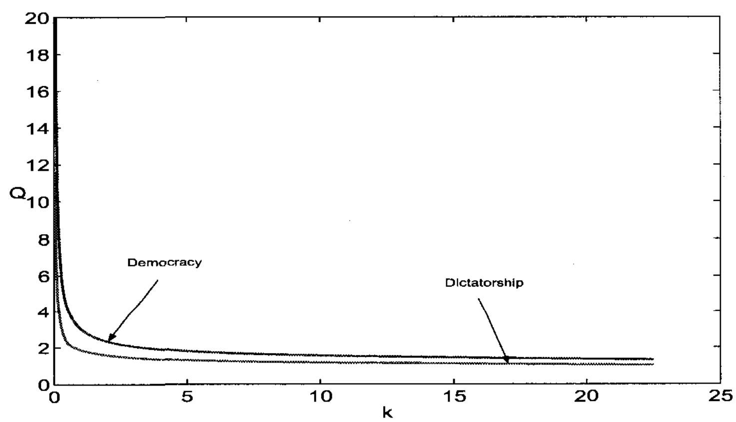
Figure 3.3: **Comparison between Democracy Firms and Dictatorship Firms**

The figure compares the average investment-to-assets ratio and the average market-to-book ratio (Tobin's Q) of Democracy firms and Dictatorship firms.

Panel A



Panel B



equity offering, firms issue equity in mergers and through private placements, convertible debts, direct purchase plans, warrants, rights issues, and employee options, grants, and benefit plans. Including all the forms of equity issuance, the issuance frequency is more than seventy percent. It is likely that the calibrated costs of equity issuance are biased downward.

Table 3.2 shows that, in general, dictatorship firms have higher leverage ratios, larger size, and lower equity issuance-to-asset ratios than democracy firms. The average investment-to-assets ratios are both close to the depreciation rate. However, dictatorship firms are generally larger in size.

Table 3.2: **Unconditional Moments from the Simulated and Real Data**

This table reports unconditional sample moments generated from the simulated data and from the real data. I simulate 100 artificial panels each of which has 4000 firms and 480 monthly observations. I report the cross-simulation averaged results. The real data moments of the market-to-book ratio $(d_t + E_t)/k_t$, book leverage d_t/k_t, and market leverage $d_t/(d_t + E_t)$ are taken from Litov (2005). The real data moments of the equity issuance-to-asset ratio $[-\pi_t^s]^+/k_t$ and the investment-to-assets ratio i_t/k_t are taken from Hennessy and Whited (2006). The real data moments of size, measure as the market capitalization E_t, are taken from Gompers, Ishii, and Metrick (2003). The average size of Democracy firms is normalized at 1. The real data moments with an asterisk are the moments of the full sample. All the sample moments are in annual frequency.

	Democracy		Dictatorship	
	Data	Model	Data	Model
Market-to-book ratio	2.00	2.05	1.51	1.58
Book leverage (net cash)	0.40	0.37	0.52	0.50
Market leverage (net cash)	0.26	0.24	0.41	0.41
Equity issuance-to-asset ratio	0.089*	0.132	-	0.084
investment-to-assets ratio	0.104*	0.104	-	0.106
Size	1	1	1.82	2.03
Frequency of equity issuance	0.175*	0.528	-	0.412

3.7.1 Governance and the Value of the Firm

The positive relation between corporate governance and the value of the firm is well documented in the literature. The value of the firm is commonly proxied by Tobin's Q for the study of governance as in Gompers, Ishii, and Metrick (2003) and Mork, Shleifer, and Vishney (1988). I ask whether the model can reproduce the same empirical pattern. Tobin's Q for firm j at date t is measured as the market value of assets divided by the book value of assets, i.e., $\frac{E_{jt}+d_{jt}}{k_{jt}}$ in the model. Following Gompers, Ishii, and Metrick (2003), I regress a firm's Q against the Governance dummy, which equals one for democracy firms and zero for dictatorship firms, and a control variable, log of the book value of assets.[4] Using the Fama and MacBeth (1973) approach, I run the cross-sectional regression annually and report the time-series mean and t-statistics of the coefficients. Panel A in Table 3.3 compares the regression results from the simulated data and the ones reported in Table VIII of Gompers et al. Both regressions show a positive and significant coefficient on the governance dummy. The magnitudes of the coefficient are similar. This result is not surprising given that the fixed operating cost f and the governance parameter η are calibrated to match the Tobin's Q of both democracy firms and dictatorship firms.

3.7.2 Corporate Governance and Capital Expenditure

Gompers, Ishii, and Metrick (2003) document a negative relation between corporate governance and capital expenditure, scaled by either sales or assets.

[4]Gompers et al. also include a dummy variable for Delaware firms, a dummy for S&P 500 firms, and the log of firm age. However, there are no corresponding variables in my model.

Table 3.3: **Q Regressions**

This table reports the cross-sectional regression of industry-adjusted Tobin's Q on the governance dummy and the log of the book value of assets. The regression equation is: $Q_{jt} = a_t + b_{1t} G_{jt} + b_{2t} log(BA_{jt}) + e_{jt}$, where Q_{jt} is the industry-adjusted Q (the Q of firm j minus sample median $\bar{Q}_t$ in year t), measured as $\frac{E_{jt}+d_{jt}}{k_{jt}} - \bar{Q}_t$, G_{jt} is the governance dummy that equals 1 if firm j is in the Democracy portfolio in year t and zero otherwise, and BA_{jt} is the book value of assets of firm j in year t, measured as k_{jt}. I simulate 100 artificial panels, each of which has 4000 firms and 480 monthly observations. I perform the above-described cross-sectional regressions in each year, calculate the time-series averages and time-series standard errors on each simulated panel, and report the cross-simulation averaged coefficients and t-statistics. For comparison, the table also reports the results from Table VIII of Gompers, Ishii, and Metrick (2003). The table only reports the coefficients and t-statistics of the governance dummy.

	Democracy Portfolio	
	Data	Model
Coefficient.	0.336	0.417
t-Statistic	8.375	16.354

I follow their approach and estimate the following regression equation

$$CAPEX_{jt} = a_t + b_{1t} DEMO_{jt} + b_{2t} \log BTM_{jt} + e_{jt}\,, \qquad (3.32)$$

where $CAPEX$ is the capital expenditure, scaled by either assets or sales, and net of the sample mean. $DEMO$ is the dummy variable for democracy firms, and $\log BTM$ is the log of the book-to-market ratio as a control variable. Equation (3.32) is estimated in the Fama-MacBeth fashion. The coefficients reported in Table 3.4 are the time-series averages. The t-statistics are calculated using the time-series standard errors. For comparison, I also include the regression results reported in Gompers, Ishii, and Metrick (2003) Table X. As

Table 3.4: **Capital Expenditure**

Panel A of this table reports the results of annual median regression $CAPEX/Assets_{jt+1} = a_t + b_{1t}\,G_{jt} + b_{2t}\,BM_{jt} + e_{jt+1}$, where $CAPEX/Assets_{jt+1}$ is the annual median capital expenditure to the assets ratio of firm j in year $t+1$, measured as $\frac{k_{jt+2}-(1-\delta)k)jt+1}{k_{jt+1}}$, G_{jt} is a dummy variable for Democracy firms, and BM_{jt} is the book-to-market equity ratio of year t, measured as $\frac{k_{jt}-d_{jt}}{E_{jt}}$. Panel B of this table reports the results of annual median regression $CAPEX/Sales_{jt+1} = a_t + b_{1t}\,G_{jt} + b_{2t}\,BM_{jt} + e_{jt+1}$, where $CAPEX/Sales_{jt+1}$ is the annual median capital expenditure to the sales ratio of firm j in year $t+1$, measured as $\frac{k_{jt+1}-(1-\delta)k)jt}{y_{jt}}$. I simulate 100 artificial panels, each of which has 4000 firms and 480 monthly observations. I perform the above-described regressions annually, calculate the time-series averages and time-series standard errors on each simulated panel, and report the cross-simulation averaged coefficients and t-statistics. I also compare my results with the results from Table X of Gompers, Ishii, and Metrick (2003).

	Panel A: CAPEX/Assets Democracy Portfolio		Panel B: CAPEX/Sales Democracy Portfolio	
	Data	Model	Data	Model
Coef.	-6.21	-15.01	-5.23	-13.72
t-Stat	-4.06	-4.11	-3.71	-2.56

predicted by the model, the coefficient on the democracy dummy is negative and significant in both the simulated data and the real data.

3.7.3 Corporate Governance and the Cost of Debt

Klock, Mansi, and Maxwell (2005) study the effect of corporate governance on the wealth of creditors and document that the credit ratings of the bonds of dictatorship firms are higher and the credit spreads are lower. I ask whether the cost of debt is lower for dictatorship firms in the model.

Using the same approach as Klock, Mansi, and Maxwell (2005), I estimate the following regression equation:

$$Spread_{jt} = a_t + b_{1t}DEMO_{jt} + b_{2t}Size_{jt} + b_{3t}BLev_{jt} + b_{4t}ROA_{jt} + e_{jt}\,, \quad (3.33)$$

where *Spread* is the annualized credit spread defined in equation (3.15), $DEMO$ is again the dummy variable for democracy firms, *Size* is measured as the log of total assets k_{jt}, $BLev$ is the book leverage, defined as d_{jt}/k_{jt}, and ROA is the profitability, defined as $[(1 - s_{jt})y_{jt} - f]/k_{jt}$.[5] Klock et al. use the Governance Index, ranging from 1 to 24, instead of the democracy dummy. The coefficients and t-statistics are estimated using the Fama-MacBeth regression.

Table 3.5 reports the regression results along with those in Klock, Mansi, and Maxwell (2005). In the regression using simulated data, the coefficient on the democracy dummy is significantly positive. The magnitude of the coefficient is 20.7, meaning that the credit spreads of dictatorship firms are on average around 21 basis points lower than that of democracy firms. Klock et al. report that the credit spread is more than four basis points lower for a unit increase in the Governance Index. That leads to at least 37 basis points difference between dictatorship firms and democracy firms, given that the former is defined as firms with Governance Index no less than 14 and the latter is defined as firms with Governance Index no larger than 5. It seems that the model only captures slightly more than half of the difference in credit spread.

There are certainly many factors that could contribute to the difference in credit spread in addition to overinvestment. One potential factor would be the

[5]There are other control variables in Klock, Mansi, and Maxwell (2005) but absent in the model, such as institutional ownership, adjusted credit rating, high yield dummy, debt duration, debt convexity, debt age, quality spread, firm volatility, and CEO ownership.

