Three Essays on Corporate Governance

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

in

THE FACULTY OF GRADUATE STUDIES
(Business Administration)

THE UNIVERSITY OF BRITISH COLUMBIA

June, 2005
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Abstract

The thesis is comprised of three essays on corporate governance. The first essay empirically tests the claim that well governed firms are safe investments and provide superior stock returns. The results show that well governed firms in fact are unusually risky, even after controlling for variables such as firm age, size and leverage. The positive and significant relationship between stock return volatility and good corporate governance also cannot be explained completely by managerial risk-taking behavior, as suggested in standard agency theory. I find that the reported abnormally high return (Gompers, Ishii and Metrick, 2003) for well governed firms is largely driven by two factors: penny stocks and outliers. By showing that there is actually no abnormal return, the essay suggests that the high firm-level risk associated with good governance is not priced and can be diversified away.

In the second essay, I demonstrate that growth prospects play a crucial role in determining a firm's governance structure choices. When growth prospects are extremely promising, board structure choices are irrelevant. When growth prospects are modest, a firm may need to voluntarily adopt a friendly board to encourage its manager to undertake risky investments. When growth prospects are weak, an independent board is needed to avoid managerial misbehavior. The model explains why empirical evidence concerning the relationship between board independence and firm performance is mixed. Also, it predicts various announcement effects across firms with different board structures. The essay suggests that improvement in legal protection can be beneficial for shareholders, but regulatory agencies' requirements aimed at increasing board independence may in fact destroy firm values and growth opportunities.

In the third essay, I modify the standard agency model to explain certain predictions provided by sociology-based executive compensation theories. When a director is also a CEO of another company, concerns about his own compensation and the non-pecuniary private benefits of being a director can affect his decisions when designing the incentive contract for the CEO. Under certain conditions, the model generates predictions consistent with those of social comparison theory, social exchange theory and social similarity theory. This simple model also provides testable implications about how and where the predictions of these social compensation theories will break.
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Acknowledgements

I would like to thank my supervisor, Murray Frank, for his guidance and support throughout my years at UBC. I also like to thank Tan Wang and Ralph Winter and seminar participants at UBC for their helpful comments. Many thanks also to my friends at UBC for listening and encouraging me. Most importantly, I am grateful to my parents and my sister for their unconditional support.
Introduction

This thesis is comprised of three essays on corporate governance. The first essay empirically tests the claim that investing in well governed firms is less risky and can generate superior returns. It also examines potential explanations for these findings. The second essay focuses on the optimal corporate board structure choices faced by firms with different growth opportunities. The interactions between board structures and several extensions such as investor protection, earnings management and over-optimistic boards/managers are also explored. The third essay analyzes the CEO compensation decisions of a corporate director (i.e., a director who is a CEO of another company). The modified agency model provided in this essay can account for the predictions of three major sociology-based executive compensation theories.

The first essay investigates the claim that well governed firms are safe investments and are associated with abnormally high returns. This claim seems to be contrary to standard financial theory in which there is a trade-off between risk and returns. In this essay, I find that well governed firms in fact demonstrate unusually high risk at both the portfolio level and firm level. Even after controlling for variables such as firm age, size and leverage, the positive relationship between high stock return volatility and good governance remains. I explore potential explanations for these findings. Neither managerial risk-taking behavior nor investor uncertainty are able to account completely for the positive relationship.

Finally, I examine whether well governed firms are associated with superior returns. Gompers, Ishii and Metrick (2003) provide strong evidence that the trading strategy of buying shares in well governed firms and shorting badly governed firms generated abnormally high returns in the 1990s. They suggest that the abnormal returns are due to the fact that investors underestimated the benefits of good corporate governance. On the contrary, the results found in this essay indicate that the abnormal returns are driven by two factors: penny stocks and outliers (the "Cisco effect"). By showing that there is actually no abnormal return, this essay suggests that the high firm-level risk associated with good governance is not priced and can be diversified away.
In the second essay, I provide a theoretical model of optimal corporate board structure choices. Fundamentally, when a possible project is available, someone must decide whether to go ahead. If the project is started, then as time progresses someone must decide whether to continue, or to stop. Who gets to make these decisions depends on the firm's board structure. Essentially, this essay studies the allocation of decision making rights between the board and the manager.

I demonstrate that growth prospects are crucial in determining a firm's governance structure choices. When growth prospects are extremely promising, board structure choices are irrelevant, because even an independent board behaves exactly like a friendly board. When growth prospects are modest, a firm may need to voluntarily adopt a friendly board to encourage its manager to undertake risky investments. When growth prospects are weak, an independent board is needed to avoid managerial misbehavior.

These results explain why empirical evidence concerning the relationship between board independence and firm performance is mixed. The model also predicts various announcement effects across firms with different board structures. In additional to the manager's project selection problem, I explore interactions between board structures and legal protection. The research suggests that improvement in legal protection can be beneficial for shareholders in the sense that asset diversion behavior can be avoided. However, regulatory agencies' requirements aimed at increasing board independence may in fact destroy firm values and growth opportunities.

In the third essay, I develop a simple agency model to account for several predictions under sociology-based compensation theories. In the standard economics-based CEO compensation literature, researchers usually assume that a risk-neutral, well-diversified principal determines the CEO's compensation. In the real world, it has been found that CEO compensation is usually set by directors who are risk-averse, undiversified CEOs from other companies. Management researchers thus suggest sociology-based theories, rather than the economics-based agency framework, should better explain how CEO compensation is determined.

Following the fact that directors are usually CEOs of other firms, in this essay I assume the CEO cares about his own compensation awarded by his home company, as well as the non-pecuniary private benefits generated from being a director. The key assumption is that the non-pecuniary
benefits are closely related to the shareholder wealth of the firm for which the director sits on the board. Because the director's personal compensation and his non-pecuniary private benefits are correlated, this gives the director incentive to adjust the CEO's compensation package when his own compensation scheme changes.

Based on this simple idea, I suggest that three major social compensation theories - social comparison theory, social exchange theory and social similarity theory - can in fact be explained by a rational economics-based model. Under certain conditions, I demonstrate a positive relationship between the director and the CEO's incentive intensity, a low probability for a corporate director to increase a CEO's incentive intensity when environmental uncertainty decreases, and a negative relationship between incentive intensity and CEO/director characteristic similarity. The simple model also offers testable implications regarding how and where the predictions of these social compensation theories will fail.

In summary, these three essays suggest that certain popular views about corporate governance may be misleading. Well governed firms do not seem to be safe investments and to offer superior returns. Imposing a strong board structure can be detrimental to firms with modest growth opportunities. Directors' "social" concerns when making compensation decisions can also be rationalized by their self-interested incentives toward risk sharing. The thesis thus provides cautions on blindly promoting certain corporate governance practices without fully understanding their real benefits and consequences.
Chapter 1

Are Well Governed Firms Safe Investments?

"...companies that emphasize corporate governance and transparency will, over time, generate superior returns and economic performance and lower their cost of capital. The opposite is also true: companies weak in corporate governance and transparency represent increased investment risks and result in a higher cost of capital."\(^1\)

1.1 Introduction

Corporate governance has become one of the most important issues among academics, business professionals and investors due to recent corporate frauds and accounting scandals. There are many different ideas related to the potential benefits of good corporate governance. One popular view is that investing in well governed firms enables investors to enjoy superior returns and low investment risks. Wall Street Journal (Brown, 2003) has reported that companies with worse governance ratings earned much lower returns than companies with good governance ratings over

\(^1\)From the GovernanceMetrics Website (http://www.gmiratings.com)
periods of 12 months, 5 years and 10 years. This low risk/high returns claim is, of course, contrary to standard finance theory, in which there is a tradeoff between risk and returns. This essay examines two main issues. First, are well governed firms really safer investments? Second, do investors obtain abnormally high returns when investing in well governed firms? These questions are crucial in the debate over corporate governance.

The first issue is the riskiness of shares of well governed firms. I consider two definitions of risk: total stock return volatility and firm-level stock return volatility. These definitions are consistent with the idea that the risk associated with corporate frauds and scandals should largely be firm-specific. Empirically, I do not find evidence to support the low risk claim. Well governed firms are actually associated with higher risk than poorly governed firms. This result holds even when controlling for other firm characteristics such as age, size and leverage. In short, the idea that well governed firms are associated with low risk is simply not correct. However, this does not preclude abnormally positive returns.

The second issue is whether investors are able to enjoy abnormally high returns by investing in well governed firms. In a CAPM or APT framework, stock returns are compensation for systematic risk investors have to bear. If markets are efficient, there should not be significant abnormal returns. Interestingly, Gompers et al. (2003) provide evidence that well governed firms exhibit positive abnormal returns and badly governed firms exhibit negative abnormal returns. They interpret their result as reflecting investors’ underestimation of the benefits of good governance during their sample period. The Gompers et al. (2003) result has also been interpreted as providing compelling evidence of the benefits of good corporate governance.

How compelling is the evidence of Gompers et al. (2003)? I consider three aspects: the role of idiosyncratic risk, robustness to minor variation in the firms, and the treatment of penny stocks. The first contention is that an abnormal return will be found if researchers have not controlled fully for priced risk. Recently, Goyal and Santa-Clara (2003) and Malkiel and Xu (2002) both show that idiosyncratic risk is priced. This suggests that high firm-level risk in well governed firms may result in what appears to be high abnormal returns, because the effect of idiosyncratic risk has been ignored. However, I find that idiosyncratic risk does not have the power to explain the anomaly.
A second idea is that the finding of significant abnormal returns might not be robust to minor changes in the sample of firms studied. In fact, during the 1990s, the removal of only two stocks (out of over 200 stocks in any single month) would have been sufficient to remove the significant abnormal returns found in Gompers et al. (2003). These two stocks are Cisco and Waste Management. Cisco is categorized as a good governance stock, while Waste Management is categorized as a bad governance stock.

Do the abnormal returns associated with these two stocks really come from investor underestimation of the firms’ good or bad governance mechanisms? Probably not. Cisco’s large positive abnormal return resulted from investors’ excitement regarding its high growth during the technology bubble period. Once the bubble burst, Cisco’s aggressive acquisition strategy was challenged and its stock price dropped dramatically.

Waste Management was very poorly governed during the 1990s. But its negative abnormal return is found during the post-1996 period. It is difficult to tell whether investors severely underestimated the consequences of bad governance practices during this time, because in 1996 one shareholder activist firm (LENS fund) became involved in restructuring the firm. It seems likely that investors may have had unrealistic expectations for the restructuring and the altered governance mechanisms. Indeed, an article from the Wall Street Journal (McGee, 1997) noted that an unexpected CEO resignation in late October 1997 “appeared to finally kill off hopes of a speedy turnaround at the company.”

A third contention is that significant abnormal returns can be found if penny stocks are included in the sample. Penny stocks may be misvalued for a variety of reasons that can be totally unrelated to corporate governance. For example, abnormal returns might result from a microstructure effect associated with bid-ask spread. These stocks are often very illiquid. Usually researchers exclude penny stocks to avoid these potential problems. I find that the abnormal return of the equal-weighted portfolio is sensitive to whether penny stocks are included or not.

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2 This applies to their value-weighted portfolio result.
3 In 2002, Cisco’s stock price was down 83% from its peak. Even in September 2003, its stock price increased 25% from $14 to $20 in five months; some analysts still believed the stock were overvalued. They questioned whether the increase in price came from “overdone optimism.” (Kharif, 2003)
4 Based on a four-factor model, from 9/1990 to 12/1995, Waste Management had a monthly abnormal return of -1.4%. From 1/1996 to 1/1998, its monthly abnormal return was -4.19%.
My results suggest an alternative interpretation of the relation between governance mechanisms and equity prices. Cremers and Nair (2004) provide interesting evidence that external mechanisms (e.g., takeover threats) and internal mechanisms (e.g., ownership structure) are complementary. Only when firms have both good external and internal governance mechanisms can they be associated with high abnormal returns. Cremers and Nair suggest that the abnormal returns of well governed firms are due to missing risk factors not captured by the current asset pricing model. The evidence presented in the current essay suggests instead that there is actually no significant abnormal return to be explained.

Core et al. also provide evidence that investors in the 1990s were not surprised by the underperformance of those poorly governed firms. They suggest that high technology firms associated with a new economy pricing anomaly may account for the high abnormal returns. In this essay, I point out that probably only a couple of firms (e.g., Cisco and Waste Management) generate this high abnormal return. Therefore, the anomaly is more likely due to the outlier effect, rather than a particular industry effect.

Loughran and Ritter (2000) argue that when applying a calendar time regression to a value-weighted portfolio in a long-run event study, researchers tend to find insignificant results because of the low power of the test. In the current research, an opposite result is found. Using a simple algorithm developed to detect potential outlier firms, I demonstrate a single extreme firm in the value-weighted portfolio can have a crucial effect on finding a positive and significant abnormal return. If researchers are not aware of this “extreme firm effect,” they can reach quite misleading conclusions.

In sum, this essay suggests that investors might not be able to enjoy low risk and high returns when investing in well governed firms. The well governed firms are in fact riskier (in terms of firm-specific risk), and there is no significant abnormal return associated with these firms. Moreover, my results suggest that care is needed before jumping to an “underestimation” or “missing risk factor” story when researchers observe an abnormal return anomaly.

The essay proceeds as follows. The next section discusses the data and sample period. In section 1.3, the relationship between stock return volatility and governance, at both the portfolio-level and
firm-level, will be documented. Section 1.4 is an attempt to understand whether a good (bad) governance portfolio can really generate significantly positive (negative) abnormal returns. Section 1.5 concludes.

1.2 Data

I use the aggregate governance index created by Gompers et al. (2003) as my governance measure. Following Gompers et al. (2003), dual-listed firms are removed from the sample. Detail description of how this index is constructed can be found in their paper. In brief, this index is based on the IRRC (Investor Responsibility Research Center) publications in which firms’ adoption of anti-takeover provisions are reported. The index increases by one each time a firm adopts a new anti-takeover provision. The higher the index, the more protections managers have when facing takeover threats. In Gompers et al. (2003), they label firms with a high governance index as “dictatorship” firms, and firms with low governance index as “democracy” firms. This index is not revised every month nor every year. It will be renewed when a new issue of the IRRC publication becomes available. Therefore, the governance measures used here are from 1990, 1993, 1995, 1998, 2000 and 2002. During the interval of each publication date, I assume that the governance measures remain the same for each firm. This is not an unreasonable assumption since firms usually do not drastically adapt or abandon their anti-takeover provisions during a short period of time. In order to make this essay comparable to Gompers et al. (2003), the main focus is on the period 1990-1999. However, I also extend my sample to 2002 to show the robustness of both their results and mine.

8I thank Professor Andrew Metrick for providing the governance index. Readers can also download the data (no CRSP Permno version) from his website: http://finance.wharton.upenn.edu/~metrick/data.htm
6The anti-takeover provisions include: (1) delay-related provisions: blank check, classified board, special meeting, written consent; (2) protection-related provisions: compensation plans, contracts, golden parachutes, indemnification, liability, severance; (3) voting related provisions: bylaws, charter, cumulative voting, secret Ballot, supermajority, unequal voting; (4) other: anti-greenmail, directors' duties, fair price, pension parachutes, poison pill, silver parachutes; and (5) state-related provisions: anti-greenmail law, business combination law, cash-out law, directors' duties law, fair price law, control share acquisition Law.
7In this essay, “well governed” firms and “democracy” firms are used interchangeably. Similarly, “poorly governed” firms and “dictatorship” firms are used interchangeably.
8Gompers et al. (2003) have made the same assumption.
Table 1.1: Distribution of Governance Index

The table summarizes the governance index distribution in each IRRC publication year. Governance Index is an aggregate index which reflects firms' adoption of anti-takeover provisions. The higher the index, the more protection managers have when facing takeover threats.

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<td>1373</td>
<td>1707</td>
<td>1670</td>
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Table 1.1 shows the distribution of governance index in each IRRC publication year. It can be observed that there is increasing coverage of firms in IRRC publications after the 1998 publication. Also, the number of firms with the lowest governance index (G<=5) is larger than the number of firms with the highest governance index (G>=14), although the difference narrowed in 2002.

The stock market-related data are downloaded from the CRSP database. I also match governance index and CRSP data with accounting data from Compustat. Generally, to make my results comparable to those of Gompers et al. (2003), I follow their selection criteria, which do not restrict the type of stock or the exchange where the stocks are traded. However, when extending the sample to 2002, this essay focuses on common stocks (i.e., CRSP share code equals 10 or 11) that are traded in NYSE, AMEX or NASDAQ.

Table 1.2 shows the governance index transition rate from month $t$ to month $t+1$. Because I assume there is no change in governance index between each IRRC publication date, most firms have the same governance index from month $t$ to month $t+1$. Moreover, it can be observed that the exit rate is lowest (0.43%) for firms with the highest governance index.
Table 1.2: Monthly Governance Index Transition Rate

The table summarizes the governance index transition rate from month $t$ to month $t+1$. The row number is the governance index for firms in month $t$. The column number is the governance index for firms in month $t+1$. If a firm has a governance index in year $t$ but leaves the sample in month $t+1$, it will be defined as an "exit" firm. This table is created using the sample from September 1990 to December 2002.

<table>
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<th>Governance Index (G)</th>
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<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>&gt;=14</th>
<th>Exit</th>
</tr>
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<td>&lt;=5</td>
<td>98.25%</td>
<td>0.64%</td>
<td>0.24%</td>
<td>0.07%</td>
<td>0.05%</td>
<td>0.03%</td>
<td>0.01%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.70%</td>
</tr>
<tr>
<td>6</td>
<td>0.18%</td>
<td>97.75%</td>
<td>0.88%</td>
<td>0.26%</td>
<td>0.12%</td>
<td>0.02%</td>
<td>0.02%</td>
<td>0.01%</td>
<td>0.02%</td>
<td>0.00%</td>
<td>0.74%</td>
</tr>
<tr>
<td>7</td>
<td>0.03%</td>
<td>0.16%</td>
<td>97.85%</td>
<td>0.86%</td>
<td>0.31%</td>
<td>0.09%</td>
<td>0.03%</td>
<td>0.01%</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.65%</td>
</tr>
<tr>
<td>8</td>
<td>0.01%</td>
<td>0.02%</td>
<td>0.21%</td>
<td>97.99%</td>
<td>0.81%</td>
<td>0.18%</td>
<td>0.07%</td>
<td>0.03%</td>
<td>0.03%</td>
<td>0.00%</td>
<td>0.66%</td>
</tr>
<tr>
<td>9</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.01%</td>
<td>0.22%</td>
<td>98.11%</td>
<td>0.75%</td>
<td>0.25%</td>
<td>0.06%</td>
<td>0.02%</td>
<td>0.01%</td>
<td>0.56%</td>
</tr>
<tr>
<td>10</td>
<td>0.01%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.05%</td>
<td>0.25%</td>
<td>98.23%</td>
<td>0.67%</td>
<td>0.10%</td>
<td>0.03%</td>
<td>0.02%</td>
<td>0.64%</td>
</tr>
<tr>
<td>11</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.02%</td>
<td>0.03%</td>
<td>0.35%</td>
<td>98.29%</td>
<td>0.61%</td>
<td>0.13%</td>
<td>0.02%</td>
<td>0.55%</td>
</tr>
<tr>
<td>12</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.06%</td>
<td>0.41%</td>
<td>98.35%</td>
<td>0.47%</td>
<td>0.07%</td>
<td>0.63%</td>
</tr>
<tr>
<td>13</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.02%</td>
<td>0.01%</td>
<td>0.07%</td>
<td>0.34%</td>
<td>98.57%</td>
<td>0.45%</td>
<td>0.50%</td>
</tr>
<tr>
<td>&gt;=14</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.01%</td>
<td>0.01%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.01%</td>
<td>0.05%</td>
<td>0.29%</td>
<td>99.20%</td>
<td>0.43%</td>
</tr>
</tbody>
</table>
An exit can result from many different reasons. Table 1.3 presents the reasons for exit. Some firms may exit the sample because the IRRC did not cover these firms in a particular issuance, but the CRSP covered these firms ("Active" firms). It is also possible that these firms were delisted from the stock exchanges because of mergers (CRSP delist code between 200 to 299), exchanges (CRSP delist code between 300 and 399), liquidations (CRSP delist code between 400 and 499) or due to having been dropped (CRSP delist code between 500 and 599). Interestingly, it does not appear that firms with the fewest anti-takeover provisions exit more frequently through mergers.

Table 1.3: Exit Reasons

The sample period is September 1990 to December 2002. In the end of year 2002, a firm is labelled as "Active" if its CRSP delist code is between 100 and 199. A firm is labelled as "Mergers" if its delist code is between 200 and 299. A firm is labelled as "Exchanges" when the delist code is between 300 and 399. A firm is labelled as "Liquidations" if the delist code is between 400 and 499. A firm is labelled as "Dropped" if its delist code is between 500 and 599.

<table>
<thead>
<tr>
<th>Governance Index</th>
<th>Active</th>
<th>Mergers</th>
<th>Exchanges</th>
<th>Liquidations</th>
<th>Dropped</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 5</td>
<td>14.79%</td>
<td>67.61%</td>
<td>0.70%</td>
<td>0.70%</td>
<td>16.20%</td>
</tr>
<tr>
<td>6</td>
<td>12.80%</td>
<td>64.00%</td>
<td>3.20%</td>
<td>0.00%</td>
<td>20.00%</td>
</tr>
<tr>
<td>7</td>
<td>15.00%</td>
<td>60.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>25.00%</td>
</tr>
<tr>
<td>8</td>
<td>11.61%</td>
<td>67.10%</td>
<td>1.94%</td>
<td>0.65%</td>
<td>18.71%</td>
</tr>
<tr>
<td>9</td>
<td>12.24%</td>
<td>65.31%</td>
<td>1.36%</td>
<td>0.00%</td>
<td>21.09%</td>
</tr>
<tr>
<td>10</td>
<td>11.83%</td>
<td>74.56%</td>
<td>1.18%</td>
<td>0.59%</td>
<td>11.83%</td>
</tr>
<tr>
<td>11</td>
<td>13.08%</td>
<td>75.38%</td>
<td>0.77%</td>
<td>0.00%</td>
<td>10.77%</td>
</tr>
<tr>
<td>12</td>
<td>4.63%</td>
<td>77.78%</td>
<td>0.93%</td>
<td>0.00%</td>
<td>16.67%</td>
</tr>
<tr>
<td>13</td>
<td>10.14%</td>
<td>81.16%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>8.70%</td>
</tr>
<tr>
<td>&gt;= 14</td>
<td>3.85%</td>
<td>80.77%</td>
<td>9.62%</td>
<td>0.00%</td>
<td>5.77%</td>
</tr>
</tbody>
</table>

1.3 Are Well Governed Firms Less Risky?

As discussed earlier, one of the claims in support of good governance is that firms practicing good governance are less risky. It is often argued that managers of firms without strong governance mechanisms do not maximize shareholder value and tend to engage in activities which may result in disaster. In other words, the unresolved agency problem between managers and investors makes
investment in these firms riskier. However, this view is inconsistent with the standard agency framework in which managers are risk averse and tend to avoid undertaking risky projects. Moreover, Bertrand and Mullainathan (2003) find that managers prefer a “quiet life” when they are not well governed. If this is true, then it is unclear why managers would choose to engage in risky activities.

To examine the relationship between corporate governance and risk, I must use proxies for both “corporate governance” and “risk.” For corporate governance, there are many different relevant factors. CEO compensation schemes, ownership structure, markets for corporate control, board characteristics and financial structure are just some of the most popular governance mechanisms mentioned by academics or practitioners. However, it is difficult to examine all of these aspects at the same time. Therefore, I focus on the adoption of anti-takeover provisions. Based on the “disciplinary” role of takeover (e.g., Scharfstein, 1988), more protections (i.e., adoption of many anti-takeover provisions) may enable managers to undertake actions that are not desired by their shareholders. Although it is admitted that this is not the most comprehensive measure, it is anticipated the measure can be positively correlated with some other governance practices. Borokhovich et al. (1997) and Bertrand and Mullainathan (2003) have provided evidence that excessively high compensation is associated with the adoption of anti-takeover provisions.

In relation to risk, I focus mainly on stock return volatility. The benefit of this focus is that higher-frequency data are readily available. Unlike cash flow volatility, which is available only on a quarterly or annual basis, stock return volatility is available with either monthly or daily frequency. Furthermore, I consider two volatility measures in this essay: total stock return volatility and firm-level stock return volatility. One reason for including idiosyncratic risk is that researchers have found recently that idiosyncratic risk can also be priced. Firm-level risk is also important in itself. Campbell et al. (2001) have discussed this point.9 Finally, focusing on firm-level stock return volatility is consistent with the idea that frauds and scandals will mainly be firm-specific.

9For example, they mention that undiversified investors may need to take idiosyncratic risk into account. Also, arbitragers who trade on mispricing also need to consider idiosyncratic risk. Moreover, the prices of stock options depend on total volatility, not just market volatility.
1.3.1 Portfolio Return Volatility and Corporate Governance

I follow Gompers et al. (2003) to construct the “dictatorship” and “democracy” portfolios. More specifically, for each IRRC publication release date, the portfolios are rebalanced according to the change in aggregate governance index. A firm is included in the democracy portfolio if its governance index is not greater than five, while a firm is included in the dictatorship portfolio if its governance index is not less than 14. The monthly returns of these two portfolios are calculated on either equal-weighted or value-weighted basis.\(^\text{10}\)

Table 1.4 shows the summary statistics of the monthly returns of these two portfolios. The mean monthly return is higher for the democracy portfolio, especially in the value-weighted case during the Gompers et al. (2003) sample period. This implies that during the 1990s, large capitalization dictatorship stocks had lower average returns than large capitalization democracy stocks. Table 1.4 also shows that the standard deviation is higher for the democracy portfolio across different sample periods and weighting schemes. Furthermore, as found in most previous studies, portfolio returns have negative skewness and positive excess kurtosis. Democracy portfolio returns generally exhibit more negative skewness and more positive kurtosis.

Although Table 1.4 shows that the returns of democracy portfolio are more volatile, it does not necessarily mean the volatility difference between the democracy and dictatorship portfolios is statistically significant. One way to compare the volatility difference of these two portfolios is to compute monthly portfolio return volatility. In doing so, two time-varying volatility series can be constructed, and it becomes quite easy to assess the significance. Equation 1.1 is the formula used to compute monthly portfolio volatility:

\begin{equation}
S_{j,t} = \left[ \sum_{d=1}^{D_t} r_{jd}^2 + 2 \sum_{d=2}^{D_t} r_{jd} r_{jd-1} \right]^{\frac{1}{2}}
\end{equation}

where \( j \) is either the democracy or dictatorship portfolio. \( D_t \) is the number of trading days in

\(^{10}\)In the value-weighted case, I assume that the portfolio weight remains the same throughout the month. This means that at the beginning of each month, investors rebalance their portfolios based on the update in governance index. Then, investors will hold the portfolios for one month.
Table 1.4: Summary Statistics of Portfolio Returns

Portfolios are formed based on governance index by using a full sample (9/1990-12/2002) or the Gompers et al. (2003) sample (9/1990-12/1999). Return is computed as simple monthly return $P_{t+1}/P_{t-1}$. Standard deviation, skewness and kurtosis are computed from the time series of monthly portfolio returns. All figures have been multiplied by 100.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std Dev</th>
<th>Skewness</th>
<th>Excess Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal-Weighted</td>
<td>Democracy</td>
<td>1.67</td>
<td>1.34</td>
<td>4.89</td>
</tr>
<tr>
<td></td>
<td>Dictatorship</td>
<td>1.32</td>
<td>1.21</td>
<td>4.27</td>
</tr>
<tr>
<td>Value-Weighted</td>
<td>Democracy</td>
<td>1.84</td>
<td>1.14</td>
<td>4.15</td>
</tr>
<tr>
<td></td>
<td>Dictatorship</td>
<td>1.18</td>
<td>0.99</td>
<td>3.9</td>
</tr>
</tbody>
</table>

French et al. (1987) and Goyal and Santa-Clara (2003) have used a similar formula to calculate monthly volatility. The idea of the formula is close to the "realized volatility" proposed by Andersen et al. (2001). The realized volatility approach sums all the squared intraday returns in a single day to generate realized daily volatility. This is analogous to the first term in equation 1.1. However, since the stock returns used in this essay are not high frequency intraday data, autocorrelation between returns can be an issue. Therefore, the second term in equation 1.1 is added to address this potential problem. Following previous research, I consider only first order autocorrelation. Moreover, neither the first nor second terms are mean-adjusted. This can be justified by the fact that average daily return is very close to zero.

Table 1.5 shows that during the Gompers et al. (2003) sample period, there is a significant return difference between the democracy and dictatorship portfolios in the value-weighted case.

\[^{11}\text{In theory, the autocorrelation adjustment term can be very negative and makes the whole term become negative. However, in the portfolio level, this never happens. In the later section, when I analyze individual stocks, I replace any negative value with its squared return (i.e., the first term).}\]
The difference is about 0.66% per month. On the other hand, the return difference (0.35%) is not significant for the equal-weighted portfolio. In fact, the magnitude of the return difference is quite similar to the abnormal return found in Gompers et al. (2003). However, both value-weighted and equal-weighted portfolio return differences become insignificant (0.14% and 0.13%, respectively) when the sample is extended to 2002.

Unlike return difference, volatility difference is significant across different sample periods and weighting schemes. In the Gompers et al. (2003) sample period, the difference is 0.31% and 0.59% for equal-weighted and value-weighted portfolios, respectively. Considering the magnitude of the portfolio return difference, the volatility difference is not trivial. This may indicate that the democracy portfolio is quite risky. When the extended sample is employed, the difference becomes even larger (about 0.7%). Since Gompers et al.'s (2003) sample covers the period right before the end of the boom period, it seems that the democracy portfolio earns high returns during the boom period. Once the stock market bubble bursts, the return of the democracy portfolio decreases and its volatility increases.