Table 3.5: **Credit Spread**

This table reports the Fama-MacBeth regression of the credit spread on the Democracy dummy and control variables. The regression equation is: $Spread_{jt} = a_t + b_{1t}DEMO_{jt} + b_{2t}Size_{jt} + b_{3t}BLev_{jt} + b_{4t}ROA_{jt} + e_{jt}$, where $DEMO$ is the dummy variable for Democracy firms, $Size$ is measured as the log of total assets k_{jt}, $BLev$ is the book leverage, defined as d_{jt}/k_{jt}, and ROA is the profitability, defined as $(y_{jt} - f)/k_{jt}$. I simulate 100 artificial panels, each of which has 4000 firms and 480 monthly observations. I perform the Fama-MacBeth regression, calculate the time-series averages and time-series standard errors on each simulated panel, and report the cross-simulation averaged coefficients and t-statistics. For comparison, the table also reports the results from Table 3 of Klock, Mansi, and Maxwell (2005). Instead of using the Democracy dummy as a measure for governance, Klock et al. use the Governance Index, which ranges from 1 to 24. The table only reports the coefficients and t-statistics of the Governance Index for the real data and the Democracy dummy for the simulated data.

	Governance Index	Democracy Dummy
	Data	Model
Coefficient.	-4.12	20.7
t-Statistic	-3.91	2.69

costs from information asymmetry. In the data, dictatorship firms are on average larger and older. Consequently, such firms have less information asymmetry and enjoy lower cost of debt.

3.7.4 Corporate Governance and Financing Policy

Litov (2005) investigates the effect of corporate governance on the financing decisions of a firm. Litov (2005) shows that weakly governed firms use more debt financing. In this section, I test whether these financing regularities are present in the model.

Following Litov (2005), I study firm's financing choices using the following regression setup:

$$\Delta D_{jt} = a_t + b_t \, DEF_{jt} + e_{jt} \tag{3.34}$$

where ΔD_{jt} is the net debt issuance of firm j in year t and DEF_{jt} is the financing deficit, defined as the sum of net equity issuance and the net debt issuance. I run Fama-MacBeth regression of equation (3.34) for democracy firms and dictatorship firms separately. Table 3.6 shows that for every one dollar external fund raised, 0.44 cents are obtained through debt financing for democracy firms while 0.71 cents for dictatorship firms. Consistent with Litov's evidence, dictatorship firms rely more on debt financing. For comparison, I also report Litov's regression results from in Table 3.6. The coefficients are close to his.

The reason that weakly governed firms use more debt financing lies on the difference in the costs of debt and the costs of bankruptcy. Section 3.7.3 shows that, *ceteris paribus*, the costs of debt are lower for dictatorship firms. Moreover, democracy firms are on average smaller and growth-type firms. Bankruptcy is more costly for such firms for the following reasons. First, bankruptcy incurs fixed costs, leading to a higher per capital deadweight loss for small firms. Second, in bankruptcy, firm loses all the growth options. The value of the firm in bankruptcy equals the value accrued to creditors, which is proportional to the value of the assets as stated in equation (3.9). Therefore, for firms with higher market-to-book value, the drop in firm value is larger if bankruptcy happens. Because debt is fairly priced and shareholders bear the bankruptcy costs ex-ante, firms with high market-to-book ratios face higher bankruptcy costs. As I show above, democracy firms tend to have higher market-to-book ratios and lower levels of assets. Consequently, bankruptcy is more costly to democracy firms than to

Table 3.6: **Financing Policy**

This table reports the Fama-MacBeth regression of the net debt issued on the financial deficit. The following regression is estimated for Dictatorship firms and Democracy firms separately: $\Delta D_{jt} = a_t + b_t\, DEF_{jt} + e_{jt}$, where ΔD_{jt} is the net debt issued of firm j in year t, measured as $d_{jt+1} - d_{jt}$, and DEF_{jt} is the financial deficit of firm j in year t, measured as the $[\pi_{jt}]^+ + (d_{jt+1} - d_{jt})$, i.e., the sum of the net equity issued and the net debt issued. I simulate 100 artificial panels, each of which has 4000 firms and 480 monthly observations. I perform the above-described cross-sectional regressions in each year, calculate the time-series averages and time-series standard errors on each simulated panel, and report the cross-simulation averaged coefficients and t-statistics. Panel A presents the regression results for Democracy firms, and Panel B presents the regression results for Dictatorship firms. For comparison, I also report the results from Table 3 Panel A in Litov (2005).

	Democracy		Dictatorship	
	Data	Model	Data	Model
Coef.	0.5355	0.4422	0.7338	0.7125
t-Stat	2.55	3.02	4.54	3.40

dictatorship firms.

3.7.5 Governance and Returns

From the simulated data, I form a governance portfolio by buying perfectly governed firms and selling weakly governed firms. I estimate the abnormal return of the governance portfolio using Carhart (1997) four-factor model, defined as

$$R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \epsilon_t\,, \quad (3.35)$$

where R_t is the excess return relative to risk-free rate of the value-weighted governance portfolio at month t, α is the abnormal return, $RMRF_t$ is the excess return of value-weighted market portfolio, and SMB_t, HML_t, and $Momentum_t$

are the month t returns on the zero-investment factor-mimicking portfolios that capture size, book-to-market, and momentum effects, respectively. I follow Fama and French (1993) and Carhart (1997) to form these factor-mimicking portfolios. Based on the implication of the model, I run two separate regressions for economic booms and economic recessions, respectively. Any month with aggregate productivity shock x_t being one standard deviation higher than its long-run mean is categorized as a boom, while any month with x_t being one standard deviation lower than the long-run mean is categorized as a recession.

Table 3.7 compares the regression results from the simulated data with those from the real data. Panels A and B report the regression results from Core, Guay, and Rusticus (2006) for the period 1990−1999 and the period 2000−2003, along with the results from the simulated data in booms and in recessions, respectively. According to NBER's business cycle dating, more than 90% of the time in the period 1990−1999 is in expansion while the second period mainly consists of recessions. Both the simulated data and the real data show that democracy firms outperform dictatorship firms during good times, and the opposite is true during bad times.

Table 3.7: **Performance-Attribution Regressions for Governance Portfolio**

This table reports the Fama-French-Carhart four-factor regression: $R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \epsilon_t$, where R_t is the excess return relative to risk-free rate of the value-weighted Governance portfolio at month t, α is the abnormal return, $RMRF_t$ is the excess return of value-weighted market portfolio, and SMB_t, HML_t, and $Momentum_t$ are the month t returns on the zero-investment factor-mimicking portfolios that capture size, book-to-market, and momentum effects, respectively. I also compare my results to those reported in Table VII of Core, Guay, and Rusticus (2006) and those reported in Table 9 of Yang (2005).

Portfolio	α		$RMRF$		SMB		HML		$Momentum$	
	Panel A: Core, Guay, and Rusticus (2006) 1990–1999 (Booms in the model)									
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Coef.	0.69	0.31	-0.04	0.06	-0.22	-0.51	-0.54	-0.64	-0.01	0.002
t-Stat	2.72	2.30	-0.59	0.56	-2.47	-3.07	-5.34	-5.49	-0.09	0.11
	Panel B: Core, Guay, and Rusticus (2006) 2000–2003 (Recessions in the model)									
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Coef.	-0.13	-0.75	0.28	0.07	0.07	-0.24	-0.41	-0.62	0.03	0.01
t-Stat	-0.24	-4.98	2.39	0.46	0.58	-4.24	-2.89	-5.06	0.63	0.54

Chapter 4

Empirical Tests

In this section, I conduct empirical tests of the model proposed in the thesis. Two hypotheses are derived from the model: (1) firms with stronger governance earn higher expected returns than firms with weaker governance during booms and lower expected returns during recessions; (2) overinvestment is the driving force underneath the procyclical return differences between firms with strong and weak governance. Both hypotheses are tested using two different measures of the strength of corporate governance: the G-index developed in Gompers, Ishii, and Metrick (2003) and the entrenchment index, simplified as E-index, in Bebchuk, Cohen, and Ferrell (2005). The G-index is from the Investor Responsibility Research Center (IRRC) data set and the E-index data is from Bebchuk's web site[1]. Chapter 6 provides detailed description on the construction of both corporate governance measures. I then match the governance data with the stock return data from the Center for Research in Security Prices (CRSP). All the tests are conducted using the data from non-financial and non-utility firms.

[1]I thank Lucian Bebchuk for sharing the data.

4.1 Procyclical Returns of the Governance Portfolio

A direct test for the first hypothesis would be to study the returns of the governance portfolio for the periods of economic booms and the periods of economic recessions separately. In order to do that, we need to define booms and recessions. The easiest way to classify economic conditions is to use NBER's business cycle dating. However, NBER's dating is ex-post and does not reflect the contemporaneous expectations of the agents in the economy. In this section, I classify booms and recessions based on the expected market risk premium, predicted by four business cycle indicators: default premium, term premium, short-term Treasury bill rate, and dividend yield.

Campbell and Cochrane (1999) and Constantinides and Duffie (1996) show theoretically that under plausible assumptions, expected market risk premium is countercyclical. Therefore, I use this risk premium to classify business cycles. The mounting literature in stock market predictability shows that default premium, term premium, short-term Treasury bill rate, and dividend yield predict future stock returns. [2] Following Petkova and Zhang (2005), I regress the realized market excess return, r_{mt+1}, on the aforementioned four business cycle indicators using the following linear model:

$$
\begin{aligned}
r_{mt+1} &= \delta_0 + \delta_1 \mathrm{DIV}_t + \delta_2 \mathrm{DEF}_t + \delta_3 \mathrm{TERM}_t + \delta_4 \mathrm{TB}_t + e_{mt+1}\,; \\
\hat{r}_{mt+1} &= \hat{\delta}_0 + \hat{\delta}_1 \mathrm{DIV}_t + \hat{\delta}_2 \mathrm{DEF}_t + \hat{\delta}_3 \mathrm{TERM}_t + \hat{\delta}_4 \mathrm{TB}_t\,.
\end{aligned}
$$

[2] Petkova and Zhang (2005) provides the reference in this literature.

The predicted market risk premiums, $\hat{r}_{mt+1}$, from the regression are then used to classify the states of the economy. Since the expected risk premium is counter-cyclical, the economy is in good state when the expected risk premium is low and *vice versa.* I classify month t as recession if the expected risk premium of month t is among the highest 20% of the risk premiums in the sample; I classify it as boom if the expected risk premium is among the lowest 20%. [3]

The sample period used in the estimation of expected risk premiums is from January 1980 to December 2005, the so called "Volcker-Greenspan" period. Jensen, Mercer, and Johnson (1996) find that the behavior of the business-condition proxies and their influence on expected stock market returns are significantly affected by the Federal Reserve (Fed) monetary policy. It has been documented in the macroeconomic literature that there is a structural break in Federal Bank's monetary policy since Volcker's appointment as Fed Chairman. Clarida, Galí, and Gertler (2000) show that interest rate policy in the Volcker-Greenspan period is much more sensitive to changes in expected inflation than in the pre-Volcker period.

Moreover, McConnell and Perez-Quiros (2000) and Kim and Nelson (1999) independently find that there is a structure break in the U.S. real GDP growth toward stabilization in the first quarter of 1984. Stock and Watson (1999) argue that this "Great Moderation" is partly due to the improved monetary policy. Campbell (2005) documents a significant declination in stock market volatility during the "Great Moderation" period.

Because the sample period used in this study is after 1990, the "Volcker-

[3]Different classifications, e.g., using 30% and 70% as the cutoff points, give similar results.

Greenspan" era is chosen based on the aforementioned evidence to ensure the relevancy and accuracy of the estimation on expected risk premium. Table 4.1 shows that the influence of the four business-conditions indicators on expected stock returns is indeed significantly different between the "pre-Volcker" period and "Volcker-Greenspan" period. Default premium has significant predictive power in the "pre-Volcker" period, while loses its significance in the "Volcker-Greenspan" period. The opposite happens to the predictive power of dividend yield. Most notably, higher short-term Treasury bill rate predicts good states in the "pre-Volcker" period, however predicts bad states in the "Volcker-Greenspan" period.

Table 4.1: **Classify States of the Economy along Business Cycles using Expected Market Risk Premium**

This table reports the linear regression used to predict expected market risk premium: $r_{mt+1} = \delta_0 + \delta_1 \text{DIV}_t + \delta_2 \text{DEF}_t + \delta_3 \text{TERM}_t + \delta_4 \text{TB}_t + e_{mt+1}$. *DIV* is the dividend yield, *DEF* is the default premium, *TERM* is the term premium, and *TB* is the short-term Treasury bill rate.

	Intercept	*DIV*	*DEF*	*TERM*	*TB*
	Panel A: Sample Period: Jan. 1970 - Dec. 1979				
coefficient	-6.73	0.24	3.21	1.20	5.12
t-stat	-2.54	0.11	2.16	1.79	1.08
	Panel B: Sample Period: Jan. 1980 - Dec. 2005				
coefficient	1.13	6.05	1.19	-0.34	-5.59
t-stat	1.12	2.65	1.52	-1.22	-2.89

According to the classification, there are 30 months in boom and 35 months in recession during September 1990 to December 2005. Figure 4.1 plots the expected market risk premium and the 20% and 80% cutoff lines. It shows that most of the boom periods are during the 1990 to 2001 and most of the recessions are after 2002. These classifications are largely consistent with the NBER business cycle dates.

Using Carhart Four-factor model, I regress the returns of the governance portfolio on market, size, value, and momentum factors to control for systematic risk. The regression is conducted only for months when the economy is in boom and for months when the economy is in recession, separately. Two governance portfolios are used for the test, based on the G-index and the E-index respectively. The range of the E-index is from 0 to 6 with 0 being the strongest governance and 6 being the weakest. Using the E-index, I classify firms as democracy firms if their entrenchment indices are lower than 2 and as dictatorship firms if their entrenchment indices are higher than 3. [4]

Table 4.2 shows the regression results with Panel *A* for G-index as governance measure and Panel *B* for E-index as governance measure. The intercept of the regression is normally called the abnormal return, given that it is not explained by the commonly used systematic risk factors. The average monthly abnormal return of the governance portfolio using G-index is 0.74% during booms and −0.99% during recessions with t-statistics being 1.14 and −2.27. The average monthly abnormal returns during booms and recessions are 1.18% and −0.18% respectively using E-index with t-statistics being 2.70 and −0.70.

Under both governance measures, the abnormal returns of governance portfolio during booms are positive and economically significant. Under the

[4]Other classifications, e.g., democracy firms being the ones with entrenchment indices lower than 2 and dictatorship firms being the ones with entrenchment indices higher than 4, give similar results.

measure of E-index, the abnormal return is also statistically significant. Firms with stronger governance earn approximately 9% (G-index) to 14% (E-index) more annually than firms with similar size and book-to-market ratios but weaker governance.

During recessions, firms with stronger governance earn approximately 2% (E-index) to 12% (G-index) less annually than firms with similar size and book-to-market ratios but weaker governance. The negative abnormal return of the governance portfolio with G-index is statistically and economically significant.

In summary, the test shows that firms with strong governance, measured by either G-index or E-index, on average earn higher returns than firms with weak governance during booms and earn lower returns during recessions. The results are largely consistent with the prediction of the model. Although I don't find statistic significance in all the regressions, it is likely due to the limited sample size.

4.2 Investment Factors

In this section, I test the second hypothesis that overinvestment drives the return difference between strongly governed firms and weakly governed firms. Since weakly governed firms overinvest, the exposure of their expected returns on the state variable that describes the stages of business cycles is different from that of strongly governed firms. A hedge portfolio based on overinvestment potentially captures the systematic risk from this business cycle state variable. To support the second hypothesis, the hedge portfolio based on overinvestment should have additional explanatory power on the returns of the governance portfolio.

I construct an investment factor based on overinvestment in two ways. The first one follows the same approach as in Lyandres, Sun, and Zhang (2005). I construct twenty-seven value-weighted portfolios formed on the intersection of the three portfolios formed on size, three portfolios formed on book-to-market,[5] and three portfolios formed on investment-to-assets ratio. The investment-to-assets ratio is defined as the annual change in gross property, plant, and equipment divided by the lagged book value of assets. The breakpoints for the investment portfolio are the 30th and 70th percentiles. The investment factor is the average return on the nine high investment-to-assets ratio portfolios minus the average return on the nine low investment-to-assets ratio portfolios.

The rationale behind this method is that if the three-way sorting on size and book-to-market does a satisfactory job in controlling for investment opportunity sets, firms in the high investment-to-assets ratio portfolio are investing beyond the optimal level. This argument implicitly assumes that firms in the lowest investment-to-assets ratio portfolio invest optimally and ignores the possibility of underinvestment. It is difficult to empirically distinguish overinvestment and underinvestment from optimal investment and this simplification assumption unavoidably adds noise to the investment factor.

The second way to construct investment factor follows the same procedure as the first one, except that instead of using the investment-to-assets ratio, I use the investment-to-assets ratio net the industry mean to control for industry effects. Presumably, the second investment factor contains less noise. However, it suffers

[5]The details about the portfolios on size and book-to-market can be found in Fama and French (1992) and Fama and French (1993).

from the same problem as the first one in ignoring underinvestment.

If, as predicted by the model, the difference in expected returns between democracy firms and dictatorship firms is due to their different loadings on the business cycle factor, which can be captured by a hedge portfolio based on overinvestment, the aforementioned investment factors could potentially add explanatory power in addition to the market factor. Moreover, because democracy firms are more likely to be in the low investment-to-assets ratio decile and dictatorship firms are more likely to be in the high investment-to-assets ratio decile, the loading on the investment factor should be negative. Table 4.3 reports the results from the following regression:

$$R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * INV_t + \epsilon_t\,. \tag{4.1}$$

where INV_t refers to the investment factor.

Panels A and B in Table 4.3 show the regression results for the governance portfolios constructed based on G-index and E-index, respectively. Consistent with the prediction of the model that weakly governed firms overinvest, the governance portfolio has a negative loading on the investment factor. In addition to the market excess return, investment factors, both with and without controlling for the industry effect, have marginal explanatory power for the returns of the governance portfolio using G-index. However, both investment factors have no significant effect on the returns of the governance portfolio using E-index.

Several reasons might lead to the weak explanatory power of the investment factors. First, the above constructed investment factors might be poor proxies for the business cycle state variable. Second, the investment factors are constructed to solely capture the return difference due to overinvestment, by controlling for size and value effects. Despite the lack of theoretical fundation, Fama-French size and value factors and Carhart momentum factor have shown explanatory power on the cross-sectional returns empirically. If size, value, and momentum do capture the effects of some unknown state variables, the regression above is misspecified and the loadings on the investment factors can be misleading. Given the difficulty of solving the first problem, I focus on addressing the second problem by explaining the returns of the governance portfolio using the Carhart four-factor model augmented by the investment factor:

$$R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \beta_5 * INV_t + \epsilon_t \,. \tag{4.2}$$

Under the null hypothesis that overinvestment is the driving forces that lead to the differences between democracy firms and dictatorship firms, the interception in regression equation (4.2) should disappear and the investment factor should have significant explanatory power.

Panel A and Panel B of Table 4.4 report the regression results using G-index and E-index respectively for sample period from September 1990 to December 2005. It appears that adjusting for industry effect does not affect the results. After including the size, value, and momentum factors in the regression, the loadings on the investment factors become more significant both statistically and economically. Again, consistent with the prediction of the model, the loadings on investment factors are negative using both G-index and E-index.

Investment factors always have significant explanatory power for the returns of the governance portfolio using G-index. Both investment factors lose their explanatory power for the governance portfolio using E-index.

It is interesting to see whether overinvestment is equally crucial during booms and recessions for the return differences between strongly and weakly governed firms. I apply the investment augmented Carhart four-factor model to booms and recessions separately. Table 4.5 and Table 4.6 report the results using G-index and E-index, respectively. Interestingly, both tables show the same pattern that overinvestment has a much larger effect on the returns of the governance portfolio during booms than that during recessions. After adding investment factors, the magnitudes of the abnormal return α decreases from 9% annually to 1% with G-index and decreases from from 14% to 11% with E-index. There is no sizable changes in the abnormal returns of the governance portfolio during recessions using neither G-index nor E-index. Moreover, the magnitudes of the loadings on the investment factors are five to ten times larger during booms than those during recessions. The results seem to suggest that although weakly governed firms do invest more (disinvest less) than strongly governed firms during both booms and recessions, overinvestment is only crucial to returns during booms. However, the validity of this conclusion lies on how well the investment factors proxy for the overinvestment.

4.3 Summary

Based on the two empirical tests conducted in this chapter, data seems to be largely supportive to the theory. Stock returns of the governance portfolios using both G-index and E-index are positive during booms and negative during recessions, controlling for market, size, value, and momentum risk factors. In some cases, the abnormal returns are both economically and statistically significant. Overinvestment seems to contribute to the return difference between strongly and weakly governed firms mainly during booms.

The low statistical power of some of the results may be due to the small sample size. In addition, the investment factors used here may not be a good proxy for overinvestment, given that we cannot perfectly control for investment opportunity sets and it is difficult to empirically distinguish among overinvestment, optimal investment, and underinvestment.

Figure 4.1: **Expected Risk Premium**

The figure plots the expected market risk premium predicted by the four macroeconomic indicators: default premium, term premium, short-term Treasury bill rate, and dividend yield. Any month with an expected risk premium greater than the 80% cutoff line is classified as recession and any month with an expected risk premium smaller than the 20% cutoff line is classified as boom.