Table 1.5: Monthly Portfolio Returns and Volatility Differences

Portfolios are formed based on governance index by using full sample (9/1990-12/2002) or Gompers et al. (2003) sample (9/1990-12/1999). Return is computed as simple monthly return $P_{t+1}/P_{t-1}$. Volatility is computed following equation 1. Difference is the average return (volatility) difference between the two portfolios during the sample period. Standard error is shown in parenthesis. All figures have been multiplied by 100. ***, **, * indicates statistical significance at 1, 5, 10 percent levels based on paired t test. Standard errors are shown in the parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Gompers et al. (2003) Sample</th>
<th>Full Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equal-Weighted</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.35</td>
<td>0.13</td>
</tr>
<tr>
<td>(0.25)</td>
<td>(0.28)</td>
<td></td>
</tr>
<tr>
<td>Volatility</td>
<td>0.31***</td>
<td>0.71***</td>
</tr>
<tr>
<td>(0.1)</td>
<td>(0.11)</td>
<td></td>
</tr>
<tr>
<td><strong>Value-Weighted</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.66**</td>
<td>0.14</td>
</tr>
<tr>
<td>(0.26)</td>
<td>(0.28)</td>
<td></td>
</tr>
<tr>
<td>Volatility</td>
<td>0.59***</td>
<td>0.77***</td>
</tr>
<tr>
<td>(0.11)</td>
<td>(0.11)</td>
<td></td>
</tr>
</tbody>
</table>
1.3.2 Average Stock Return Volatility and Corporate Governance

In the previous subsection, the two portfolios are formed, and then the volatility measures of the two portfolios are compared. During the portfolio construction process, part of the idiosyncratic risk should have been diversified away. In this subsection, the focus is on the "average" firm-level volatility difference between these two portfolios. To attain the average firm-level volatility, the monthly variance of each individual firm is computed first, and each firm's monthly variance is averaged according to whether they belong to the democracy or dictatorship portfolio. The square root of the average variance can thus be viewed as "average firm-level" volatility. Specifically, the formula can be written as:

\[ V_{j,t} = \left[ \frac{1}{N} \sum_{i=1}^{N} \left( \frac{D_t}{d-1} \sum_{d=1}^{D_t} r_{jd}^2 + 2 \sum_{d=2}^{D_t} r_{jd} r_{jd-1} \right) \right]^{\frac{1}{2}} \]  \hspace{1cm} (1.2)

where \( N \) is the number of firms in each portfolio.\(^{12}\) Since firm-level volatility is largely idiosyncratic,\(^{13}\) the measure can also be viewed as a proxy for the idiosyncratic risk associated with the two portfolios.

Figure 1.1 shows the time series pattern of the average firm-level volatility of these two portfolios. It is clear that there is a volatility gap between the democracy and dictatorship portfolios. Also, from Figure 1.1, it can be observed that when there is a shock, firms in the democracy portfolio have much stronger reactions. For example, in the period between 1998 and 1999,\(^{14}\) a large difference (34.16% vs. 11.64% in November 1998) in average firm-level volatility can be found. This can probably be explained by the fact that dictatorship firms are usually larger than democracy firms. Since the average firm-level volatility measure is essentially equal-weighted, small firms can have a considerate effect on this measure. Table 1.6 confirms the graphical intuition. The mean volatility difference (computed in terms of equation 1.2) is 3.53% (3.59%) for the Gompers et al. (full) sample period, and it is statistically significant. This difference, when compared with the portfolio-level

\(^{12}\)Following Goyal and Santa-Clara (2003), I require firms in our sample to have at least five observations in a particular month.

\(^{13}\)See Goyal and Santa-Clara (2003) for the proof.

\(^{14}\)During that period of time, there were Russia default, emerging market currency crisis and LTCM problem.
Figure 1.1: Average Firm-Level Volatility - Democracy vs. Dictatorship Portfolio

The democracy portfolio is formed with firms which have a governance index no less than 14; the dictatorship portfolio is formed with firms which have a governance index no larger than 5. The average firm-level volatility is computed following equation 1.2: $V_{jt} = \left[ \frac{1}{N} \sum_{i=1}^{N} (\sum_{d=1}^{D_i} r_{jd}^2 + 2 \sum_{d=2}^{D_i} r_{jd} r_{jd-1}) \right]^\frac{1}{2}$. 

![Graph showing firm-level volatility over time for democracy and dictatorship portfolios.](image-url)
results in the previous subsection, is about 5 to 10 times larger. It suggests that well governed firms are associated with very large idiosyncratic risk. Moreover, this large idiosyncratic risk can be at least partially diversified away by investing in a portfolio of stocks.

To determine the robustness of this result, I also compute the value-weighted firm-level volatility following equation 1.3:

\[
V_{j,t} = \left( \sum_{i=1}^{N} \omega_{i,t} \left( \sum_{d-1}^{D_t} r_{jd}^2 + 2 \sum_{d-2}^{D_t} r_{jd} r_{jd-1} \right) \right)^{\frac{1}{2}}
\]  

where \( \omega \) is the weight of stock \( i \) in the start of month \( t \). The weight is computed as stock \( i \)'s market value relative to the total market value of the portfolio in the beginning of month \( t \). From Table 1.6, it can be observed that the difference becomes much smaller, but remains statistically significant. This result again confirms the previous observation that the democracy portfolio contains a group of small firms with very volatile stock returns.

In Table 1.6, a slightly different average firm-level volatility measure, labelled "Measure2," is also employed for a robustness check. In equations 1.2 and 1.3, the average variance is computed first, and then the square root is taken. It is also possible to compute the square root of the individual firm variance first, and then average the firm-level volatility. The formula can be written as:

**Equal-weighted**: 
\[
V_{j,t} = \left[ \frac{1}{N} \sum_{i=1}^{N} \left( \sum_{d-1}^{D_t} r_{jd}^2 + 2 \sum_{d-2}^{D_t} r_{jd} r_{jd-1} \right) \right]^{\frac{1}{2}}
\]  

or

**Value-weighted**: 
\[
V_{j,t} = \left( \sum_{i=1}^{N} \omega_{i,t} \left( \sum_{d-1}^{D_t} r_{jd}^2 + 2 \sum_{d-2}^{D_t} r_{jd} r_{jd-1} \right) \right)^{\frac{1}{2}}
\]

The results are qualitatively similar when using these new volatility measures. The democracy portfolio always has a significantly higher average firm-level volatility compared to the dictatorship portfolio.
Table 1.6: Average Volatility Difference between Democracy and Dictatorship Portfolios

Average volatility is computed in either equal-weighted or value-weighted terms. For value-weighted volatility, the weight is a stock's previous month-end capitalization. There are two measures used to compute the average volatility. Measure 1 is the square root of the average monthly variance. More specifically, in equal weighted case, the formula is 

\[ V_{i,t} = \left( \frac{1}{N} \sum_{i=1}^{N} \left( \sum_{d=1}^{D_i} \tau_{jd}^2 + 2 \sum_{d=2}^{D_i} \tau_{jd} \tau_{jd-1} \right) \right)^{\frac{1}{2}} \]

Measure 2 computes the square root first, then averages the firm-level volatility: 

\[ V_{j,t} = \left( \frac{1}{N} \sum_{i=1}^{N} \left( \sum_{d=1}^{D_i} \tau_{jd}^2 + 2 \sum_{d=2}^{D_i} \tau_{jd} \tau_{jd-1} \right) \right)^{\frac{1}{2}} \] . The full sample covers the period 9/1990 to 12/2002. The Gompers et al. (2003) sample covers the period 9/1990 to 12/1999. Difference is the average volatility difference between the two portfolios during the sample period. Standard error is shown in parenthesis. All figures have been multiplied by 100. **,**,* indicate statistical significance at the 1, 5 and 10 percent levels based on paired t test. Standard errors are shown in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Gompers et al. (2003) Sample</th>
<th>Full Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal-Weighted Measure 1</td>
<td>3.53*** (0.28)</td>
<td>3.59*** (0.27)</td>
</tr>
<tr>
<td></td>
<td>2.26*** (0.14)</td>
<td>2.32*** (0.13)</td>
</tr>
<tr>
<td>Value-Weighted Measure 1</td>
<td>0.54*** (0.13)</td>
<td>0.50*** (0.13)</td>
</tr>
<tr>
<td></td>
<td>0.46*** (0.12)</td>
<td>0.42*** (0.12)</td>
</tr>
</tbody>
</table>
1.3.3 Firm-level Stock Return Volatility and Corporate Governance

I have demonstrated that the democracy portfolio exhibits higher volatility than the dictatorship portfolio at both the portfolio-level and average firm-level. This fact, though informative, does not provide a full picture of corporate governance and stock return volatility. Gompers et al. (2003) have pointed out that firms in the dictatorship portfolio and democracy portfolio may have different characteristics. The results presented previously also suggest that democracy firms may be smaller than dictatorship firms. Therefore, the observed difference in volatility can be associated with other firm characteristics, rather than the difference in corporate governance structures.

Because of the possibility stated above, in this subsection I try to control for certain other firm characteristics that might be related to higher stock return volatility. More precisely, for each firm (including firms other than democracy firms and dictatorship firms), firm-level monthly volatility is computed following equation 1.1. To match the yearly control variables, I average the monthly firm-level volatility in each calendar year. The control variables are similar to those used in Pastor and Veronesi (2003). In particular, I control for growth opportunities (M/B), book leverage (LEV), dividend paying dummy (DD), firm size (SIZE), return on equity (ROE) and firm age (AGE). Detailed descriptions of each control variable are provided in Appendix 1.1. Fama-MacBeth type regressions are employed to study the relationship between stock return volatility and corporate governance.\footnote{There are two steps associated with Fama-MacBeth type regressions. First, cross-sectional Ordinary Least Square regressions for each year are conducted. Then, the time series of the coefficients estimated in the first step is analyzed. Specifically, the mean and standard deviation of the coefficients will be used to assess the significance of the explanatory variable.}

Tables 1.7 and 1.8 indicate that even after controlling for other important firm characteristics that might affect stock return volatility, firms with better governance (low G firms) are still associated with higher return volatility. This result is even stronger when volatility is adjusted by the industry median.\footnote{The industry classification follows Fama and French (1997).} A decrease in G (i.e., a drop in one anti-takeover provision) is associated with a 0.020%-0.044% increase in stock return volatility, depending on different sample periods and variable definitions. Other significant explanatory variables include dividend dummy, size and age. These three variables are all negatively correlated with firm-level stock return volatility. Leverage is
generally positively correlated with firm-level volatility, but sometimes it is insignificant at the 10% level. In sum, these results indicate that the positive relationship between volatility and corporate governance is not merely a size or age effect.

Some robustness checks are also conducted to make sure the results hold under different settings. First, some firms leave the sample during the year and these firms have less than 12 observations in that particular year.\(^{17}\) This may induce bias in the estimate. However, the results are qualitatively similar when only firms with complete records in a particular year are used (results not shown). Furthermore, a subset of the sample composed of only democracy and dictatorship firms is employed. For this subset of the sample, a dummy variable is created to represent well governed and poorly governed firms. The results show that there is a significant 0.2%-0.3% "volatility premium" for the democracy firms when firm-level volatility is industry-adjusted.

\subsection*{1.3.4 Discussion}

The results shown previously suggest that well governed firms may not be as safe as practitioners and governance activists claim them to be. In fact, well governed firms are riskier than poorly governed firms at both the portfolio level and firm level. This relation remains even when other firm characteristics such as firm size, leverage and age have been controlled for.

Of course, there are possible explanations for these findings. First, in the standard agency framework, managers are more risk-averse than shareholders. Therefore, they can behave conservatively and may be unwilling to undertake risky projects if governance mechanisms are weak. On the other hand, with strong corporate governance mechanisms, shareholders' and managers' interests can be better aligned. This alignment promotes managerial risk-taking behavior and consequently increases stock return volatility.\(^ {18}\)

\(^{17}\) One reason is that the IRRC publishes the data during the year, not at the end of each year. Therefore, when the IRRC does not follow a firm continuously, the firm may have less than 12 months observations during that particular year. This problem is especially serious in 1990 since each firm has four observations at most due to the fact that my sample begins in September 1990. Firms can also leave my sample because they have been merged, acquired or gone bankrupt.

\(^{18}\) Good governance mechanisms may also help the boards and the shareholders distinguish managers' "bad luck" from "bad decision making." This improved monitoring can also give the manager more incentives to undertake risky projects. This rationale has been suggested by Litov (2004).
This table shows the relationship between volatility and corporate governance by using the full sample (9/1990-12/2002). The firm-level volatility measure (FirmV) and industry-adjusted volatility measure (DfirmV) are regressed cross-sectionally on market to book ratio (M/B), book leverage ratio (LEV), Dividend Dummy (DD), the log of total assets (SIZE), Return on equity (ROE) and firm age (AGE). The dummy variable (DummyG) is a 0/1 variable indicating whether the firm is a democracy firm or dictatorship firm. A zero for DummyG represents dictatorship firms. Coefficients and standard errors reported in the table are computed from the time series of the estimated cross-sectional regression coefficients. This is similar to Fama-MacBeth regression. All figures (except average N and average adjusted $R^2$) have been multiplied by 1000. ***, **, * indicate statistical significance at the 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

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<th>FirmV</th>
<th>DfirmV</th>
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Table 1.8: Firm-level Volatility Regression - Gompers et al. Sample

This table shows the relationship between volatility and corporate governance by using the Gompers et al. (2003) sample (9/1990-12/1999). The firm-level volatility measure (FirmV) and industry-adjusted volatility measure (DfirmV) are regressed cross-sectionally on market to book ratio (M/B), book leverage ratio (LEV), Dividend Dummy (DD), the log of total assets (SIZE), Return on equity (ROE) and firm age (AGE). The dummy variable (DummyG) is a 0/1 variable indicating whether the firm is a democracy firm or dictatorship firm. A zero for DummyG represents dictatorship firms. Coefficients and standard errors reported in the table are computed from the time series of the estimated cross-sectional regression coefficients. This is similar to Fama-MacBeth regression. All figures (except average N and average adjusted $R^2$) have been multiplied by 1000. ***,*,* indicate statistical significance at the 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

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<td>0.36</td>
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</table>
The second possible explanation is specific to the governance mechanism studied in this essay. The governance index provided by Gompers et al. (2003) is computed as the number of anti-takeover provisions adopted by the firms. This index potentially measures the degree of shareholder rights and investors’ perceived probability of takeover. When managers become less entrenched because fewer anti-takeover provisions are adopted, investors may perceive that the probability of these firms being taken over is higher. This increased probability of takeover can raise investor uncertainty and lengthen learning process about the future profitability of these potential target firms. Pastor and Veronesi (2003) have pointed out that investor uncertainty about a firm’s future profitability can generate high stock return volatility. The heightened uncertainty may thus explain why high stock return volatility is associated with well governed firms.

The above argument seems to suggest that good governance leads to more investor uncertainty. However, it is also possible that good governance allows shareholders to demand more transparency in company information. This increase in transparency indicates a decrease in uncertainty and thus lower stock return volatility. However, Roll (1988) and Durnev et al. (2004) suggest that transparency in fact can be positively associated with firm-specific stock return volatility. This is due to the fact that stock price will be able to incorporate relevant news and become more informative and volatile. If this is true, good governance mechanisms may increase stock return volatility through transparent information provided by the firms.

The following analysis explores whether these explanations can account for the observed relationship between governance practices and stock return volatility. The empirical strategy is straightforward. If Gompers et al.’s governance index is a proxy for the explanations stated above, the significance of the governance index will probably be weakened after these explanations have been controlled for. Of course, “risk-taking behavior,” “investor uncertainty” and “information transparency” usually cannot be easily measured. I thus use five different measures to control for these potential explanations.

For example, Borokhovich et al. (1997) find anti-takeover provisions reduce the likelihood for firms to receive takeover bids. However, this is not a conclusive result. Comment and Schwert (1995) argue that the probability of being taken over is the same for adopting firms and non-adopting firms. Also, they argue that anti-takeover provisions in fact can create value, since acquiring firms must bid more due to the high bargaining power of target firms.

In this exercise, I focus on the full sample, rather than the subset sample with only dictatorship and democracy firms.
To measure risk-taking behavior, I employ three proxies: S&P long term credit ratings, Altman's Z score and R&D intensity. As argued previously, managers are willing to undertake risky projects when governance mechanisms are strong. However, this alignment between the managers and shareholders can be beneficial to shareholders at the expense of bondholders. If creditors recognize the potential harm caused by this risk-shifting behavior, the credit ratings of these well governed firms should be affected, and bondholders may demand high yields as compensation. Litov (2004) and Ashbaugh, Collins and Lafond (2004) provide empirical evidence that firms with larger governance index (i.e., firms with weaker shareholder rights) are indeed associated with better credit ratings. Cremers, Nair and Wei (2004) find that firms exposed to stronger shareholder governance have higher bond yields. Campbell and Taksler (2003), on the other hand, suggest there is a positive relationship between equity volatility and corporate bond yields.

Compustat records S&P long term credit ratings in a range from 2 to 90. Following Ashbaugh, Collins and Lafond (2004), I reclassify Compustat's rating into a range from 1 (highest grade) to 7 (default grade). The detailed classification is provided in Appendix 1.2. It is worth mentioning that a large number of firms in the Compustat database do not have information on long term credit ratings. It is not surprising that firms with credit rating information tend to be larger and much more levered.

Firms' risk exposure can also be reflected in the bankruptcy probability. I use the standard Altman's Z-score to measure firms' tendencies to go bankrupt. Z-score is computed from firms' various accounting ratios, such as working capital to total assets, retained earnings to total assets, and earnings before interest and tax to total assets. The detailed description of Altman's Z-score is provided in Appendix 1.1. I do not adopt the more advanced expected default frequency model (e.g., KMV approach) because this approach uses equity return volatility directly to impute default probability. Since the dependent variable in the regression analysis is stock return volatility, it may not be reasonable to use the KMV measure in this specific empirical setting.

Although credit ratings and Z-score may capture managers' risk-taking behavior, these two measures can best be viewed as indirect. A more direct measure might be firms' R&D intensity. R&D activities can be viewed as risky in the sense that these activities contain largely intangible
information. Moreover, the success rate of R&D activities can be very low: I define R&D intensity as the ratio of R&D expenditure to total assets. It should be noted that R&D intensity can also be negatively correlated with strong corporate governance practices. For example, Cohen, Dey and Lyz (2004) find that R&D expenditure has decreased since the Sarbanes-Oxley Act. They argue that managers are held more accountable now that the act has been passed. The increased liability burden may make managers behave more conservatively.

Table 1.9 and Table 1.10 present the results obtained when these additional control variables are included. The expected signs of these control variables are generally consistent with standard predictions. Firms with low credit rankings, with high probability of bankruptcy, and with high R&D intensity are associated with high stock return volatility. Both the credit rating and R&D intensity measures are significant, while the coefficient of Z-score is insignificantly different from zero.

Interestingly, even after including these risk-related variables, the coefficient of governance index is still significant at the 1% level in almost all cases. The results even seem to suggest that the relationship between governance index and stock return volatility becomes more negative. For example, previously in the Gompers et al. (Full) sample, the coefficient of governance index is -0.33 (-0.44) when the dependent variable is industry-adjusted volatility. However, the coefficient of governance index is between -0.34 and -0.5 (-0.47 and -0.63) when the controlled variables are included. These findings suggest that risk-increasing behavior may not be able to account fully for the negative relation found in this essay.

I use analyst forecast dispersion and forecast error as my measures for investor uncertainty and information transparency. Admittedly, these two measures cannot distinguish investor uncertainty about the future from accounting information transparency. The two measures are more reasonably viewed as composite measures of these two possibilities. For forecast dispersion, I use a five-year growth forecast dispersion. Therefore, it is more likely to capture the long-term uncertainty (or transparency) of the firms. The dispersion measure is computed as the standard deviation of analysts' five-year EPS growth forecasts. I require firms to have at least three analyst forecasts in order to be included in my sample.
Table 1.9: Firm-level Volatility Regression - Gompers et al. Sample

This table shows the relationship between volatility and corporate governance using the Gompers et al. (2003) sample (9/1990-12/1999). The firm-level volatility measure (FirmV) and industry-adjusted volatility measure (DfirmV) are regressed cross-sectionally on market to book ratio (M/B), book leverage ratio (LEV), Dividend Dummy (DD), the log of total assets (SIZE), Return on equity (ROE) and firm age (AGE). Credit ratings is the S&P long term credit rating. Z-score measures the probability of default. R&D intensity is the ratio of R&D expenditure to total assets. Coefficients and standard errors reported in the table are computed from the time series of the estimated cross-sectional regression coefficients. This is similar to Fama-MacBeth regression. All figures (except average N and average adjusted $R^2$) have been multiplied by 1000. ***, **, * indicate statistical significance at the 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

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<th>FirmV</th>
<th>DfirmV</th>
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Table 1.10: Firm-level Volatility Regression - Full Sample

This table shows the relationship between volatility and corporate governance by using the full sample (9/1990-12/2002). The firm-level volatility measure (FirmV) and industry-adjusted volatility measure (DfirmV) are regressed cross-sectionally on market to book ratio (M/B), book leverage ratio (LEV), Dividend Dummy (DD), the log of total assets (SIZE), Return on equity (ROE) and firm age (AGE). Credit ratings is the S&P long term credit rating. Z-score measures the probability of default. R&D intensity is the ratio of R&D expenditure to total assets. Coefficients and standard errors reported in the table are computed from the time series of the estimated cross-sectional regression coefficients. This is similar to Fama-MacBeth regression. All figures (except average N and average adjusted $R^2$) have been multiplied by 1000. ***, **, * indicate statistical significance at the 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

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<td>-2.85***</td>
<td>-2.52***</td>
<td>-2.69***</td>
<td>-2.74***</td>
</tr>
<tr>
<td></td>
<td>(0.39)</td>
<td>(0.36)</td>
<td>(0.27)</td>
<td>(0.25)</td>
<td>(0.49)</td>
<td>(0.42)</td>
</tr>
<tr>
<td>ROE</td>
<td>-4.44</td>
<td>-4.09</td>
<td>-2.05*</td>
<td>-1.62*</td>
<td>-3.03**</td>
<td>-2.90**</td>
</tr>
<tr>
<td></td>
<td>(2.50)</td>
<td>(2.35)</td>
<td>(1.07)</td>
<td>(0.82)</td>
<td>(1.04)</td>
<td>(0.98)</td>
</tr>
<tr>
<td>AGE</td>
<td>-1.68***</td>
<td>-1.18**</td>
<td>-2.42***</td>
<td>-0.78</td>
<td>-1.90**</td>
<td>-0.93</td>
</tr>
<tr>
<td></td>
<td>(0.54)</td>
<td>(0.46)</td>
<td>(0.63)</td>
<td>(0.50)</td>
<td>(0.78)</td>
<td>(0.76)</td>
</tr>
<tr>
<td>Credit Rating</td>
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<td>5.71***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>(1.49)</td>
<td>(1.37)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-Score</td>
<td>-0.26</td>
<td>-0.26*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>(0.15)</td>
<td>(0.14)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>R&amp;D Intensity</td>
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<td></td>
</tr>
<tr>
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<td>(16.55)</td>
<td>(13.70)</td>
<td></td>
<td></td>
<td></td>
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<td>1017</td>
<td>630</td>
<td>630</td>
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<tr>
<td>Average adjusted $R^2$</td>
<td>0.32</td>
<td>0.18</td>
<td>0.24</td>
<td>0.14</td>
<td>0.28</td>
<td>0.16</td>
</tr>
</tbody>
</table>

28
Unlike the forecast dispersion measure, the analyst forecast error used in this essay focuses on short term uncertainty (or transparency). The forecast information used is the most recent one-year EPS median forecast before the accounting information report date. This EPS forecast is normalized with the fiscal year-end stock price.

Table 1.11 and Table 1.12 present the results when the uncertainty measures are included. It can be observed that firms with larger forecast dispersion and analyst forecast error are associated with higher stock return volatility. These results are consistent with those of Rajgopal and Venkat­achalam (2005). Nevertheless, these control variables still do not seem to weaken the significance of the governance index. Most coefficients of governance index are still negative and significantly different from zero at the 1% level. These results again suggest that the uncertainty argument may not explain fully the relation between governance index and stock return volatility.

It should be noted that the results provided in this subsection do not imply any causal relationship between governance index and volatility or between governance index and the risk or transparency variables. Moreover, these risk and uncertainty explanations are not exclusive. Well-disciplined managers can undertake risky projects and thus affect the uncertainty faced by investors. The main point of the above exercise is that standard explanations may not be able to account fully for the positive relationship between “better” governance and stock return volatility.

Of course, the results do not preclude the possibility that strong corporate governance mechanisms indeed promote risk-taking behavior and investor uncertainty in a more complex way. This means these controlled variables may be able to weaken the significance of the governance index if a more complicated empirical approach is employed. Moreover, the five measures used in the section can be quite noisy and may not capture completely the actual managerial and investor behavior. Therefore, it is worthwhile to examine further the underlying driving forces of the relationship between well governed firms and high stock return volatility. Nevertheless, all the results seem to indicate robustly that stocks of well governed firms are riskier. The findings give little support for governance activists’ claims that well governed firms are safe investments.
Table 1.11: Firm-level Volatility Regression - Gompers et al. Sample

This table shows the relationship between volatility and corporate governance using the Gompers et al. (2003) sample (9/1990-12/1999). The firm-level volatility measure (FirmV) and industry-adjusted volatility measure (Dfirmv) are regressed cross-sectionally on market to book ratio (M/B), book leverage ratio (LEV), Dividend Dummy (DD), the log of total assets (SIZE), Return on equity (ROE), and firm age (AGE). Coefficients and standard errors reported in the table are computed from the time series of the estimated cross-sectional regression coefficients. This is similar to Fama-MacBeth regression. All figures (except average N and average adjusted $R^2$) have been multiplied by 1000. ***,**, indicates statistical significance at 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>FirmV</th>
<th>DfirmV</th>
<th>FirmV</th>
<th>DfirmV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>-0.17*</td>
<td>-0.26**</td>
<td>-0.20**</td>
<td>-0.32***</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.10)</td>
<td>(0.07)</td>
<td>(0.08)</td>
</tr>
<tr>
<td>M/B</td>
<td>-0.98</td>
<td>-3.79***</td>
<td>-0.64</td>
<td>-3.42***</td>
</tr>
<tr>
<td></td>
<td>(1.04)</td>
<td>(0.89)</td>
<td>(1.18)</td>
<td>(0.98)</td>
</tr>
<tr>
<td>LEV</td>
<td>-3.34**</td>
<td>4.07***</td>
<td>0.78</td>
<td>6.55***</td>
</tr>
<tr>
<td></td>
<td>(1.30)</td>
<td>(1.21)</td>
<td>(1.51)</td>
<td>(1.18)</td>
</tr>
<tr>
<td>DD</td>
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<td>-11.61***</td>
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</tr>
<tr>
<td></td>
<td>(0.85)</td>
<td>(0.68)</td>
<td>(1.12)</td>
<td>(0.93)</td>
</tr>
<tr>
<td>SIZE</td>
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<td>(0.18)</td>
<td>(0.22)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>ROE</td>
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<td>-1.58**</td>
<td>-1.66</td>
<td>-1.26*</td>
</tr>
<tr>
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<td>(0.84)</td>
<td>(0.68)</td>
<td>(0.92)</td>
<td>(0.61)</td>
</tr>
<tr>
<td>AGE</td>
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<td>-2.33***</td>
<td>-1.97***</td>
</tr>
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<td></td>
<td>(0.31)</td>
<td>(0.26)</td>
<td>(0.39)</td>
<td>(0.32)</td>
</tr>
<tr>
<td>Forecast Dispersion</td>
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<td>0.48***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forecast Error</td>
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<td></td>
<td>42.13***</td>
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</tr>
<tr>
<td></td>
<td>(7.00)</td>
<td></td>
<td>(7.09)</td>
<td></td>
</tr>
<tr>
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<td>743</td>
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<td>942</td>
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<tr>
<td>Average adjusted $R^2$</td>
<td>0.33</td>
<td>0.11</td>
<td>0.34</td>
<td>0.19</td>
</tr>
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</table>
This table shows the relationship between volatility and corporate governance by using the full sample (9/1990-12/2002). The firm-level volatility measure (FirmV) and industry-adjusted volatility measure (DfirmV) are regressed cross-sectionally on market to book ratio (M/B), book leverage ratio (LEV), Dividend Dummy (DD), the log of total assets (SIZE), Return on equity (ROE), and firm age (AGE). Coefficients and standard errors reported in the table are computed from the time series of the estimated cross-sectional regression coefficients. This is similar to Fama-MacBeth regression. All figures (except average N and average adjusted $R^2$) have been multiplied by 1000. ***,**, * indicates statistical significance at 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
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<th>Dfirmv</th>
<th>Firmv</th>
<th>Dfirmv</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>-0.34**</td>
<td>-0.35**</td>
<td>-0.35***</td>
<td>-0.40***</td>
</tr>
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<td>(0.07)</td>
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<tr>
<td>M/B</td>
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</tr>
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<td>(2.28)</td>
<td>(2.45)</td>
<td>(2.58)</td>
</tr>
<tr>
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<td>-6.05***</td>
</tr>
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<td>(0.66)</td>
<td>(1.46)</td>
<td>(0.80)</td>
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<td>-1.36***</td>
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</tr>
<tr>
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<td>(0.21)</td>
<td>(0.14)</td>
<td>(0.21)</td>
<td>(0.14)</td>
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<tr>
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<td></td>
<td>(1.64)</td>
<td>(0.94)</td>
<td>(0.91)</td>
<td>(0.59)</td>
</tr>
<tr>
<td>AGE</td>
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<td>-2.14***</td>
<td>-2.98***</td>
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<td>(0.47)</td>
<td>(0.41)</td>
</tr>
<tr>
<td>Forecast Dispersion</td>
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<td>0.53***</td>
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<tr>
<td></td>
<td>(0.09)</td>
<td>(0.07)</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>804</td>
<td>1010</td>
<td>1010</td>
</tr>
<tr>
<td>Average adjusted $R^2$</td>
<td>0.30</td>
<td>0.11</td>
<td>0.32</td>
<td>0.18</td>
</tr>
</tbody>
</table>
1.4 Are Well Governed Firms Really Associated with Abnormally High Returns?