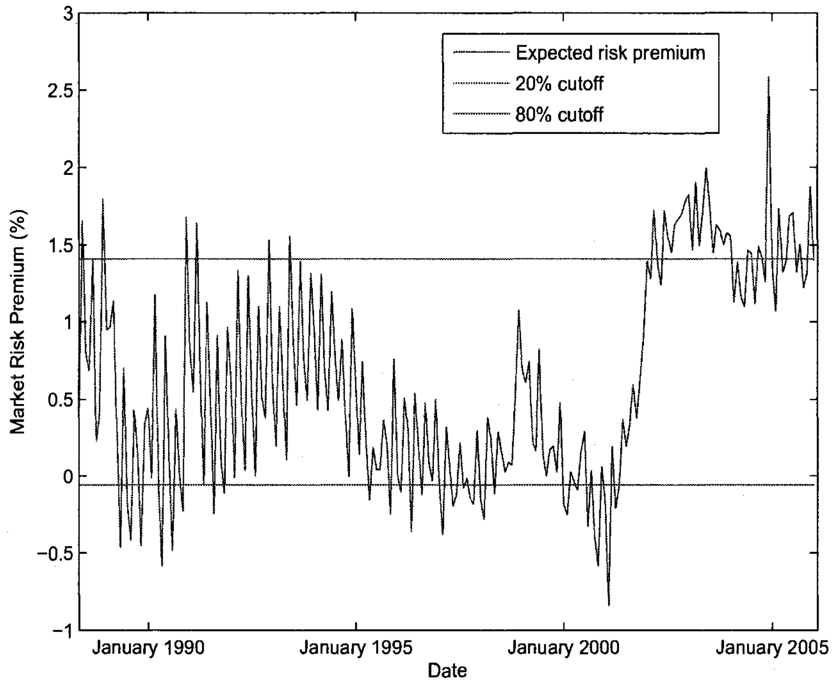


Table 4.2: **Performance-Attribution Regressions for Governance Portfolio in Booms and Recessions**

This table reports the Fama-French-Carhart four-factor regression: $R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \epsilon_t$, where R_t is the excess return relative to risk-free rate of the value-weighted Governance portfolio at month t, α is the abnormal return, $RMRF_t$ is the excess return of value-weighted market portfolio, and SMB_t, HML_t, and $Momentum_t$ are the month t returns on the zero-investment factor-mimicking portfolios that capture size, book-to-market, and momentum effects, respectively.

Panel A: G-index as a measure of corporate governance					
	α	$RMRF$	SMB	HML	$Momentum$
	Panel A-1: Sep. 1990 – Dec.2005				
coefficient	0.17	0.06	-0.13	-0.58	0.09
t-stat	0.81	1.04	-2.24	-7.93	2.07
	Panel A-2: Booms in Sep. 1990 – Dec.2005				
coefficient	0.74	-0.19	-0.05	-0.85	0.16
t-stat	1.14	-0.95	-0.26	-3.57	1.82
	Panel A-3: Recessions in Sep. 1990 – Dec.2005				
coefficient	-0.99	0.19	-0.04	-0.66	0.01
t-stat	-2.27	1.48	-0.24	-3.68	0.11

Panel B: Entrenchment Index as a measure of corporate governance					
	α	$RMRF$	SMB	HML	$Momentum$
	Panel B-1: Sep. 1990 – Dec.2005				
coefficient	0.34	0.00	-0.16	-0.48	0.01
t-stat	2.61	0.02	-4.24	-10.57	0.26
	Panel B-2: Booms in Sep. 1990 – Dec.2005				
coefficient	1.18	-0.26	-0.38	-1.04	0.05
t-stat	2.70	-1.94	-2.78	-6.51	0.80
	Panel B-3: Recessions in Sep. 1990 – Dec.2005				
coefficient	-0.18	0.11	-0.21	-0.46	-0.01
t-stat	-0.70	1.40	-2.33	-4.35	-0.16

Table 4.3: **Factor Model with both the Market Factor and the Investment Factor**

This table reports the investment factor augmented CAPM regression: $R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * INV_t + \epsilon_t$, where R_t is the excess return relative to risk free rate of the value-weighted Governance portfolio at month t, α is the abnormal return, $RMRF_t$ is the excess return of value-weighted market portfolio, and INV_t are the month t returns on the zero-investment factor-mimicking portfolios that captures the effect of overinvestment. This investment factor is the return of the zero-cost portfolio that buys firms in the low investment-to-assets ratio decile and sells firms in the high investment-to-assets ratio decile, controlling for size, book-to-market, and industry effects.

Panel A: G-index as a measure of corporate governance			
	α	$RMRF$	INV
	Panel A-1: Investment factor		
coefficient	-0.34	0.29	-0.28
t-stat	-1.47	5.11	-1.90
	Panel A-2: Investment factor adjusted for industry means		
coefficient	-0.35	0.29	-0.29
t-stat	-1.50	5.13	-1.98
Panel B: Entrenchment Index as a measure of corporate governance			
	α	$RMRF$	INV
	Panel B-1: Investment factor		
coefficient	0.007	0.17	-0.05
t-stat	0.04	4.36	-0.47
	Panel B-2: Investment factor adjusted for industry means		
coefficient	0.31	0.17	-0.04
t-stat	0.02	4.40	-0.39

Table 4.4: **Performance-Attribution Regressions with the Investment Factors**

This table reports the investment factor augmented Fama-French-Carhart four-factor regression: $R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \beta_5 * INV_t + \epsilon_t$, where R_t is the excess return relative to risk free rate of the value-weighted Governance portfolio at month t, α is the abnormal return, $RMRF_t$ is the excess return of value-weighted market portfolio, and SMB_t, HML_t, $Momentum_t$, and INV_t are the month t returns on the zero-investment factor-mimicking portfolios that capture size, book-to-market, momentum, and investment effects, respectively. The investment factor is the return of the zero-cost portfolio that buys firms in the low investment-to-assets ratio decile and sells firms in the high investment-to-assets ratio decile, controlling for size, book-to-market, and industry effects.

Panel A: G-index as a measure of corporate governance						
	α	$RMRF$	SMB	HML	$Momentum$	INV
	Panel A-1: Sample Period: Sep. 1990– Dec. 2005					
coefficient	0.17	0.06	-0.13	-0.58	0.09	
t-stat	0.81	1.04	-2.24	-7.93	2.07	
	Panel A-2: Investment factor					
coefficient	0.06	0.08	-0.14	-0.63	0.05	-0.43
t-stat	0.29	1.49	-2.40	-8.63	1.26	-3.19
	Panel A-3: Investment factor adjusted for industry means					
coefficient	0.06	0.08	-0.14	-0.63	0.05	-0.44
t-stat	0.27	1.49	-2.39	-8.63	1.27	-3.24

Panel B: Entrenchment Index as a measure of corporate governance						
	α	$RMRF$	SMB	HML	$Momentum$	INV
	Panel B-1: Sample Period: Sep. 1990– Dec. 2005					
coefficient	0.34	0.00	-0.16	-0.48	0.01	
t-stat	2.61	0.02	-4.24	-10.57	0.26	
	Panel B-2: Investment factor					
coefficient	0.31	0.01	-0.16	-0.50	0.00	-0.12
t-stat	2.36	0.20	-4.29	-10.64	-0.08	-1.34
	Panel B-3: Investment factor adjusted for industry means					
coefficient	0.31	0.01	-0.16	-0.50	0.00	-0.12
t-stat	2.35	0.20	-4.29	-10.66	-0.08	-1.37

Table 4.5: **Performance-Attribution Regressions with the Investment Factors in Booms and Recessions: G-index as the Governance Measure**

This table reports the investment factor augmented Fama-French-Carhart four-factor regression: $R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \beta_5 * INV_t + \epsilon_t$, where R_t is the excess return relative to risk free rate of the value-weighted Governance portfolio at month t, α is the abnormal return, $RMRF_t$ is the excess return of value-weighted market portfolio, and SMB_t, HML_t, $Momentum_t$, and INV_t are the month t returns on the zero-investment factor-mimicking portfolios that capture size, book-to-market, momentum, and investment effects, respectively. The investment factor is the return of the zero-cost portfolio that buys firms in the low investment-to-assets ratio decile and sells firms in the high investment-to-assets ratio decile, controlling for size, book-to-market, and industry effects.

Panel A: Booms in Sep. 1990 – Dec.2005						
	α	$RMRF$	SMB	HML	$Momentum$	INV
	Panel A-1: Carhart Four-factor					
coefficient	0.74	-0.19	-0.05	-0.85	0.16	
t-stat	1.14	-0.95	-0.26	-3.57	1.82	
	Panel A-2: Investment factor					
coefficient	0.09	-0.02	-0.15	-0.94	0.10	-1.13
t-stat	0.14	-0.12	-0.83	-4.40	1.19	-2.59
	Panel A-3: Investment factor adjusted for industry means					
coefficient	0.08	-0.03	-0.15	-0.95	0.10	-1.12
t-stat	0.13	-0.17	-0.82	-4.40	1.20	-2.56

Panel B: Recessions in Sep. 1990– Dec. 2005						
	α	$RMRF$	SMB	HML	$Momentum$	INV
	Panel B-1: Carhart Four-factor					
coefficient	-0.99	0.19	-0.04	-0.66	0.01	
t-stat	-2.27	1.48	-0.24	-3.68	0.11	
	Panel B-2: Investment factor					
coefficient	-1.03	0.21	-0.07	-0.67	0.03	-0.21
t-stat	-2.33	1.60	-0.43	-3.66	0.25	-0.78
	Panel B-3: Investment factor adjusted for industry means					
coefficient	-1.03	0.22	-0.07	-0.66	0.03	-0.22
t-stat	-2.34	1.61	-0.44	-3.66	0.27	-0.83

Table 4.6: **Performance-Attribution Regressions with the Investment Factors in Booms and Recessions: E-index as the Governance Measure**

This table reports the investment factor augmented Fama-French-Carhart four-factor regression: $R_t = \alpha + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \beta_5 * INV_t + \epsilon_t$, where R_t is the excess return relative to risk free rate of the value-weighted Governance portfolio at month t, α is the abnormal return, $RMRF_t$ is the excess return of value-weighted market portfolio, and SMB_t, HML_t, $Momentum_t$, and INV_t are the month t returns on the zero-investment factor-mimicking portfolios that capture size, book-to-market, momentum, and investment effects, respectively. The investment factor is the return of the zero-cost portfolio that buys firms in the low investment-to-assets ratio decile and sells firms in the high investment-to-assets ratio decile, controlling for size, book-to-market, and industry effects.

Panel A: Booms in Sep. 1990 – Dec.2005						
	α	$RMRF$	SMB	HML	$Momentum$	INV
	Panel A-1: Carhart Four-factor					
coefficient	1.18	-0.26	-0.38	-1.04	0.05	
t-stat	2.70	-1.94	-2.78	-6.51	0.80	
	Panel A-2: Investment factor					
coefficient	0.95	-0.20	-0.42	-1.07	0.03	-0.39
t-stat	2.02	-1.43	-2.99	-6.67	0.42	-1.19
	Panel A-3: Investment factor adjusted for industry means					
coefficient	0.96	-0.21	-0.42	-1.07	0.03	-0.37
t-stat	2.03	-1.48	-2.97	-6.64	0.44	-1.13
Panel B: Recessions in Sep. 1990– Dec. 2005						
	α	$RMRF$	SMB	HML	$Momentum$	INV
	Panel B-1: Carhart Four-factor					
coefficient	-0.18	0.11	-0.21	-0.46	-0.01	
t-stat	-0.70	1.40	-2.33	-4.35	-0.16	
	Panel B-2: Investment factor					
coefficient	-0.18	0.11	-0.22	-0.46	-0.01	-0.03
t-stat	-0.71	1.39	-2.27	-4.28	-0.11	-0.21
	Panel B-3: Investment factor adjusted for industry means					
coefficient	-0.19	0.11	-0.22	-0.46	-0.01	-0.04
t-stat	-0.72	1.40	-2.29	-4.29	-0.09	-0.27

Chapter 5

Conclusion

The paper provides an economic explanation for the documented link between corporate governance and the costs of financing from both the equity markets and the bond markets. I show that the managers of firms with weak governance overinvest due to rent-extraction. Consequently, such firms tend to be larger, less profitable, and have lower market-to-book ratios. Although not favored by shareholders, the overinvestment behavior of entrenched managers reduces the costs of debt financing, *ceteris paribus*, by lowering the probability of default and increasing the residual value accruing to creditors upon bankruptcy. Consequently, dictatorship firms rely more on debt financing.

The effect of corporate governance on stock returns depends on the aggregate economic conditions. The suboptimal investment behavior lowers both the values of expansion options and the values of disinvestment options. In economic booms, when the value of a firm is mainly driven by its expansion options and assets in place, firms with stronger governance have higher values of expansion options, which are call options and are riskier than firms with weaker governance. In recessions, when the value of a firm is mainly driven by its disinvestment options and assets in place, firms with stronger governance have higher values of disinvestment options, which are put options and are less risky than firms with weaker governance.

The empirical tests largely support the predictions of the model. Based on the expected risk premium, I define booms and recessions for the sample period from September 1990 to December 2005. Data shows that controlling for market, size, value, and momentum factors, strongly governed firms on average earn higher returns than weakly governed firms during booms and earn lower returns during recessions. I also construct two investment factors to proxy for the the effect of overinvestment on stock returns. Based on these investment factors, data seems to suggest that overinvestment is a crucial factor explaining for the return differences between strongly and weakly governed firms only when the economy is in good states. A larger sample size and better proxies for overinvestment may improve the statistical power and the reliability of the tests.

Chapter 6

Corporate Governance Measures

Two measures of corporate governance are used: the governance index developed by Gompers, Ishii, and Metrick (2003) and the entrenchment index by Bebchuk, Cohen, and Ferrell (2005). Both measures are based on the 24 provisions in firm's charter that the Investor Responsibility Research Center (IRRC) monitors. The 24 provisions appear to benefit management, giving them job security and greater power. They include:

Antigreenmail Greenmail refers to the agreement between a large shareholder and a company in which the shareholder agrees to sell his stock back to the company, usually at a premium, in exchange for the promise not to seek control of the company for a specified period of time. Antigreenmail provisions prevent such arrangements unless the same repurchase offer is made to all shareholders or the transaction is approved by shareholders through a vote. They are thought to discourage accumulation of large blocks of stock because one source of exit for the stake is closed, but the net effect on shareholder wealth is unclear (Shleifer and Vishny (1986a)). Five states have specific antigreenmail laws, and two other states have recapture of profits laws, which enable firms to recapture raiders profits earned in the secondary market. We consider recapture of profits laws to be a version of antigreenmail laws (albeit a stronger one). The antigreenmail category includes both firms with the provision and those incorporated in states with either antigreenmail or recapture of profits laws.

Blank check preferred stock This is preferred stock over which the board of directors has broad authority to determine voting, dividend, conversion, and other rights. While it can be used to enable a company to meet changing financial needs, it can also be used to implement poison pills or to prevent takeover by placement of this stock with friendly investors. Companies who have this type of preferred stock but who have required shareholder approval before it can be used as a takeover defense are not coded as having this provision in our data.

Business Combination laws These laws impose a moratorium on certain kinds of transactions (e.g., asset sales, mergers) between a large shareholder and the firm for a period usually ranging between three and five years after the shareholders stake passes a pre-specified (minority) threshold.

Bylaw and Charter amendment limitations These provisions limit shareholders ability to amend the governing documents of the corporation. This might take the form of a supermajority vote requirement for charter or bylaw amendments, total elimination of the ability of shareholders to amend the bylaws, or the ability of directors beyond the provisions of state law to amend the bylaws without shareholder approval.

Classified board A classified board is one in which the directors are placed into different classes and serve overlapping terms. Since only part of the board can be replaced each year, an outsider who gains control of a corporation may have to wait a few years before being able to gain control of the board. This provision may also deter proxy contests, since fewer seats on the board are open each year.

Compensation plans with changes in control provisions These plans allow participants in incentive bonus plans to cash out options or accelerate the payout of bonuses should there be a change in control. The details may be a written part of the compensation agreement, or discretion may be given to the compensation committee.

Director indemnification contracts These are contracts between the company and particular officers and directors indemnifying them from certain legal expenses and judgments resulting from lawsuits pertaining to their conduct. Some firms have both indemnification in their bylaw/charter and these additional indemnification contracts.

Control-share cash-out laws enable shareholders to sell their stakes to a controlling shareholder at a price based on the highest price of recently acquired shares. This works something like fair-price provisions (see below) extended to non-takeover situations.

Cumulative voting Cumulative voting allows a shareholder to allocate his total votes in any manner desired, where the total number of votes is the product of the number of shares owned and the number of directors to be elected. By enabling them to concentrate their votes, this practice helps enable minority shareholders to elect favored directors. Cumulative voting and secret ballot (see below), are the only two provisions whose presence is coded as an increase in shareholder rights, with an additional point to G if the provision is absent.

Directors duties allow directors to consider constituencies other than shareholders when considering a merger. These constituencies may include, for example, employees, host communities, or suppliers. This provision provides boards of directors with a legal basis for rejecting a takeover that would have been beneficial to shareholders. 31 states also have laws with language allowing an expansion of directors duties, but in only two of these states (Indiana and Pennsylvania) are the laws explicit that the claims of shareholders should not be held above those of other stakeholders [Pinnell (2000)]. We treat firms in these two states as though they had an expanded directors duty provision unless the firm has explicitly opted out of coverage under the law.

Fair-Price Requirements These provisions limit the range of prices a bidder can pay in twotier offers. They typically require a bidder to pay to all shareholders the highest price paid to any during a specified period of time before the commencement of a tender offer and do not apply if the deal is approved by the board of directors or a supermajority of the targets shareholders. The goal of this provision is to prevent pressure on the targets shareholders to tender their shares 40 in the front end of a two-tiered tender offer, and they have the result of making such an acquisition more expensive. This category includes both the firms with this provision and the firms incorporated in states with a fair price law.

Golden parachutes These are severance agreements which provide cash and non-cash compensation to senior executives upon a triggering event such as termination, demotion, or resignation following a change in control. They do not require shareholder approval.

Director indemnification This provision uses the bylaws and/or charter to indemnify officers and directors from certain legal expenses and judgments resulting from lawsuits pertaining to their conduct. Some firms have both this indemnification in their bylaws/charter and additional indemnification contracts. The cost of such protection can be used as a market measure of the quality of corporate governance [Core (2000)].

Limitations on director liability These charter amendments limit directors personal liability to the extent allowed by state law. They often eliminate personal liability for breaches of the duty of care, but not for breaches of the duty of loyalty or for acts of intentional misconduct or knowing violation of the law.

Pension parachute This provision prevents an acquirer from using surplus cash in the pension fund of the target in order to finance an acquisition. Surplus funds are required to remain the property of the pension fund and to be used for plan participants benefits.

Poison pills These securities provide their holders with special rights in the case of a triggering event such as a hostile takeover bid. If a deal is approved by the board of directors, the poison pill can be revoked, but if the deal is not approved and the bidder proceeds, the pill is triggered. In this case, typical poison pills give the holders of the targets stock other than the bidder the right to purchase stock in the target or the bidders company at a steep discount, making the target unattractive or diluting the acquirers voting power. The early adopters of poison pills also called them shareholder rights plans, ostensibly since they give current shareholders the rights to buy additional shares, but more likely as an attempt to influence public perceptions. A raider-shareholder might disagree with this nomenclature.

Secret ballot Under secret ballot (also called confidential voting), either an independent third party or employees sworn to secrecy are used to count proxy votes, and the management usually agrees not to look at individual proxy cards. This can help eliminate potential conflicts of interest for fiduciaries voting shares on behalf of others, or can reduce pressure by management on shareholder-employees or shareholder-partners. Cumulative voting (see above) and secret ballot, are the only two provisions whose presence is coded as an increase in shareholder rights, with an additional point to G if the provision is absent.

Executive severance agreements These agreements assure high-level executives of their positions or some compensation and are not contingent upon a change in control (unlike Golden or Silver parachutes).

Silver parachutes These are similar to golden parachutes in that they provide severance payments upon a change in corporate control, but unlike golden parachutes, a large number of a firms employees are eligible for these benefits.

Special meeting requirements These provisions either increase the level of shareholder support required to call a special meeting beyond that specified by state law or eliminate the ability to call one entirely.

Supermajority requirements for approval of mergers These charter provisions establish voting requirements for mergers or other business combinations that are higher than the threshold requirements of state law. They are typically 66.7, 75, or 85 percent, and often exceed 42 attendance at the annual meeting. This category includes both the firms with this provision and the firms incorporated in states with a control-share acquisition law. These laws require a majority of disinterested shareholders to vote on whether a newly qualifying large shareholder has voting rights. In practice, such laws work much like supermajority requirements.

Unequal voting rights These provisions limit the voting rights of some shareholders and expand those of others. Under time-phased voting, shareholders who have held the stock for a given period of time are given more votes per share than recent purchasers. Another variety is the substantial-shareholder provision, which limits the voting power of shareholders who have exceeded a certain threshold of ownership.

Limitations on action by **written consent** These limitations can take the form of the establishment of majority thresholds beyond the level of state law, the requirement of unanimous consent, or the elimination of the right to take action by written consent.

Governance index counts the number of those twenty-four provisions in an individual firm's charter. Higher value of governance index means greater power for management and less power for shareholders. Bebchuk, Cohen, and Ferrell (2005) argues that the twenty-four provisions do not have the same relevance in determining shareholder value and some of the provisions are products of other provisions. They conclude that six out of the twenty-four provisions play a substantial and independent role in determining shareholder value: staggered boards, limits to shareholder amendments of the bylaws, supermajority requirements for mergers, supermajority requirements for charter amendments, poison pills, and golden parachute arrangements. Entrenchment index is the count of these six provisions appearing in a company's charter. Entrenchment index ranges from zero to six.

Chapter 7

Numerical Method: Evolutionary Programming

The computational difficulty in solving models with capital structure comes from the "curse of dimensionality". Compared to the model with all-equity firms, we have one more state variable, current liability, and one more control variable, the optimal next period liability. The conventional algorithm, which searches the optimal control variables on every grid point in the state space, becomes impractical here. Projection method is a widely used method to overcome the "curse of dimensionality". However, to implement the projection method, we need to have a fairly good initial guess of the solution, and the value equation needs to be differentiable. Both requirements are not satisfied here. To solve the problem, I use Evolutionary Programming (EP), which belongs to the family of population-based metaheuristic optimization algorithms that use mechanisms inspired by biological evolution, such as mutation and the survival of the fittest.