In addition to the claim that well governed firms are safe investments, researchers and practitioners also suggest that well governed firms are associated with abnormally high returns. It is difficult to rationalize this high return argument. In fact, McKinsey's Global Investor Opinion Survey on Corporate Governance (2002) shows that in 2002 (2000), investors were willing to pay a 14% (18%) premium to hold shares in well governed firms. In other words, if good governance is really desirable, high demand for the shares in well governed firms should drive prices up and returns down. In a relatively efficient market, investors should not be able to enjoy large and significant abnormal returns by holding shares in these well governed firms.

Gompers et al. (2003) therefore argue that the high abnormal return is due to the fact that investors underestimated the benefits of good governance in their sample period. Controlling for growth opportunities, they find that well governed firms engage less in M&A, and capital investment activities. They thus infer that investors underestimated the over-investment propensity of poorly governed firms, which leads to their conclusion that investors underestimated the benefits of good corporate governance. However, during or even before this period of time (1990s), there were a lot of news stories and academic studies in which good corporate governance mechanisms were strongly promoted. It is surprising that investors still made such an underestimation.

In the following subsections, three possible reasons for finding abnormally high returns will be examined:

1. Abnormal returns can be found if researchers do not control fully for priced risk

It is possible that the abnormal returns finding in Gompers et al. (2003) is due to the fact that they fail to include important risk factors when pricing the portfolios. Recently, researchers have begun to suggest that idiosyncratic risk may also be priced. One possible reason is that investors hold non-traded assets such as human capital and private businesses. Holding

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21Interestingly, in the same Wall Street Journal article (Brown, 2003) I have mentioned previously, the author also writes: "Stock market investors, not being the best-behaved group around, often have turned a blind eye to dodgy corporate behavior. Now there is evidence showing just how costly that lax attitude has been."
these non-traded assets makes investors unable to diversify their risk in the way that standard
CAPM or APT model would predict. As a result, idiosyncratic risk can affect these investors' portfoilo allocation decisions. Empirically, Malkiel and Xu (2002) and Goyal and Santa-Clara (2003) respectively provide cross-sectional and time-series evidence that idiosyncratic risk can explain stock market returns. In the following, I examine whether the excessive idiosyncratic risk observed in the previous section can explain the high abnormal returns.

2. A small number of firms in the sample drive the finding. The abnormal returns result is not robust to minor change in the sample of firms studied

This is one obvious, but sometimes overlooked explanation. It is possible that a small number of firms in the sample have great impact on the finding of abnormal returns. These firms may have certain characteristics that result in large mispricing influences. Therefore, including these firms in the sample may generate significant abnormal returns while the abnormal returns in fact have nothing to do with good or bad corporate governance.

3. Abnormal returns can be found if penny stocks are included in the sample

Penny stocks are usually quite illiquid. Moreover, their returns may be affected by a microstructure effect associated with bid-ask spread. Because of these features, penny stocks can potentially generate large abnormal returns when the standard four-factor model is employed. Therefore, I examine whether the abnormal returns finding is sensitive to the inclusion of penny stocks.

1.4.1 Can High Idiosyncratic Risk Explain the High Abnormal Return?

If there is really an idiosyncratic risk factor that should have been included in Gompers et al.'s pricing regression, this factor should have a different impact on high volatility and low volatility firms. Generally speaking, high volatility firms should have a positive loading on the factor, while low volatility firms should have a negative loading. If this "idiosyncratic risk" factor can be exactly measured, researchers can just add this factor to the pricing regression. If the abnormal return disappears once the factor is included, it can be argued that Gompers et al.'s abnormal return find-
ing probably results from pricing model misspecification. This is the most direct way to test the hypothesis. Unfortunately, a theoretical model is needed in order to construct this missing factor. This is beyond the focus of this essay. Therefore, I adopt an indirect method to check the validity of this hypothesis. If firm-level risk should be priced, then when the democracy and dictatorship portfolios are further divided into high volatility and low volatility portfolios, positive abnormal returns (computed based on four-factor model\textsuperscript{22}) should be found in the high volatility/democracy portfolio, while negative abnormal returns should be found in the low volatility/dictatorship portfolio. If this is not the case, the abnormal returns cannot be explained by firm-level volatility.

More specifically, in the beginning of each month, the previous month’s industry-adjusted firm-level volatility is computed for each firm. Then, portfolios are formed based not only on the aggregate governance index, but also on the previous month’s volatility. If a firm’s volatility is greater than the industry median, the firm is categorized in the high volatility portfolio; otherwise, the firm is categorized in the low volatility portfolio.

Table 1.13 presents the results. Interestingly, compared with the low volatility/democracy portfolio, the high volatility/democracy portfolio does not exhibit a high abnormal return. On the other hand, the low volatility/dictatorship portfolio does not have a larger and more negative returns than the high volatility/dictatorship portfolio. In fact, the relationship seems to be reversed.

In the value-weighted case, buying a low volatility/democracy portfolio and shorting a high volatility/democracy portfolio can earn a significant positive abnormal return of 0.76%. Moreover, buying a low volatility/dictatorship portfolio and shorting a high volatility/dictatorship portfolio can also earn a significant positive abnormal return with similar magnitude (0.77%). This result implies that firm-level volatility is unable to explain the high abnormal return finding noted by Gompers et al. (2003).

The previous result is based on the total firm-level volatility measure (adjusted by industry median). To show the robustness of my result, I also employ a different proxy for idiosyncratic risk. The proxy is the mean residual square computed from the pricing regression. The asset pricing

\textsuperscript{22}The three Fama-French factors (MKT, SMB, HML) are downloaded from Kenneth French's Website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/. The momentum factor is computed following Carhart (1997).
Table 1.13: Volatility, Governance and Abnormal Returns - Industry-Adjusted Volatility

In this table, I show abnormal return results generated from further sorting the democracy and dictatorship portfolios into high volatility and low volatility portfolios. In the beginning of each month, portfolios are rebalanced using the governance index and previous month industry-adjusted volatility. I only focus on two levels of industry-adjusted volatility: High (above industry median volatility) and Low (below or equal to industry median volatility). Hence, I have four portfolios each month. GH is the low volatility/democracy portfolio; BH is the high volatility/dictatorship portfolio; GL is the low volatility/democracy volatility portfolio; and finally BL is the high volatility/dictatorship portfolio. GL-GH represents the trading strategy of buying GL portfolio while shorting GH portfolio. BL-BH represents the trading strategy of buying BL portfolio while shorting BH portfolio. The sample period follows Gompers et al. (2003). All figures have been multiplied by 1000. ***,**, indicate statistical significance at the 1, 5 and 10 percent level based on t statistics. Standard errors are shown in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>GH</th>
<th>GL</th>
<th>BL</th>
<th>GL-GH</th>
<th>BL-BH</th>
</tr>
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<td>-6.13*</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(2.67)</td>
<td>(1.58)</td>
<td>(3.17)</td>
<td>(3.03)</td>
<td>(2.95)</td>
</tr>
<tr>
<td>Equal-Weighted</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>GH</td>
<td>GL</td>
<td>BH</td>
<td>BL</td>
<td>GL-GH</td>
</tr>
<tr>
<td>Intercept</td>
<td>-2.69</td>
<td>4.86**</td>
<td>-9.62***</td>
<td>-1.95</td>
<td>7.55**</td>
</tr>
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</tr>
<tr>
<td>Value-Weighted</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 1.14: Volatility, Governance and Abnormal Returns - Idiosyncratic Volatility

In this table, I show abnormal return results generated from further sorting the democracy and dictatorship portfolios into high volatility and low volatility portfolios. In the beginning of each month, portfolios are rebalanced using the governance index and previous month idiosyncratic volatility. Monthly idiosyncratic volatility is proxied by the residual sum square computed from daily four-factor model. I only focus on two levels of industry-adjusted volatility: High (above industry median volatility) and Low (below or equal to industry median volatility). Hence, I have four portfolios each month. GH is the low volatility/democracy portfolio; BH is the high volatility/dictatorship portfolio; GL is the low volatility/democracy volatility portfolio; and finally BL is the high volatility/dictatorship portfolio. GL-GH represents the trading strategy of buying GL portfolio while shorting GH portfolio. BL-BH represents the trading strategy of buying BL portfolio while shorting BH portfolio. The sample period follows Gompers et al. (2003). All figures have been multiplied by 1000. ***,***, * indicate statistical significance at the 1, 5 and 10 percent level based on t statistics. Standard errors are shown in parentheses.

<table>
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<th>GL</th>
<th>BH</th>
<th>BL</th>
<th>GL-GH</th>
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</thead>
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<tr>
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<td>-3.46</td>
<td>-2.02</td>
<td>-3.32</td>
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<td>(1.56)</td>
<td>(2.52)</td>
<td>(1.74)</td>
<td>(3.27)</td>
<td>(2.43)</td>
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</table>

<table>
<thead>
<tr>
<th>Value-Weighted</th>
<th>GH</th>
<th>GL</th>
<th>BH</th>
<th>BL</th>
<th>GL-GH</th>
<th>BL-BH</th>
</tr>
</thead>
<tbody>
<tr>
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<td>-0.86</td>
<td>4.20***</td>
<td>-4.19</td>
<td>-3.45*</td>
<td>5.06</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>(3.06)</td>
<td>(1.56)</td>
<td>(2.91)</td>
<td>(1.97)</td>
<td>(3.63)</td>
<td>(3.02)</td>
</tr>
</tbody>
</table>

regression for each firm is conducted in each month using daily return data. The systematic factors are the daily Fama-French factors and the daily momentum factor. I require the sample firms to have at least 15 observations in each month. This different firm-level volatility measure is designed to eliminate any potential systematic volatility that might exist in the previous measure. Table 1.14 shows that even with this new measure, a similar conclusion can be reached. These results suggest that idiosyncratic risk may not be the missing factor.

1.4.2 Is the High Abnormal Return Result Robust?

The abnormal return result found in Gompers et al. (2003) is based on long run event study methodology. The basic idea of long run event study is to group firms that share some common

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23Daily momentum factor are downloaded form Jeffrey Busse's website: http://www.bus.emory.edu/jbusse/daily.htm
characteristic(s) (i.e., governance practices) into portfolios, and to see whether holding these portfolios can generate abnormal returns. This simply implies that "governance practices" should have a similar impact on stock returns among stocks in the same portfolio group. Of course, this impact might weaken or strengthen depending on other firm characteristics. Nevertheless, when the number of sample firms in the portfolio is large enough, a true impact from "governance practices" should be found if, as argued by Gompers et al. (2003), investors have underestimated the benefits of good corporate governance in the 1990s. However, if a small number of firms in the sample are associated with certain other characteristics that are difficult to price, and if these firms are given great weights on portfolio returns, including these firms can result in a significant abnormal return even when the majority of the firms are priced correctly.

Researchers typically believe that this is not an important issue in the value-weighted portfolio case. The most common reason is that larger firms are generally less misvalued. In other words, large firms in the portfolio should drive the computed abnormal returns toward zero. This is the basic idea of Loughran and Ritter (2000). They indicate that calendar time regression with the value-weighted portfolio has little power to detect any abnormal returns. In addition, Loughran and Ritter suggest that a few very large firms in the portfolio can make the value-weighted portfolio less diversified. This in turn makes variance of the intercept large and it becomes difficult to reject the hypothesis that the intercept is zero. Thus, having a dominant firm in the value-weighted portfolio seems to create bias toward finding an insignificant result.

However, Loughran and Ritter's finding is based on simulation. Empirically, it is not clear whether their assertions are valid. Moreover, the sample period in Gompers et al. (2003) is relatively short and covers the whole stock bubble period. Some stocks can be misvalued and at the same time have very large market capitalizations. If this is true, some "extreme" stocks with large capitalizations can in fact generate large abnormal returns.

I therefore develop a simple algorithm to detect potential "extreme" stocks. The motivation of the algorithm is very simple: if there is in fact a "governance effect" on stock returns, then removing a single stock from a portfolio should not make a dramatic impact on the observed abnormal return. If removing a stock indeed significantly affects the abnormal return, the removed stock might have
characteristics other than corporate governance that make the stock difficult to price.

More specifically, suppose there are $N$ stocks in portfolio $G$. $N$ is the total number of stocks with the same characteristic $G$ during the sample period. It is not the number of stocks at a particular point in time. A simple two-period example is illustrated as follows. In period one, there are ten stocks. In period two, one of the ten stocks leaves the sample and two new stocks start sharing the common characteristic $G$. In this example, $N$ will be 12 for the whole sample period. Abnormal returns can then be computed from the following “extreme” trading strategy.$^{24}$

- Buy a portfolio with all stocks in portfolio $G$, including stock $j$
- Short a portfolio with all stocks in portfolio $G$, excluding stock $j$, where $j = 1$ to $N^{25}$

The portfolio can be formed on either a value- or equal-weighted basis. Since there are $N$ stocks in portfolio $G$, there will be $N$ abnormal returns.$^{26}$ In this essay, abnormal returns are calculated using the standard four-factor model. Theoretically, if the common characteristic $G$ leads to similar abnormal returns for individual stocks, the “extreme” trading strategy should not create any significant abnormal return. Nevertheless, empirically, it is possible that $M$ of the $N$ abnormal returns might be significantly different from zero. I define “significant” as a case in which the p-value of the estimated abnormal return is less than 0.05. Next, the $M$ significant abnormal returns will be sorted on their absolute values. The stock with the largest abnormal return (in the sense of absolute value) will be removed from my sample. Then, the abnormal return of portfolio $G$ without this “extreme” stock can be computed. This is the first round of my algorithm.

After the first round, there exist $N - 1$ different stocks. The same “extreme” trading strategies computation can be implemented. However, in this round, portfolio $G$ does not include the stock

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$^{24}$Strictly speaking, this is not really a trading strategy since investors might not be able to use this strategy to trade their stocks. Nevertheless, it is easier to understand the algorithm by using the standard “short” and “long” terminology.

$^{25}$The “extreme” trading strategy is not equivalent to only buying stock $j$. The weights of the same stocks in the two portfolios generally differ.