Candidate solutions to the optimization problem play the role of individuals in a population, and the cost function determines the environment within which the solutions "live" and the criterion of fitness. The fitness of each individual is evaluated. Multiple individuals are stochastically selected from the current population based on their fitness and modified using operators, such as mutation and crossover, to form a new population. Evolution of the population then takes place after the repeated application of the above operators. Gomme (1997) and Allen and Karjalainen (1999) are the applications of EP in Economics and Finance. Heer and Maubner (2005) provide details about different versions of the Evolutionary Programming. I use the plain vanilla version of the evolutionary algorithm, which works as follows.

1. Choose nk grid points in the range of $[k_{min}, k_{max}]$ for k and nl grid points in the range of $[l_{min}, l_{max}]$ for l. Use discrete Markov process for the productivity shocks, such that $x \in \mathcal{X} \equiv \{x_1, \ldots, x_{nx}\}$ and $z \in \mathcal{Z} \equiv \{z_1, \ldots, z_{nz}\}$. σ_k and σ_l are the radiuses of the searching circles in the space of k and l, respectively. The searching radiuses for the optimal policies will be reduced gradually. Set the starting value for σ_k and σ_l as $(k_{max} - k_{min})/2$ and $(l_{max} - l_{min})/2$, respectively.

2. Make an initial guess, $V^{(0)}(k_{ik}, l_{il}, x_{ix}, z_{iz})$, for the value function of the manager on each of the grid points $(k_{ik}, l_{il}, x_{ix}, z_{iz})$, where $1 \leq ik \leq nk$, $1 \leq il \leq nl$, $1 \leq ix \leq nx$, and $1 \leq iz \leq nz$. If solving for the Democracy firms, the value function of the manager is the same as the equity value. If solving for the Dictatorship firms, make an initial guess, $E^{(0)}(k_{ik}, l_{il}, x_{ix}, z_{iz})$, for the equity value as well.

3. Make NG initial guesses of the optimal policy functions, $(k^{*ig}(ik, il, ix, iz)$, $l^{*ig}(ik, il, ix, iz))$, at each grid point. If solving for the Dictatorship firms, for each guess ig, compute E_{ig} using equation (3.22) at each grid point. Get the indicator of solvency from E_{ig} and compute V_{ig} using equation (3.21) at each grid point. If solving for the Democracy firms, just compute V_{ig}. Define the fitness function for the solution ig as the average of the value functions on all the grid points in the state space under solution ig, i.e.,

$$F(ig) = \frac{1}{nk \times nl \times nx \times nz} \sum_{\forall \{ik,il,ix,iz\}} V_{ig}(k_{ik}, l_{il}, x_{ix}, z_{iz} \,|\, k^{*ig}(ik, il, ix, iz),\, l^{*ig}(ik, il, ix, iz)) \,.$$

Sort the guesses according to their values of the fitness function in the descending order and re-index the guesses such that

$$F_1 \geq F_2 \geq \ldots \geq F_{NG} \,.$$

4. Update the value function of the manager according to

$$V^{(1)}(k_{ik}, l_{il}, x_{ix}, z_{iz}) = \max_{ig \leq NG} \{V_{ig}(k_{ik}, l_{il}, x_{ix}, z_{iz} \,|\, k^{*ig}(ik, il, ix, iz),\, l^{*ig}(ik, il, ix, iz))\} \,. \quad (7.1)$$

Replace guess $NG/2$ with the policy functions that achieves the maximum in equation (7.1).

5. Update guesses $ig \in \{NG/2+1, \ldots, NG\}$ according to the following rule:

$$\begin{aligned} k^*_{ig}(k_{ik}, l_{il}, x_{ix}, z_{iz}) &= \min\{k_{max}, \max\{k_{min}, k^*_{ig-NG/2}(k_{ik}, l_{id}, x_{ix}, z_{iz}) + \epsilon_k\}\}\,; \\ l^*_{ig}(k_{ik}, l_{il}, x_{ix}, z_{iz}) &= \min\{l_{min}, \max\{l_{max}, l^*_{ig-NG/2}(k_{ik}, l_{il}, r_{ir}, x_{ix}, z_{iz}) + \epsilon_l\}\} \\ & \quad \forall \ \ \{ik, il, ix, iz\}\,, \end{aligned}$$

where

$$\begin{aligned} \epsilon_k &\sim \mathcal{N}(0, \sigma_k)\,; \\ \epsilon_l &\sim \mathcal{N}(0, \sigma_l)\,. \end{aligned}$$

6. Repeat steps $3-5$ until either the best policy functions in step 4 have not changed for NC iterations, or a total of NI iterations have been completed. I set $NC = 20$ and $NI = 200$.

7. Reduce σ_k and σ_l to half of their values, respectively.

8. Repeat $3-7$ until σ_k and σ_l are sufficiently small, e.g., less than $1e-5$.

9. Repeat $3-8$ with a different set of initial guesses and include the optimal k^* and l^* from the last run. Use the value function from the last run as the initial guess $V^{(0)}(k_{ik}, l_{il}, x_{ix}, z_{iz})$ in step 3. Stop when the algorithm reaches the same global maximum.

Chapter 8

Proofs

Proof of Proposition 1: After the investment is made, the value of the newly installed capital, which is also $\frac{1}{N}$ of the value of the installed capital before expropriation from the manager, is

$$V_0(y) = \frac{y}{\mu}$$

where, given the risk-free interest rate r_f, μ is the risk and growth adjusted discount factor, defined as

$$\mu = r_f + \phi\sigma\rho_{ym} - \pi\,.$$

The value of the investment option *per share*, is defined as $F^m(y)$ for the manager and $F^s(y)$ for the outside shareholders. The manager will exercise the option optimally to maximize the option value to him, which is not the first best to outside shareholders. Both $F^s(y)$ and $F^m(y)$ satisfy the following ordinary differential equation (ODE)

$$\frac{1}{2}\sigma^2 y^2 F''(y) + (r_f - \mu) y F'(y) - r_f F(y) = 0\,.$$

The general solution of the ODE is

$$F(y) = A_1\, y^{\beta_1} + A_2\, y^{\beta_2}\,,$$

where A_1 and A_2 are constants to be determined, and $\beta_1 > 1$ and $\beta_2 < 0$ are the two roots of the quadratic function

$$\frac{1}{2}\sigma^2 \beta(\beta - 1) + (r_f - \mu)\beta - r = 0\,.$$

The value of the expansion option is determined by the boundary conditions.

First, let's determine the value of $F^m(y)$. Define y^* as the exercise price. The manager's *per share* value of the investment option before investment cost I at y^* is given by

$$V^m(y^*) = \theta(\eta)\frac{y^*}{\mu}\,. \tag{8.1}$$

where

$$\theta(\eta) = 1 + \frac{(1-\alpha)^2}{2\alpha\eta} > 1\,. \tag{8.2}$$

and $\theta(\eta)$ is larger than 1, meaning that the manager gets more cash flows from owning one share of the firm than outside shareholders. The second term in the right hand side of equation (8.2) represents the perks received by the manager. We can see that θ is a decreasing function of η, which is consistent with less expropriation under better governance. To determine the value of A_1^m, A_2^m, and the price y^* at which the option is exercised, we need three boundary conditions:

$$F^m(y=0) = 0; \tag{8.3}$$

$$F^m(y^*) = V^m(y^*) - I; \tag{8.4}$$

$$F_y^m(y^*) = V_y^m(y^*), \tag{8.5}$$

where F_y^m and V_y^m are the first-order derivatives of F^m and V^m with respect to y, respectively. The second equation is the value-matching condition, which requires that the value of the option equals the net value obtained by exercising it. The third equation is the smooth pasting condition, which is satisfied when the manager chooses y^* to maximize his option value. With these three boundary conditions, we can solve for A_1^m, A_2^m, and y^*:

$$y^* = \frac{\beta_1 I \mu}{(\beta_1 - 1)\theta(\eta)}; \tag{8.6}$$

$$A_1^m = \left(\frac{\beta_1 - 1}{I}\right)^{\beta_1 - 1} \left(\frac{\theta(\eta)}{\beta_1 \mu}\right)^{\beta_1}; \tag{8.7}$$

$$A_2^m = 0. \tag{8.8}$$

It's clear that y^* is an increasing function of η, meaning that entrenched manager tends to exercise the option earlier than the first best decision where η equals infinity.

Knowing the exercising price y^*, we can solve the option value for outside shareholders. Since the manager does not exercise the option to maximize outside shareholders' value, the smooth pasting condition is not satisfied here. The boundary conditions for outside shareholders are

$$F^s(y=0) = 0; \tag{8.9}$$

$$F^s(y^*) = V^s(y^*) - I, \tag{8.10}$$

where the *per share* present value of future cash flows $V^s(y)$ is given by

$$V^s(y) = \frac{(1-s^*)y}{\mu}.$$

Substitute the value of y^* that we get from solving the manager's maximization problem, we get

$$A_1^s(\eta) = \left(\frac{\beta_1 \mu}{\beta_1 - 1}\right)^{-\beta_1} I^{1-\beta_1} \left[\frac{\beta_1(1-s^*)}{\beta_1 - 1}\theta(\eta)^{\beta_1 - 1} - \theta(\eta)^{\beta_1}\right]; \tag{8.11}$$

$$A_2^s = 0. \tag{8.12}$$

Therefore, the value of the firm consisting with the value of asset in place and the value of the expansion option can be written as

$$V(y) = \frac{(1-s^*)Ny}{\mu} + A_1^s(\eta)\, y^{\beta_1}. \tag{8.13}$$

The correlation of net return on firm stock and market portfolio times the standard deviation of the net return on the stock is given by

$$\begin{aligned} corr\left(\frac{dm}{m}, \frac{dV}{V}\right) std\left(\frac{dV}{V}\right) &= corr\left(\frac{dm}{m}, \frac{V_y y}{V}\sigma dz\right) std\left(\frac{V_y y}{V}\sigma dz\right) \\ &= \frac{V_y y}{V}\sigma\, corr\left(\frac{dm}{m}, \frac{dy}{y}\right) \\ &= \frac{V_y y}{V}\sigma\, \rho_{ym} \\ &= \left[1 + (\beta_1 - 1)\frac{F^s}{V}\right]\sigma\, \rho_{ym}\,. \end{aligned} \tag{8.14}$$

where

$$\begin{aligned} \frac{F^s}{V} &= \frac{A_1^s(\eta)\, y^{\beta_1}}{\frac{(1-s^*)Ny}{\mu} + A_1^s(\eta)\, y^{\beta_1}} \\ &= \frac{1}{\frac{1-s^*}{A_1^s(\eta)}\frac{Ny^{1-\beta_1}}{\mu} + 1}\,. \end{aligned} \tag{8.15}$$

Next I show that $\frac{F^s}{V}$ is an increasing function of η by showing $\frac{A_1^s}{1-s^*}$ is an increasing function of η.

$$\begin{aligned} \frac{\partial A_1^s(\eta)/(1-s^*)}{\partial \eta} &= \left(\frac{\beta_1 \mu}{\beta_1 - 1}\right)^{-\beta_1} I^{1-\beta_1}\frac{s^*\theta^{\beta_1 - 2}}{\eta}\left[\frac{\beta_1 s^*(1-\alpha^2)}{4\alpha^2(1-s^*)} + \left(\frac{\theta}{1-s^*}\right)^2\right] \\ &> 0 \end{aligned} \tag{8.16}$$

Outside shareholders' expected return can be easily calculated as

$$r^s = r_f + \phi\sigma\rho_{ym}\left[1 + (\beta_1 - 1)\frac{F^s}{V}\right]\,. \tag{8.17}$$

Therefore, the expected return of the firm increases with the strength of corporate governance. Moreover, from equation (8.13) and (8.30), it is clear that the firm value V is an increasing function of η.