$^{26}$More precisely, the number of abnormal returns we obtain from the $N$ “extreme” trading strategies can be less than $N$. For example, among 100 sample periods, stock A only qualifies to be in portfolio $G$ for three periods. Statistically, it is impossible to compute the abnormal return from the trading strategy of buying all stocks in $G$ and selling all stock in $G$ except stock A. This should not bias my analysis, since for stock like A, it will have very limited contribution to the total abnormal return.
removed from the previous rounds. The algorithm will be repeated for $T$ times. In the end, at most $T$ “extreme stocks” and associated abnormal returns should be generated.\(^{27}\) Each abnormal return is computed from the portfolios that exclude stocks which have been removed in rounds 1 to $t$ ($t \leq T$). The effectiveness of the algorithm is provided in Appendix 1.3.

Tables 1.15 and 1.16 show the results of the “extreme” firms and the associated abnormal returns generated from the algorithm. I follow the same sample period and data selection criteria as in Gompers et al. (2003). The abnormal returns become relatively stable only after the first round. Therefore, $T$ is set to ten. Table 1.15 is computed based on value-weighted portfolios. Gompers et al. (2003) have shown that the democracy portfolio can generate positive abnormal returns and dictatorship portfolio can generate negative abnormal returns. Their results have been replicated in row one, which is labelled as round zero.\(^{28}\)

The most surprising result comes from the democracy portfolio. Using all stocks in the democracy portfolio, a significant monthly abnormal return of 0.29% can be found. However, after “Cisco” has been removed, the democracy portfolio essentially earns zero abnormal return. Although further eliminations increase the abnormal returns a little (from 0.08% to around 0.1%), the abnormal returns for the democracy portfolio are still far from significant. For the dictatorship portfolio, the result is less dramatic. Nevertheless, when “Waste Management Inc.” is removed from the dictatorship portfolio in the first round, the abnormal return becomes less negative and turns insignificant (from -0.39% to -0.28%).\(^{29}\) Moreover, the trading strategy proposed in Gompers et al. (2003) becomes insignificant when these two stocks are removed.

Table 1.16 shows the result generated from the equal-weighted portfolio. For the equal-weighted portfolio, a weakened result can also be found after the “extreme stocks” are removed. However, compared to Gompers et al. (2003) (in row one), the result does not differ substantially. After removing Cisco, the democracy portfolio abnormal return decreases from 0.193% to 0.173%; while

\(^{27}\)If there is no significant abnormal return found in, say, round $t$ ($t < T$) of the computation, less than $T$ extreme firms will be detected.

\(^{28}\)The result is very similar, though not exactly the same. This can result from the fact that I do not have exactly the same risk factors. For example, the momentum factor used in this essay might be slightly different from theirs. It is also possible that the governance index has been revised and some firms have been reclassified.

\(^{29}\)One might think that a monthly abnormal return of -0.28% would be economically significant. However, since it is not statistically significant, one should not have too much confidence that it reflects anything more than sampling variation.
Table 1.15: Extreme Stocks - Value-Weighted Portfolio

I use the algorithm discussed in section 1.4.2 to detect "extreme stocks." Columns 2 and 4 list the names of the extreme stocks detected. The monthly abnormal returns are computed after removing the stocks from the current round and all previous rounds. The sample period follows Gompers et al. (2003). Moreover, the portfolios are formed on a value-weighted basis. Trading strategy abnormal returns are obtained from the abnormal returns generated from buying the democracy portfolio and shorting the dictatorship portfolio. All figures have been multiplied by 100. ***, *** indicate statistical significance at the 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

<table>
<thead>
<tr>
<th>Round</th>
<th>Name-Democracy Firms excluded</th>
<th>Intercept (Abnormal Return)</th>
<th>Name-Dictatorship Firms excluded</th>
<th>Intercept (Abnormal Return)</th>
<th>Trading Strategy (Abnormal Return)</th>
</tr>
</thead>
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<tr>
<td>0</td>
<td>-</td>
<td>0.29**</td>
<td>-</td>
<td>-0.30**</td>
<td>0.68***</td>
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<td>(Gompers et al. (2003))</td>
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<td>(0.25)</td>
</tr>
<tr>
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<td>Cisco</td>
<td>0.08</td>
<td>Waste Management Inc. New</td>
<td>-0.28</td>
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<td></td>
<td>(0.18)</td>
<td></td>
<td>(0.25)</td>
</tr>
<tr>
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</tr>
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<td>(0.18)</td>
<td></td>
<td>(0.25)</td>
</tr>
<tr>
<td>3</td>
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<td>Sovereign Bancorp Inc</td>
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<td>0.32</td>
</tr>
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<td>(0.14)</td>
<td></td>
<td>(0.18)</td>
<td></td>
<td>(0.25)</td>
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<tr>
<td>4</td>
<td>Laboratory Corp America Holdings</td>
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<td>Armstrong Holding Inc</td>
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</tr>
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<td>(0.19)</td>
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<td>(0.25)</td>
</tr>
<tr>
<td>5</td>
<td>Mercury General Corp New</td>
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<td>Goorich BF Co</td>
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<td>(0.19)</td>
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<td>(0.25)</td>
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<td>Astoria Financial Corp</td>
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<td>(0.19)</td>
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<td>(0.25)</td>
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<td>Zurn Industry Inc</td>
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</tr>
<tr>
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<td>Wisconsin Central Trans Corp</td>
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<td>(0.19)</td>
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<td>(0.25)</td>
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</table>
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<table>
<thead>
<tr>
<th>Round</th>
<th>Name-Democracy Firms excluded</th>
<th>Intercept (Abnormal Return)</th>
<th>Name-Dictatorship Firms excluded</th>
<th>Intercept (Abnormal Return)</th>
<th>Trading Strategy (Abnormal Return)</th>
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<tr>
<td>0</td>
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<td>0.19</td>
<td>-</td>
<td>-0.27</td>
<td>0.47**</td>
</tr>
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<td>Cisco</td>
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<td>Robertson CECO Corp</td>
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<td>Oxy Energy Co.</td>
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<td>8</td>
<td>J &amp; L Specialty Steel Inc</td>
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<td>-</td>
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<td>0.16</td>
<td>-</td>
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after removing Roberson CECO Corp., the dictatorship portfolio abnormal return increases from -0.272% to -0.239%. When these two stocks are dropped, the trading strategy proposed by Gompers et al. (2003) earns an abnormal return of 0.412% at the 10% significance level (p-value=0.064).

1.4.3 Penny Stock Effect

In the previous subsection, I have shown that in the value-weighted portfolio case, the findings in Gompers et al. (2003) are not robust to minor change in the firms. It is also possible that stocks have different characteristics when they reach certain states. As mentioned earlier, researchers usually remove penny stocks from their studies (e.g., Ritter and Welch, 2002; Jegadeesh and Titman, 2001) to avoid the problem associated with the microstructure or illiquidity effect. In this section, I examine the penny stock effect on the appearance of abnormal returns. Since penny stocks are often small market capitalization stocks, they have a very limited impact on the value-weighted portfolio. Therefore, I only focus on the equal-weighted portfolio case.

In order to take into account the penny stock effect, each month stocks that become penny stocks on the last trading day of the previous month are removed from the portfolios. Then, abnormal returns are computed based on the four-factor model. I use both five dollars and three dollars as my penny stocks threshold. The results are qualitatively similar for these two measures. Table 1.17 shows that when the penny stocks are removed from the sample, the democracy portfolio earns a negative (but insignificant) return of -0.012% (-0.071%) when three (five) dollar threshold is employed. This is quite different from the finding in Gompers et al. (2003). On the other hand, dictatorship portfolio still earns a negative abnormal return, but it becomes slightly less negative (-0.26% (-0.23%) using the three (five) dollar threshold) than the abnormal return (-0.27%) found in Gompers et al. (2003). Moreover, for the trading strategy proposed in Gompers et al. (2003), after the penny stock effect is controlled for, it no longer generates significant abnormal returns in the equal-weighted case.

According to these results, the abnormal return findings in Gompers et al. (2003) does not seem to be robust. The anomaly is likely to be driven by a small number of firms with influential characteristics quite different from good or bad corporate governance. Penny stocks may also play
Table 1.17: Penny Stock effect

In the beginning of each period, portfolios are formed based not only on governance index, but also on the stock price of the last trading day in the previous month. If the price of a stock is less then $3 ($5), it is excluded from the sample. The intercept is the abnormal return generated by the trading strategy. Sample period follows Gompers et al. (2003). Also, the portfolios are formed on an equal-weighted basis. All figures (except for adjusted $R^2$) have been multiplied by 100. ***, ** indicate statistical significance at the 1, 5 and 10 percent levels based on t statistics. Standard errors are shown in parentheses.

<table>
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<td>Dictatorship</td>
<td>Democracy-Dictatorship</td>
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<tr>
<td>Intercept</td>
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a role in finding an abnormal return. Although well governed firms are riskier, they do not have abnormally high returns. These results imply that the high firm-level risk associated with well governed firms is diversifiable and not priced. An additional risk factor is not needed to explain the anomaly.

1.5 Conclusion

In this essay I examine the popular idea that well governed firms are associated with high returns and low risk. Despite popular claims in the Wall Street Journal and in academic articles, the evidence does not support this view. Instead, well governed firms are found to be associated with high stock return volatility. Moreover, this positive relationship between good governance and stock return volatility remains even after other firm characteristics, such as firm size and firm age, have been controlled for. This finding suggests that practitioners and governance activists may have focused too closely on extreme and rare events. Overemphasizing these firms (e.g., Enron, Tyco, etc) or events can lead to misleading conclusions related to the true relationship between risk and governance mechanisms.

I attempt to link the high volatility result to Gompers et al.'s (2003) abnormal return finding in the hope that high firm-level risk might explain the anomaly. However, I find that the high volatility portfolios do not generate high abnormal returns when employing the standard four-factor pricing regression model. Hence, the high idiosyncratic risk found in well governed firms does not seem to be a missing risk factor.

Surprisingly, I find that the major result in Gompers et al. (2003) is not robust when only two firms are removed from the sample. When Cisco and Waste Management are removed, the large abnormal return found in the case of the value-weighted portfolio becomes insignificant. On the other hand, for the equal-weighted portfolio, their finding can be explained by the inclusion of...

\[30\] Holmstrom and Kaplan (2003) conclude "...while parts of the U.S. corporate governance system failed under the exceptional strain of the 1990s, the overall system, which includes oversight by the public and the government, reacted quickly to address the problems. We then consider the effects that the legislative, regulatory, and market responses are likely to have in the near future. Our assessment is that they are likely to make a good system better, though there is a danger of overreacting to extreme events."
penny stocks. After controlling for the penny stock effect, the abnormal return in the equal-weighted portfolio case also becomes much smaller and insignificant.

If the majority of firms in the sample are more representative than firms such as Cisco, my insignificant abnormal return result implies that the current asset pricing model works reasonably well. There is no need to find an additional risk factor to explain the anomaly. Although well governed firms are associated with high firm-level risk, the result suggests that the risk is not priced and can be diversified away.

This essay provides evidence that well governed firms are risky and do not earn abnormal returns, but this result does not imply that there is no need for firms to pursue good corporate governance. Good corporate governance may, of course, help firms become more profitable, productive and competitive. However, it may be quite problematic to use “high stock returns” and “low risk” to infer the potential benefits of good corporate governance.

My results illustrate the general point that before working to find another risk factor to explain an abnormal return, researchers should first check their sample carefully. A simple algorithm is provided here that can be used as a robustness check. Similarly, investors should be cautious of the strategy of buying well governed firms and shorting poorly governed firms. The easy high returns that have been reported may not really be available.
Chapter 2

Growth Opportunities and Governance Structure Choices

"We are creating a corporate structure that is designed for stability over long term horizons... The main effect of this structure is likely to leave our team, especially Sergey and me, with increasingly significant control over the company's decisions and fate.... New investors will fully share in Google’s long term economic future but will have little ability to influence its strategic decisions...."¹

2.1 Introduction

The above quote is taken from the prospectus of the high-profile Google IPO. The firm essentially asked shareholders to yield power to the management and argued this would be in the best interests of the shareholders. Not everyone was convinced by this statement. The New York-based teacher’s pension fund TIAA-CREF asserted that there should be a substantial discount for the stock of this

poorly-governed company. Governance activist Robert Monks also described Google’s governance decision as “stupid.” An article from Business Week Online warned Google’s investors that the lack of voting power might allow Google to fill the board with insiders, with undesirable consequences.

Many outside observers view Google’s statement as little more than a convenient excuse for managerial entrenchment. Nevertheless, on August 19, 2004, in the face of such criticism, Google sold 7.23% of the firm for $1.67 billion. This is a market capitalization of $23 billion for a company that generated less than $0.11 billion in net income in 2003. Why were Google’s investors willing to give the management such “significant control over the company’s decisions”? Does this suggest that governance structure may not be as important as activists claim it to be? Or is it possible that corporate governance matters more in some situations, but is irrelevant in others?

In this essay, I try to answer these questions by examining the allocation of decision making power through governance structure choices. Fundamentally, when a possible project is available, someone must decide whether to go ahead. If the project is started, then as time progresses someone must decide whether to keep going, or to stop. Who gets to make these decisions depends on the firm’s board structure.

Board structure decisions usually involve trade-offs. On the one hand, managers typically have better information than do boards regarding the value of firms’ opportunities. Excessive interventions from boards may make managers behave conservatively to avoid their efforts being wasted. This perspective tends to favor giving decision making power to managers. On the other hand, managers often receive private benefits from projects. These private benefits may give managers

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4 Louis Lavelle, 2004. Google’s governance falls way short, Business Week Online, August 25. Moreover, although Google states that they do have an independent board, the governance rating agency Institutional Shareholder Services (ISS) argues that less than two-thirds of Google’s board are independent directors. The agency also views one member of the nominating committee as an “affiliated outsider.” (Phyllis Plitch, 2004, Google at bottom of ISS governance ranking, Dow Jones Newswires, August 23.) There is also controversy concerning the accusation that one of Google’s board members may have a conflict of interests when it comes to monitoring the firm. Stanford University President John Hennessy sits on Google’s board. Since Hennessy might expect Google’s founders to be contributors to the school, whether he can remain independent has been questioned. (Ann Grimes, 2004, Why Stanford is Celebrating the Google IPO, Wall Street Journal, August 23, page B1.)
5 This is consistent with the OECD’s (1999) definition: “corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporation.”

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incentives to pursue projects that are beneficial only to them, and detrimental to firms. To avoid managerial abuse, many corporate governance activists have suggested that boards should not relinquish decision making power to managers. The manner in which these forces interact has a great impact on corporate governance choices.

In the model analyzed here, the current board chooses from three different board structures to maximize shareholder value. These structures include: (1) a management-friendly board that rubber-stamps the manager's decision, (2) an independent board that holds a project termination option and (3) an independent board that holds both project termination and initiation options.