Proof of Proposition 2: To simplify notations, let's still use $F(y)$ as the value of this exit option. Again, since the manager has different objectives from outside shareholders, the value of the exit option to the manager, denoted by $F^m(y)$, is different from the value to outside shareholders, denoted by $F^s(y)$. The ODE that defines $F(y)$ is the same as the ODE that defines the expansion option and has the general solution

$$F(y) = A_1\, y^{\beta_1} + A_2\, y^{\beta_2}\,.$$

However, the boundary conditions are different now. For the manager, these conditions are

$$F^m(y \to \infty) \;=\; 0\,; \tag{8.18}$$

$$F^m(y^*) \;=\; I - V^m(y^*)\,; \tag{8.19}$$

$$F^m_y(y^*) \;=\; -V^m_y(y^*)\,. \tag{8.20}$$

For outside shareholders, the boundary conditions are:

$$F^s(y \to \infty) \;=\; 0\,; \tag{8.21}$$

$$F^s(y^*) \;=\; I - V^s(y^*)\,. \tag{8.22}$$

Following the same procedure, we can get

$$\begin{aligned}
y^* &= \frac{-\beta_2 I \mu}{(1-\beta_2)\theta(\eta)}\,; && (8.23)\\
A_1^m &= 0\,; && (8.24)\\
A_2^m &= \left(\frac{I}{1-\beta_2}\right)^{1-\beta_2}\left[\frac{-\beta_2\mu}{\theta(\eta)}\right]^{-\beta_1}\,; && (8.25)\\
A_1^s &= 0\,; && (8.26)\\
A_2^s(\eta) &= I^{1-\beta_2}\left(\frac{-\beta_2\mu}{1-\beta_2}\right)^{-\beta_2}\left[\theta(\eta)^{\beta_2} - \frac{-\beta_2(1-s^*)}{1-\beta_2}\theta(\eta)^{\beta_2-1}\right]. && (8.27)
\end{aligned}$$

With the same argument, we can show that the exercise price y^* is lower when η is lower. Therefore, the more entrenched manager would wait longer to divest. The value of a single share of the firm's publicly traded stock is given by

$$V(y) = \frac{(1-s^*)Ny}{\mu} + A_2^s(\eta)\, y^{\beta_2}\,, \tag{8.28}$$

and the expected stock return is

$$\begin{aligned}
r^s &= r_f + \phi\sigma\rho_{ym}\left[1-(1-\beta_2)\frac{F^s}{V}\right]\\
&= r_f + \phi\sigma\rho_{ym}\left[1-(1-\beta_2)\frac{1}{1+\frac{1-s^*}{A_2^s(\eta)}\frac{Ny^{1-\beta_2}}{\mu}}\right] && (8.29)
\end{aligned}$$

With a higher η, the manager expropriates less and hence the value of asset in place is larger. Therefore, a sufficient condition for the total firm value to be an increasing function of η is a condition that guarantees the positive relation between the value of the divest option and η. We can calculate that

$$\begin{aligned} \frac{dA_2^s}{\eta} &= \frac{\partial A_2^s}{\theta}\frac{\theta}{\eta} + \frac{\partial A_2^s(\eta)}{s^*}\frac{s^*}{\eta} \\ &= \mu^{-\beta_2}\left(\frac{-I\beta_2}{1-\beta_2}\right)^{1-\beta_2}\theta^{\beta_2-2}s^{*2}\left[\frac{s^*(1-\beta_2)(1+\alpha)}{4\alpha^2} - \frac{2\alpha+(1-\alpha)s^*}{1-\alpha}\right] \end{aligned} \tag{8.30}$$

which means as long as

$$\frac{s^*(1-\beta_2)(1+\alpha)}{4\alpha^2} > \frac{2\alpha+(1-\alpha)s^*}{1-\alpha}$$

$$\Longrightarrow$$

$$\beta_2 < \frac{1-\alpha}{1+\alpha} - \frac{4\alpha^2}{s^*(1-\alpha^2)}, \tag{8.31}$$

the value of the firm increases with η.

The expected return decreases with η as long as $A_2^s(\eta)/(1-s^*)$ increases with η. To find the condition that guarantees the negative relation between the expected return and the governance strength, let's first simplify $A_2^s(\eta)/(1-s^*)$.

$$\begin{aligned} \frac{A_2^s(\eta)}{1-s^*} &= I^{1-\beta_2}\left(\frac{-\beta_2\mu}{1-\beta_2}\right)^{-\beta_2}\left[\frac{\theta^{\beta_2}}{1-s^*} + \frac{\beta_2}{1-\beta_2}\theta^{\beta_2-1}\right] \\ &= I^{1-\beta_2}\left(\frac{-\beta_2\mu}{1-\beta_2}\right)^{-\beta_2}\Theta(\eta) \end{aligned} \tag{8.32}$$

where

$$\Theta(\eta) \equiv \left[\frac{\theta^{\beta_2}}{1-s^*} + \frac{\beta_2}{1-\beta_2}\theta^{\beta_2-1}\right]. \tag{8.33}$$

Differentiate Θ with respect to η, one obtains

$$
\begin{aligned}
\frac{d\Theta(\eta)}{d\eta} &= \frac{\partial\Theta(\eta)}{\partial\theta}\frac{\partial\theta}{\partial\eta} + \frac{\partial\Theta(\eta)}{\partial s^*}\frac{\partial s^*}{\partial\eta} \\
&= \frac{(1-\alpha)\theta^{\beta_2-2}}{\eta^2(1-s^*)^2}\left[\frac{-\beta_2(1-\alpha)(1-s^*)}{2\alpha}(\theta-1+s^*)-\theta^2\right] \\
&= \frac{(1-\alpha)\theta^{\beta_2-2}}{\eta^2(1-s^*)^2}\left[\frac{-\beta_2(\theta-1)(1-s^*)(1+\alpha)}{2\alpha}-\theta^2\right]. \qquad (8.34)
\end{aligned}
$$

Therefore, the condition to have a negative relation between the expected return and governance equality is given as follows.

$$
\frac{-\beta_2(\theta-1)(1-s^*)(1+\alpha)}{2\alpha} - \theta^2 > 0. \qquad (8.35)
$$

Hence,

$$
\begin{aligned}
\beta_2 &< -\frac{2\alpha\theta^2}{(\theta-1)(1-s^*)(1+\alpha)} \\
&= -\frac{[2\alpha+(1-\alpha)s^*]^2}{s^*(1-s^*)(1-\alpha^2)}. \qquad (8.36)
\end{aligned}
$$

Next, I show that condition (8.31) is less restrictive than condition (8.36). Since s^* and α are both positive and less than 1, one obtains that

$$
\frac{[2\alpha+(1-\alpha)s^*]^2}{s^*(1-s^*)(1-\alpha^2)} > \frac{4\alpha^2}{s^*(1-\alpha^2)}.
$$

Therefore, it is straightforward to show that

$$
-\frac{[2\alpha+(1-\alpha)s^*]^2}{s^*(1-s^*)(1-\alpha^2)} < \frac{1-\alpha}{1+\alpha} - \frac{4\alpha^2}{s^*(1-\alpha^2)}.
$$

Proof of Lemma 1: Applying Leibniz's rule, we obtain

$$\frac{\partial \mathbb{E}_t[M_{t+1}\mathbf{1}_{t+1}]}{\partial l_{t+1}} = -\mathbb{E}_t\left[M_{t+1}\frac{\partial z_d}{\partial l_{t+1}}\right] \leq 0 \tag{8.37}$$

$$\frac{\partial \mathbb{E}_t[M_{t+1}\mathbf{1}_{t+1}]}{\partial k_{t+1}} = -\mathbb{E}_t\left[M_{t+1}\frac{\partial z_d}{\partial k_{t+1}}\right] \geq 0 \tag{8.38}$$

where z_d is the threshold level of the productivity shock at which the equity value is zero, i.e.,

$$\mathbb{E}(l_{t+1}, k_{t+1}, x_{t+1}, z_d(l_{t+1}, k_{t+1}, x_{t+1})) = 0\,. \tag{8.39}$$

Redefine the residual value as the value of debt repayment minus bankruptcy cost

$$\begin{aligned} R_{t+1}(k_{t+1}, x_{t+1}, z_{t+1}) &= p_{t+1} - BC(k_{t+1}, x_{t+1}, z_{t+1}) \\ &= \frac{l_{t+1}}{1-\tau_c} - \frac{\tau_c}{1-\tau_c}d_{t+1} - BC(k_{t+1}, x_{t+1}, z_{t+1})\,. \end{aligned} \tag{8.40}$$

By the definition of R_{t+1}, we know that the bankruptcy cost BC is non-negative. It can be shown that

$$\frac{\partial d_{t+1}}{\partial l_{t+1}} = \frac{\mathbb{E}_t[M_{t+1}\mathbf{1}_{t+1}]}{1-\tau_c+\tau_c\mathbb{E}_t[M_{t+1}\mathbf{1}_{t+1}]} - \frac{\mathbb{E}_t[M_{t+1}BC_{t+1}\frac{\partial z_d}{\partial l_{t+1}}]}{\left(1+\frac{\tau_c}{1-\tau_c}\mathbb{E}_t[M_{t+1}\mathbf{1}_{t+1}]\right)^2} \tag{8.41}$$

$$\frac{\partial d_{t+1}}{\partial k_{t+1}} = \frac{\mathbb{E}_t[M_{t+1}R_{kt+1}(1-\mathbf{1}_{t+1}]) - \mathbb{E}_t[M_{t+1}BC_{t+1}\frac{\partial z_d}{\partial k_{t+1}}]}{\left(1+\frac{\tau_c}{1-\tau_c}\mathbb{E}_t[M_{t+1}\mathbf{1}_{t+1}]\right)^2}\,. \tag{8.42}$$

The first term in $\frac{\partial d_{t+1}}{\partial l_{t+1}}$ is positive and decreases to zero as l_{t+1} increases. The second term is zero when l_{t+1} is small (BC is zero) and increases as l_{t+1} increases.