A management-friendly board allows the manager to secure his private benefits. Therefore, the manager has the option of pursuing any project without considering whether the project will create or destroy firm value. This suggests that the current board should choose a management-friendly structure when it expects that the project under consideration is very likely to be value-creating, i.e., growth prospects are very promising. In this case, the board is willing to err on the side of accepting the potentially profitable opportunity, even if that means a value-destroying project might also be implemented.

A friendly board is not the only way to ensure that a growth opportunity is pursued. If growth prospects are strong enough, an independent board in fact can credibly commit to project initiation and continuation. In other words, the chosen board will always initiate a project and allow it to continue even after a poor performance is observed. This commitment thus secures the manager's private benefits and his willingness to undertake the project. Since an independent board will act exactly like a management-friendly board, the result suggests that board structure is irrelevant when high enough growth potential is expected.

When growth prospects are less promising, the board structure choice becomes relevant. An independent board may exercise its termination option and cannot commit to project initiation and continuation. This implies that the manager's private benefits are no longer secured and he may lose his incentive to undertake the project. Sometimes a profitable project can even be given away. To avoid this inefficiency, the current board may voluntarily choose a management-friendly

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6It can also be thought of as the shareholders choosing among these structures, since I assume there exist no agency conflicts between shareholders and the board.
structure in order to encourage project implementation. Although ex post yielding the termination power can be a bad decision, ex ante the decision is rational and consistent with shareholder value maximization.

Of course, a management-friendly board is not always beneficial when growth prospects are less promising. It is possible that the manager's private benefits are so large (or his personal cost of implementing a project is so small) that he will not lose his incentive to undertake a project under an independent board. In this case, holding a termination option can be quite valuable. With this option, the board is able to stop the project if it deems continuation unprofitable. For example, after observing a poor performance the board can simply discontinue the project to avoid future losses.

Unfortunately, when growth prospects are very weak, holding a termination option may not be sufficient. The board may decide to continue a project after observing a favorable outcome. However, since growth prospects are very weak, ex ante the probability of observing a favorable outcome is very low. This implies that the project should not be implemented in the first place. Therefore, the chosen board should hold an additional initiation option.

These results have implications for the relationship between growth opportunities and governance structure choices. My model predicts that growth opportunities should be either unrelated or negatively correlated with board independence when growth prospects are not too extreme. This prediction is consistent with recent empirical findings based on US samples (Lehn et al., 2004; Denis and Sarin, 1999; Bhagat and Black, 2002).

However, this non-positive relationship between governance structure and growth seems to be inconsistent with the prediction offered in the investor protection literature. In this line of research, strong legal protection is argued to be an effective mechanism to reduce managers' asset diversion incentives. If managers are less likely to engage in asset diversion activities, investors will be more willing to fund high growth projects and they can be ensured of a large portion of the cash flow. Therefore, better legal protection is predicted to be correlated with higher growth (Shleifer and

\footnote{If the board can credibly commit to the policy in which a high performance project will also be terminated, it makes no difference whether it holds an initiation option or not. This may occur when growth prospects are extremely weak.}
Wolfenzon, 2002).

The different predictions between the investor protection model and mine actually result from the different agency conflicts assumed in the models. In the standard investor protection model, asset diversion is the main focus. However, in my model the agency conflicts come from project implementation problems. Moreover, in the investor protection literature, researchers are generally interested in macro-level governance structures rather than firm-level governance structures. The interactions between firm-level governance structures and the legal environment have been largely ignored. 8 My model provides an explanation of why both predictions may be valid at the same time.

When adding the asset diversion feature to my model, it can be shown that in a weak legal protection regime, a strong firm-level governance structure is generally needed to prevent severe agency problems. When pursuing a risky growth opportunity, due to weak legal protection the manager can always claim a project fails when in fact it succeeds. By doing so, the manager can steal the realized profits and leave the shareholders with losses. Anticipating this misbehavior, the current board should adopt a strong firm-level governance structure to avoid any project implementation. In a sense, the growth opportunity is a bad thing for the shareholders in this regime.

On the other hand, in a strong legal protection regime, asset diversion is less of an issue. The shareholders will thus view the growth opportunity positively. A weak governance structure may be adopted to encourage the managers to undertake the risky project. Therefore, a quite different prediction on growth opportunities and firm-level governance structures might be expected. This version of my model is thus able to explain why empirical evidence related to growth opportunities and firm-level governance structures is so different between the US or UK sample and samples from emerging economies. Moreover, it is consistent with the investor protection model that countries with better investor protection should be associated with higher growth.

My model also helps clarify the debates on shareholder power among legal scholars. Some scholars argue that shareholders should be given more power to intervene, because this can ameliorate the managerial entrenchment problem (Bebchuk, 2004). On the other hand, others claim

that more shareholder intervention power would reduce the investment opportunities available to shareholders, because stakeholders may have no incentive to invest (Blair, 2004). Both parties' assertions can be true. But both may also be incorrect under some circumstances. In fact, the question of whether shareholders should have more power or less power does not have a universal answer independent of the firm's context. A firm's operating environment and characteristics have a great impact on its optimal governance structure choices.

Recently, some theoretical papers examine the benefits of a weak board. Adams and Ferreira (2003) focus on the advisory role of the board. A weak governance structure (i.e., a friendly board) can serve as a commitment device that allows the manager to reveal his information in exchange for the board's better advice. In Raheja's model (2004), the non-CEO insiders have the incentive to become future CEOs. The shareholders thus can take advantage of these non-CEO insiders' career concerns incentive and add these insiders strategically to the board to reveal the CEO's misbehavior. Hermalin and Weisbach (1998), on the other hand, argue that a weaker board is the result of higher CEO negotiation power, which comes from better firm performance. All these models stress that a weak governance structure is in fact chosen to maximize shareholder value. Although this essay also shares the notion that a weak governance structure can be endogenously chosen, the basic rationale is fundamentally very different. The current analysis places particular emphasis on differing growth opportunities as the key element.

In a very general model, Aghion and Tirole (1997) illustrate the point that too much monitoring can harm an agent's initiative incentive. Therefore, the principal may encourage the agent to engage in valuable information gathering activities by giving away the decision making rights. Allen and Gale (2000) also argue that it may be beneficial to yield decision making rights to the agent. Their basic idea is that although the informed agent makes biased decisions, the decisions can still lead to better outcomes than those made by the uninformed principal. In order to study the relationship between growth opportunities and governance structure choices, I impose more

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9Burkart, Gromb and Panunzi (1997) extend Aghion and Tirole's idea to the study of stock ownership concentration. They argue that dispersed ownership can be used as a commitment device for less monitoring. Carlin and Mayer (2003) do not find strong empirical support for this argument.

10Harris and Raviv (2004) also use the cheap talk model to study board size and composition decision. In their model, contrary to the work of Allen and Gale (2000), both the manager and the board have private information.
structure than these general models. This allows me to determine when and why a particular governance structure should be chosen.

Some predictions of my model are also complementary to the results provided in Povel, Singh and Winton (2004). When the shareholders and the boards expect high growth opportunities, they tolerate more projects with poor initial outcomes. Therefore, during a boom period some managers will try to take advantage of the high growth expectation and engage in questionable projects. In a recession period, a strong governance structure should be chosen. Managerial misbehavior can thus be largely deterred, even though the cost is missed growth opportunities. This is also consistent with Philippon's (2003) real business cycle model in which a weaker governance is adopted when a positive shock occurs.

The remainder of this essay explores the issues above. In the next section, I describe the basic model setting and the equilibria. Section 2.3 describes the empirical implications of the basic model. In the basic model, I do not consider the roles of incentive contracts, more complicated payoff structures, or mixed strategy equilibria. I will relax these assumptions in Section 2.4 and discuss the robustness of the basic model. In Sections 2.5, I extend the basic model by considering some prominent issues in the literature, including asset diversion behavior, earnings manipulation, stigma of failure and manager/board overoptimism. A macro-perspective interpretation of the basic model is also provided. Section 2.6 concludes.

2.2 The Model

2.2.1 Sequence of the Game and Assumptions

There are three dates (i.e., two periods): date 0, date 1 and date 2. Outputs are realized at date 1 and date 2. The discount rate is normalized to zero. Both the manager and the board are assumed to be risk neutral. In addition to the risk neutrality assumption, I assume the manager is wealth constrained and has limited liability. The board's goal is to maximize shareholder value. In other words, there is no agency conflict between the board and the shareholders. On the other hand,
the manager only cares about maximizing his own utility. This is the source of potential agency problems. The manager's reservation wage is normalized to zero. In this section, I assume the firm offers the manager a fixed wage contract that satisfies the manager's reservation utility. In Section 2.4, I will consider the feasibility of incentive contracts. Figure 2.1 illustrates the sequence of the game.

At date 0 an existing firm is operated with a riskless production technology. This technology, which can be viewed as "business as usual," generates $G$ per period. In addition to the business as usual activity there also exists a risky project. The decisions to pursue this risky project and to terminate the project once it has been implemented are determined by the party with the decision making power. It is the current board's responsibility to make this power allocation decision. More specifically, the current board allocates the decision making rights by choosing a new board from the following three governance structures:

1. Management-friendly board: the board always rubber-stamps the manager's decisions. In other words, the manager has the options to initiate and terminate a project.

2. Independent board: in this case, the board holds a termination option. This option gives the board the right to discontinue a project if the board deems continuation unprofitable. The termination option captures the monitoring function of the board.

3. Independent board with a project initiation option: in addition to the termination option, this board also has an option to initiate a project. In this case, the manager just implements the
directions given by the board. If the manager does not want to follow the board’s proposal, he must leave the firm.\textsuperscript{11}

After the current board has chosen the governance structure, the manager or the new board needs to make the project initiation decision. If the new project is not chosen, the firm will continue operating with the riskless technology. The manager’s cost of managing this “business as usual” activity is normalized to zero. On the other hand, if the new project is pursued in addition to the “business as usual” activity, the manager must exert efforts \( c \). Possible costs for the manager of undertaking the new project include new skills acquisition, overtime work and the disutility resulting from giving up a “quiet life.” \textsuperscript{12}

The risky new project can be thought of as an opportunity to enter a new product market or start a new venture. It can either be a positive NPV project (hereafter, “a growth opportunity”) or a negative one. Because the board has limited time and information with which to understand this new strategic direction, it may not be able to assess the true quality of the new project. Therefore, I assume that the board knows only the probability of having a growth opportunity. The board realizes with probability \( p \in (0, 1) \) that the risky project is a real growth opportunity, and with probability \( 1 - p \) that the project is just a value-destroying deal. Nevertheless, the board’s belief is assumed to be unbiased.\textsuperscript{13}

Unlike the board, the manager is responsible for the day-to-day operation. He is more likely to know whether the new project is profitable or not. To simplify the analysis I assume the manager knows the quality of the project exactly. This creates information asymmetry between the board and the manager.

There are two possible states (i.e. \( H \) and \( L \)) for this risky project. For a growth opportunity

\textsuperscript{11}If the manager has a veto right over the board’s project initiation decision, he is in fact monitored under an independent board as discussed in \( (2) \).

\textsuperscript{12}I assume a manager’s personal cost of pursuing a growth opportunity and undertaking a value-destroying deal are the same. It is also reasonable to assume that the personal cost of implementing a bad project is lower (e.g., less overtime needed due to lower demand). The results described below largely remain the same if this additional assumption is made.

\textsuperscript{13}This implies the board can never verify the true quality of the project. This contrasts with the assumption made in Aghion and Tirole (1997). In their model, the principal can verify project quality with some probability. However, in the real world if the board can easily verify the project quality, then the firm should be managed by the directors not the manager. The cost of verification may be too large. Therefore, the board may at best acquire an unbiased signal as assumed in this essay.
with probability \( \pi_g \) the project generates \( H \); while with probability \( 1 - \pi_g \), the project generates \( L \).\(^{14}\) I assume \(-G < L < 0 < H \) and \( \pi_g H + (1 - \pi_g) L > 0 \) (i.e., \( \pi_g > \frac{L}{H-L} = \bar{\pi} \)). The assumption \(-G < L \) ensures that the firm will never go bankrupt. If the risky project is in fact a value-destroying deal, state \( H \) occurs only with probability \( \pi_b \) where \( \pi_b < \bar{\pi} \). In the basic model, the success probability of the risky project is assumed to be the same in both periods. I later relax this assumption and analyze the case in which the success probability can be different across periods. The parameters \( \pi_g, \pi_b, \bar{\pi}, H \) and \( L \) are known to both the board and the manager.\(^{15}\)

Depending on the chosen board structure, the manager or the board must make the project termination decision after the first period output is realized. If the project is continued, the manager will be able to enjoy private benefits \( B \) regardless of the true quality of the project. I assume the manager’s private benefits are larger than his efforts of implementing the project (i.e., \( B > c > 0 \)). This implies that if there is no information asymmetry the manager will definitely pursue the growth opportunity. If the project is terminated the firm will focus only on the “business as usual” activity, because there is no growth opportunity during the second period. Once the project is terminated, the manager will not be able to enjoy his private benefits, and his efforts exerted in the previous period are wasted.

At date 2, the second period output is realized and the firm is liquidated.

2.2.2 Equilibrium

In this section, I solve the equilibrium strategies of the current board, the manager and the new board. The equilibrium concept adopted is a Perfect Bayesian Equilibrium (PBE). I consider only the pure strategy equilibria at this time. More sophisticated mixed strategy equilibria are discussed in Section 2.4.

In subsections A-C, I solve the board and the manager’s strategies and expected payoffs when a management-friendly board, an independent board, or an independent board with an initiation

\(^{14}\)Investment cost for this new project is not explicitly modelled. \( H \) and \( L \) can be thought as the net payoff after investment cost.

\(^{15}\)In the model, \( p \) and \( \pi \) represent different things. For example, in an industry with promising growth prospects, the probability of having a positive NPV project can be very high (i.e., \( p \) is large). However, the success probability of the project can be extremely low (i.e., \( \pi_g \) is very low).
option is chosen. Then in subsection D, the current board compares the expected payoffs from these different board structures and decides the optimal board structure.

A. Management-friendly Board

When the new board is management-friendly it simply rubber-stamps the decisions made by the manager. In the second period, the manager obtains private benefits $B$ if the project is kept, and 0 if the project is terminated. Hence, he always prefers to continue the project. Moreover, when the manager makes the project implementation decision, knowing his private benefits are secured, he undertakes any project regardless of whether it is a growth opportunity or a value-destroying deal.

Lemma 1 If a management-friendly board is chosen, the manager will always implement the risky project regardless of the project profitability.

The manager's and the shareholders' expected payoffs can thus be summarized in the following Corollary:

Corollary 1 If a management-friendly board is chosen, the shareholders' expected payoff is $2G + 2[p(\pi_g H + (1 - \pi_g)L) + (1 - p)[\pi_b H + (1 - \pi_b)L]$. The manager's expected payoff is $B - c > 0$.