Therefore, the value of $\frac{\partial d_{t+1}}{\partial l_{t+1}}$ changes from positive to negative as l_{t+1} becomes larger. It's straightforward to see that $\frac{\partial d_{t+1}}{\partial k_{t+1}}$ is always positive. **Q.E.D.**

Proof of Proposition 3: The marginal benefits of expropriation is given by

$$MB_t = y_t - f\,. \tag{8.43}$$

The marginal cost of expropriation when the firm pays dividends is given by

$$MC_t^d = \alpha(1-\tau_c)y_t + s_t\eta y_t \tag{8.44}$$

and the marginal cost of expropriation when the firm raises equity is given by

$$MC_t^e = (1+\mathbf{1}_{\pi_t<0})[\alpha(1-\tau_c)y_t + s_t\eta y_t]\,. \tag{8.45}$$

If the firm pays dividends, the manager chooses the optimal expropriation rate s^d such that MB_t equals MC_t^d. If the firm issues equity, the optimal expropriation rate is s^e at which MB_t equals MC_t^e. The values of s^d and s^e are given by

$$s^d = \frac{1-(1-\tau_c)\alpha}{\eta}\,; \tag{8.46}$$

$$s^e = \frac{1-(1+\lambda_1)(1-\tau_c)\alpha}{\eta}\,. \tag{8.47}$$

It is straightforward that both s^d and s^e decrease with η. Therefore, the optimal expropriation rate is a decreasing function of η. Since λ_1 is positive, the expropriation rate while issuing equity is smaller than that while paying dividends.

The expropriation rate at the point where the firm switches from dividend-paying regime to equity-issuing regime is given by $\tilde{s}_t$, defined in equation 3.4.1. When $\tilde{s}_t$ is larger than s^d, the manger can keep the high expropriation rate s^d and still distribute dividends. When $\tilde{s}_t$ is smaller than s^e, the firm needs to raise equity and the manager has to expropriate at the low rate s^e. When the value of $\tilde{s}_t$ falls between s^e and s^d, the manager will expropriate at the rate $\tilde{s}_t$ so that the firm neither distributes dividends nor issues equity. **Q.E.D.**

Proof of Proposition 4: For firms in the same financial regime, we only need to show that θ decreases with η. Substitute the optimal choice of the expropriation rate into the expression of θ, one obtains

$$\theta = 1 + \frac{[1 - \alpha(1 + \lambda_1 \mathbf{1}_{\pi_{t+1}<0})(1 - \tau_c)]^2}{\alpha(1 - \tau_c)(1 + \lambda_1 \mathbf{1}_{\pi_{t+1}<0})} \frac{1}{\eta} > 1\,, \tag{8.48}$$

which implies a negative relation between θ and η. **Q.E.D.**

Bibliography

Albuquerque, R. and N. Wang (2007). Investor protection and asset pricing. forthcoming, *Journal of Finance.*

Allen, F. and R. Karjalainen (1999). Using genetic algorithms to find technical trading rules. *Journal of Financial Economics 51*, 245–271.

Altinkilic, O. and R. S. Hansen (2000). Are there economies of scale in underwriting fees? Evidence of rising external financing costs. *Review of Financial Studies 13*, 191–218.

Altman, E. I. (1984). A further emipircal investigation of the bankruptcy cost question. *Journal of Finance 39*, 1067–1089.

Barclay, M. J. and C. G. Holderness (1989). Private benefits from control of public corporations. *Journal of Financial Economics 25*, 371–395.

Bebchuk, L., A. Cohen, and A. Ferrell (2005). What matters in corporate governance? Manuscript, Harvard Law School and NBER.

Berk, J. B., R. C. Green, and V. Naik (1999). Optimal investment, growth options, and security returns. *Journal of Finance 54*, 1153–1607.

Campbell, J. Y. and J. H. Cochrane (1999, April). By force of habit:

A consumption-based explanation of aggregate stock market behavior. *Journal of Political Economy 107*(2), 205–251.

Campbell, S. D. (2005). Stock market volatility and the great moderation. FEDs working paper No. 2005-47.

Carhart, M. (1997). On persistence in mutual fund performance. *Journal of Finance 52*, 57–82.

Carlson, M., A. Fisher, and R. Giammarino (2004). Corporate investment and asset price dynamics: Implications for the cross section of returns. *Journal of Finance 59*(6), 2577–2603.

Clarida, R., J. Galí, and M. Gertler (2000). Monetary policy rules and macroeconomic stability: evidence and some theory. *Quarterly Journal of Economics 115*, 147.

Constantinides, G. M. and D. Duffie (1996). Asset pricing with heterogeneous consumers. *Journal of Political Economy 104*, 219–240.

Core, J. E., W. R. Guay, and T. O. Rusticus (2006). Does weak governance cause weak stock returns? An examamination of firm operating performance and investors' expectations. *Journal of Finance 61*, 655.

Core, J. E., R. W. Holthausen, and D. F. Larker (1999). Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics 51*, 371.

Cremers, M. K., V. B. Nair, and K. John (2005). Takeovers, governance and the cross-section of returns. Manuscript, Yale School of Management, and The

Wharton School, University of Pennsylvania, and Stern School of Business, New York University.

Dixit, A. and P. S. Pindyck (1994). *Investment Under Uncertainty.* NJ: Princeton University Press.

Doidge, C. (2004). U.S cross-listings and the private benefits of control: Evidence from dual-class firms. *Journal of Financial Economics 72*, 519–553.

Durnev, A. and E. H. Kim (2005). To steal or not to steal: Firm attributes, legal environment, and valuation. *Journal of Finance 60*, 1461–1493.

Fahlenbrach, R. (2003). Shareholder rights and CEO compensation. Manuscript, The Wharton School, University of Pennsylvania.

Fama, E. F. and K. R. French (1992). The cross-section of expected stock returns. *Journal of Finance 67*, 427–465.

Fama, E. F. and K. R. French (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics 33*, 3–56.

Fama, E. F. and K. R. French (1995). Size and book-to-market factors in earnings and returns. *Journal of Finance 50*, 131–155.

Fama, E. F. and K. R. French (2005). Financing decisions: Who issue stocks? *Journal of Financial Economics 76*, 549–582.

Fama, E. F. and J. D. MacBeth (1973). Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy 81*, 607–636.

Gomes, J. F., L. Kogan, and L. Zhang (2003). Equilibrium cross section of returns. *Journal of Political Economy 111*, 693–732.

Gomme, P. (1997). Evolutionary programming as a solution technique for the Bellman Equation. Manuscript, Federal Reserve Bank of Cleveland.

Gompers, P., J. Ishii, and A. Metrick (2003). Corporate governance and equity prices. *Quarterly Journal of Economics 118*, 107–155.

Heer, B. and A. Maubner (2005). *Dynamic General Equilibrium Modelling: computational Methods and Applications.* Springer.

Hennessy, C. A. and T. M. Whited (2005). Debt dynamics. *Journal of Finance 60*, 1129–1165.

Hennessy, C. A. and T. M. Whited (2006). How costly is external financing? Evidence from a structural estimation. Manuscript, University of California, Berkeley and University of Wisconsin, Madison.

Himmelberg, C. P., G. R. Hubbard, and I. Love (2006). Investor protection, ownership, and the cost of capital. Manuscript, Columbia University, Columbia University, and The World Bank.

Holderness, C. G. and D. P. Sheehan (1988). The role of majority shareholders in publicly held corporations. *Journal of Financial Economics 20*, 317–346.

Jensen, G. R., J. M. Mercer, and R. R. Johnson (1996). Business conditions, monetary policy, and expected secutrity returns. *Journal of Financial Economics 40*, 213–237.

Jensen, M. (1986). Agency costs of free cash flow, corporate finance and takeovers. *American Economic Review 76*, 323–329.

Kim, C.-J. and C. R. Nelson (1999). Has the U.S. economy become more stable?: A Bayesian approach based on a Markov-Switching model of the business cycle. *Review of Economics and Statistics 81*, 608–616.

Klock, M. S., S. A. Mansi, and W. F. Maxwell (2005). Does corporate governance matter to bondholders? *Journal of Financial and Quantitative Analysis 40*, 693–719.

Kothari, S. P. and J. Shanken (1997). Book-to-market, dividend yield, and expected market returns: A time-series analysis. *Journal of Financial Economics 44*, 169–203.

La Porta, R., F. Lopez-de Silanes, A. Shleifer, and R. Vishney (2002). Investor protection and corporate valuation. *Journal of Finance 57*, 1147–1170.

Lan, Y. and N. Wang (2003). Investor protection and investment. Manuscript, University of Rochester.

Li, E. X., D. Livdan, and L. Zhang (2006). Optimal market timing. Manuscript, University of California, Berkeley, University of Michigan, and Unviversity of Michigan.

Litov, L. P. (2005). Corporate governance and financing policy: New evidence. Manuscript, Stern School of Business, New York University.

Lyandres, E., L. Sun, and L. Zhang (2005). Investment-based underperformance following seasoned equity offerings. Manuscript, Rice University and University of Rochester.

McConnell, M. M. and G. Perez-Quiros (2000). Output fluctuations in the United States: What has changed since the early 1980's. *American*

Economic Review 90, 1464–1476.

Morellec, E. (2004). Can managerial discretion explain observed leverage ratios? *Review of Financial Studies 17*, 257–294.

Mork, R., A. Shleifer, and R. Vishney (1988). Management ownership and market valuation: an empirical analysis. *Journal of Financial Economics 10*, 293–315.

Moyen, N. (2004). Investment-cash flow sensitivity: Constrained versus unconstrained firms. *Journal of Finance 69*, 2061–2092.

Moyen, N. (2006). How big is the debt overhang problem? Manuscript, University of Colorado, Boulder.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics 5*, 147–175.

Nenova, T. (2003). The value of corporate votes and control benefits: Cross-country analysis. *Journal of Financial Economics 68*, 325–351.

Ofek, E. and D. Yermack (2000). Taking stock: Equity-based compensation and the evolution of managerial ownership. *Journal of Finance 3*, 1367–1384.

Petkova, R. and L. Zhang (2005). Is value riskier than growth? *Journal of Financial Economics 78*, 187–202.

Philippon, T. (2004). Corporate governance over the business cycle. Manuscript, New York University.

Pontiff, J. and L. Schall (1999). Book-to-market as a predictor of market returns. *Journal of Financial Economics 49*, 141–160.

Richardson, S. (2005). Over-investment of free cash flow. Manuscript, The Wharton School, University of Pennsylvania.

Shleifer, A. and D. Wolfenzon (2002). Investor protection and equity market. *Journal of Financial Economics 66*, 3–27.

Stock, J. H. and M. W. Watson (1999). Has the business cycle changed? Evidence and explanations. *Journal of Economic Perspectives 13*, 23–44.

Strebulaev, I. A. (2007). Do tests of capital structure theory mean what they say? *Journal of Financial Economics*. Forthcoming.

Warner, J. (1977). Bankruptcy costs: Some evidence. *Journal of Finance 32*, 337–347.

Yang, M. Y. (2005). Effects of corporate governnace and agency conflicts along business cycles. Manuscript, William E. Simon School of Business Administration, University of Rochester.

Zhang, L. (2005). The value premium. *Journal of Finance 60*, 67.