The benefit of having a management-friendly board is that a real growth opportunity will never be missed. Unfortunately, this benefit comes at a cost. The implemented project can also be a value-destroying deal. When $p > \frac{-[L + \pi_b(H-L)]}{[H-L](\pi_b - \pi_g)} = \bar{p}$, the shareholders' expected payoff from the risky project will be positive. Conversely, when $p \leq \bar{p}$, the risky project is not expected to add value to the firm. Also, other things being equal, a management-friendly board destroys more value when the probability of a real growth opportunity $p$ is low.

B. Independent Board

When an independent board is chosen, the board holds a project termination option that allows it to terminate a project if continuation is not desirable. This termination option will in turn affect the manager's incentive to undertake the risky project. Therefore, an equilibrium can be written
as a set of strategies and beliefs \( \{q, \gamma, I; p\} \). When a growth opportunity exists, the manager must decide whether to pursue this positive NPV project \( (q = 1) \) or to forgo it \( (q = 0) \). When the project under consideration is value-destroying, the manager must also decide whether to undertake this negative NPV project \( (\gamma = 1) \) or to restrain himself and focus on the “business as usual” activity \( (\gamma = 0) \). The board must decide whether to keep the project \( (I_j = 1) \) or to terminate the project \( (I_j = 0) \) after date 1 output is found to be \( G + j \), where \( j \in \{H, L\} \).

The equilibria are solved backward. Once the date 1 output is realized, the board updates its belief about \( p \) following Bayes’ Rule. If the date 1 output is high \( (H + G) \), the posterior will be:

\[
P(\text{growth opportunity}|y_1 = G + H) = \frac{pq\pi_g}{pq\pi_g + (1-p)\gamma\pi_b}
\] (2.1)

The board’s decision to continue the project or terminate the project is thus made by finding the \( I_H \in \{0, 1\} \) that maximizes:

\[
I_H\left\{\frac{pq\pi_g}{pq\pi_g + (1-p)\gamma\pi_b}\left[L + \pi_g(H - L)\right] + \frac{(1-p)\gamma\pi_b}{pq\pi_g + (1-p)\gamma\pi_b}\left[L + \pi_b(H - L)\right]\right\}
\] (2.2)

Using the same logic, it can be shown that when the first period output is low \( (L + G) \), the board’s decision is made by finding the \( I_L \in \{0, 1\} \) that maximizes:

\[
I_L\left\{\frac{pq(1-\pi_g)}{pq(1-\pi_g) + \gamma(1-p)(1-\pi_b)}\left[L + \pi_g(H - L)\right] + \frac{(1-p)(1-\pi_b)\gamma}{pq(1-\pi_g) + \gamma(1-p)(1-\pi_b)}\left[L + \pi_b(H - L)\right]\right\}
\] (2.3)

**Lemma 2**

1. When the date 1 output is \( H+G \), the board keeps the project \( (I_H = 1) \) if \( \frac{\pi_g}{\pi_b} > \frac{-(1-p)\pi_b[L + \pi_b(H - L)]}{pq[L + \pi_g(H - L)]} \).

2. When the date 1 output is \( L+G \), the board keeps the project \( (I_L = 1) \) if \( \frac{\pi_g}{\pi_b} > \frac{-(1-p)(1-\pi_g[L + \pi_g(H - L)]}{pq(1-\pi_g)[L + \pi_b(H - L)]} \).

From Lemma 2, it can be observed that when the board believes that the possibility of having a growth opportunity is higher, the project is more likely to be kept. This intuition is straightforward.
When strong growth prospects are expected, the implemented project is less likely to be a value-destroying deal. Therefore, even when the initial performance is not favorable, the board tends to infer that this is due to bad luck, not the poor quality of the project. Therefore, the board is more likely to allow the project to continue.

From the above project continuation policy, I can analyze the manager’s project implementation decision. The manager will pursue the risky project only when his expected payoff is positive. Thus, he undertakes the project if:

\[ \pi_i[I_H(B - c) + (1 - I_H)(-c)] + (1 - \pi_i)[I_L(B - c) + (1 - I_L)(-c)] > 0, \quad \text{where } i \in \{g, b\} \quad (2.4) \]

Since the manager knows the quality of the project with certainty, his decision to undertake the project will not be directly dependent on \( p \). However, growth prospects will indirectly influence the manager’s implementation decision through the board’s termination decision \( I_H \) and \( I_L \).

**Lemma 3** The manager undertakes the risky project if \( \frac{\sigma}{B} < I_L + \pi_i[I_H - I_L] \), where \( i \in \{g, b\} \).

It follows from Lemma 3 that when the efforts of implementing a project are higher or the deferred private benefits are lower, the manager is less likely to undertake a project. Furthermore, it can be observed that if the manager is willing to undertake a negative NPV project, he must be willing to pursue a growth opportunity if there one exists. This result follows directly from the assumption \( \pi_b < \pi_g \).

The board’s project termination policy (Lemma 2) and the manager’s project implementation policy (Lemma 3) thus lead to the following proposition:

**Proposition 1** If an independent board is chosen:

1. When \( p > \frac{-(1-\pi_b)[L+\pi_b(H-L)]}{(1-\pi_g)[L+\pi_g(H-L)]-(1-\pi_b)[L+\pi_b(H-L)]} = p_T^L \), the board will continue the project regardless of the realized date 1 performance \( (I_L = I_H = 1) \). The manager therefore always implements the risky project \( (q = \gamma = 1) \), regardless of its profitability.

2. When \( \frac{\sigma}{B} < \pi_b < \pi_g \) and \( p < \frac{-\pi_b[L+\pi_b(H-L)]}{(\pi_g)[L+\pi_g(H-L)]-(\pi_b)[L+\pi_b(H-L)]} = p_T^H \), the board will terminate
the project regardless of the realized date 1 performance ($I_L = I_H = 0$). The manager chooses to forgo the risky project ($q = \gamma = 0$), regardless of its profitability.

3. When $\frac{\pi_H}{\pi_b} < \pi_b < \pi_g$ and $p_l^H < p < p_l^I$, the board will continue the project only if the date 1 output is high ($I_H = 1, I_L = 0$): The manager always undertakes the risky project ($q = \gamma = 1$), regardless of its profitability.

4. When $\pi_b < \pi_g < \frac{\pi_b}{\pi_H}$ and $p < p_I^I$, the board will terminate the project if the date 1 output is low ($I_L = 0$). The manager forgoes the risky project ($q = \gamma = 0$), regardless of its profitability.

Proof See Appendix 2.1.

The above proposition shows that in the case where only pure strategy is allowed, the effectiveness of the board’s termination threat is crucially dependent on the board’s belief related to growth prospects. If the board believes the implemented project is very likely to be a positive NPV project, it will not exercise its termination option. This gives the manager an incentive to pursue his private benefits by undertaking the risky project. On the other hand, if a growth opportunity is extremely unlikely, the board will always exercise the option to avoid future losses. This policy can be a credible threat useful in deterring any managerial misbehavior. The manager thus chooses to forgo the risky project.

The probability of a project’s success and the manager’s cost to benefit ratio ($\frac{\pi_g}{\pi_b}$) also have a great impact on the realized equilibrium when the manager’s private benefits are not secured. If project success probability is lower than the cost to benefit ratio (i.e. $\pi_b < \pi_g < \frac{\pi_b}{\pi_H}$), the manager’s expected gains from undertaking the project are insufficient in comparison to the efforts needed. Therefore, it is not beneficial for him to undertake the risky project. Conversely, if the project success probability is greater than the cost to benefit ratio (i.e. $\frac{\pi_b}{\pi_H} < \pi_b < \pi_g$), the manager’s expected gains from undertaking the project can justify the efforts needed. Hence, as long as the board is willing to continue a project characterized by good performance, the manager will pursue the risky project.

When $p_l^H < p < p_l^I$ and $\pi_b < \frac{\pi_b}{\pi_H} < \pi_g$, it seems that the manager will restrain himself and undertake only profitable growth opportunities. However, if this is true, the board will always
maintain the project and cannot commit to the termination policy. Since the threat is now not credible, the manager still has an incentive to pursue a value-destroying deal. Therefore, there is no stable pure strategy equilibrium if the cost to benefit ratio is within this range. Agency conflicts between the board and the manager can never be fully resolved even when the board holds a termination option.

Based on the equilibrium outcomes, the manager and the shareholders’ expected payoffs can be summarized in the following Corollary:

**Corollary 2** If an independent board is chosen, the shareholders’ and the manager’s expected payoffs are as follows:

1. **When** \( p > p_f^L \), the shareholders’ expected payoff is \( 2G + 2[pL + \pi_g(H - L)] + (1 - p)[L + \pi_b(H - L)] \) and the manager’s expected payoff is \( B - c \).

2. **When** \( p < p_f^H \), the shareholders’ expected payoff is \( 2G \) and the manager’s expected payoff is 0.

3. **When** \( p_f^H < p < p_f^L \) and \( \pi_b < \pi_g < \frac{p}{0} \), the shareholders’ expected payoff is \( 2G \) and the manager’s expected payoff is 0.

4. **When** \( p_f^H < p < p_f^L \) and \( \frac{p}{0} < \pi_b < \pi_g \), the shareholders’ expected payoff is \( 2G + p(1 + \pi_g)[L + \pi_g(H - L)] + (1 - p)(1 + \pi_b)[L + \pi_b(H - L)] \) and the manager’s expected payoff is \( \pi_i B - c \), where \( i \in \{g, b\} \).

When \( p > p_f^L \), the risky project is expected to generate a positive payoff if \( p > \bar{p} \). It can be shown that \( p_f^L \) is strictly larger than \( \bar{p} \). Therefore, when \( p > p_f^L \), even though the termination option is not exercised, the implemented project on average will have a positive payoff. On the other hand, when \( p_f^H < p < p_f^L \) and \( \frac{p}{0} < \pi_b < \pi_g \), the break-even \( p \) for the risky project is

\[
\left(\frac{-(1+\pi_b)[L+\pi_b(H-L)]}{(\pi_g-\pi_b)(H+\pi_b+\pi_g)(H-L)}\right) \Rightarrow \bar{p}.
\]

Using algebra it can be shown that \( p_f^H < \bar{p} < p_f^L \). This implies that within this range, even with the termination option, ex ante the expected payoff can still be negative. This suggests a stronger board should be adopted.
C. Independent Board with an Initiation Option

The equilibrium outcomes shown in the previous subsection suggest that an independent board with only a termination option cannot completely resolve the agency conflicts. When growth prospects are very strong, the board will allow project continuation even though the implemented project may be value-destroying. On the other hand, when growth prospects are very weak, the manager may lose his incentive to implement a project. What is more troublesome is that even with a termination option, the ex ante expected payoff can still be negative.

These results suggest that the shareholders cannot be worse off if the new board holds an additional project initiation option. In other words, all results discussed in the independent board case can be replicated when the board also holds an initiation option.

When the board holds both initiation and termination options, the manager becomes powerless and merely follows the directions given by the board. The board relies only on its unbiased but noisy information to make the project initiation decision. If the manager does not follow the orders of the board, he must leave the firm.

As in the previous subsection, the equilibria are solved by backward induction. After the date 1 output turns out to be $G + H$, the board will continue the project if:

$$
\frac{p\pi_g}{p\pi_g + (1-p)\pi_b} [L + \pi_g(H - L)] + \frac{(1-p)\pi_b}{p\pi_g + (1-p)\pi_b} [L + \pi_b(H - L)] > 0 \quad (2.5)
$$

On the other hand, if the output is $G + L$, the board will continue the project if:

$$
\frac{p(1-\pi_g)}{p(1-\pi_g) + (1-p)(1-\pi_b)} [L + \pi_g(H - L)] + \frac{(1-p)(1-\pi_b)}{p(1-\pi_g) + (1-p)(1-\pi_b)} [L + \pi_b(H - L)] > 0 \quad (2.6)
$$

The board’s project termination policy is the same as in the independent board case where $q = \gamma = 1$. This is because the board does not have perfect information and thus the initiated and implemented project can be either a positive or negative NPV project.

**Lemma 4** When an independent board with an initiation option is chosen, if the manager’s par-
ticipation is not an issue, the chosen board's project initiation and termination policy is as follows:

1. When \( p > p_f^T \), the board always initiates a project. The project will not be terminated even after a poor performance is observed.

2. When \( p < \bar{p} \), the board never initiates a project.

3. When \( \bar{p} < p < p_f^T \), the board initiates a project. If the date 1 output is found to be low, the project will be terminated.

Proof See Appendix 2.2.

The above policy suggests that when the board holds both initiation and termination options, some projects unimplemented under an independent board might now be implemented. The board can experiment with projects with lower growth potential. When the date 1 output turns out to be unfavorable, the board can simply terminate the experiment. Moreover, since the board has the project initiation right, ex-ante shareholder value will always be non-negative. Therefore, this seems to be a very attractive governance structure. However, the manager's participation incentive has not yet been considered.

When \( p > p_f^T \), the project will not be terminated. Therefore, the manager's participation constraint can be satisfied. When \( p < \bar{p} \), no project will be initiated. The manager's participation will not be an issue here either. The key question is whether the manager will wish to work for this firm if \( \bar{p} < p < p_f^T \). In this case, the manager will participate if \( \pi_i B - c \geq 0 \) where \( i \in g, b \). Therefore, if \( \frac{c_i}{B_i} < \pi_b < \pi_g \), there will be no participation problem. The participation problem occurs when \( \pi_b < \pi_g < \frac{c_i}{B_i} \). When the manager's cost to benefit ratio is too large, it does not pay for the manager to follow the board's direction. Considering the loss \( (2G) \) if the manager leaves the firm, the board may choose not to exercise the initiation option and engage only in the "business as usual" activity.\(^{16}\)

\(^{16}\)This argument assumes the board is not able to find a new manager with the same or lower cost to benefit ratio. If the incumbent manager chooses to leave the firm, it will send a signal to the potential new manager who has the same (or higher) cost to benefit ratio that the project is not worth undertaking. Therefore, the firm will not be able to attract anyone to implement the project. Anticipating this, the board may choose not to initiate the project in the first place. If the incumbent manager has made firm-specific investment which makes him much more productive when engaging in the "business as usual" activity, the firm will also prefer the incumbent manager and choose not to exercise the initiation option.
Does this imply that when \( \pi_b < \frac{\pi_g}{2} < \pi_g \), the firm can successfully identify project quality by observing the manager’s willingness to participate? The answer is no. If the board believes participation can reveal project quality, it should then never terminate the project. Knowing this, the manager may want to participate even when no growth opportunity exists. The equilibrium is thus unstable. Therefore, the expected payoffs can be summarized in the following Corollary:

**Corollary 3** If an independent board with an initiation option is chosen, the shareholders’ and the manager’s payoffs are:

1. When \( p > p_f^I \), the shareholders’ expected payoff is \( 2G + 2[p[L + \pi_g(H - L)] + (1 - p)[L + \pi_b(H - L)] \) and the manager’s expected payoff is \( B - c \).

2. When \( p < p_f^I \) and \( \pi_b < \pi_g < \frac{\pi_g}{2} \), the shareholders’ expected payoff is \( 2G \) and the manager’s expected payoff is \( 0 \).

3. When \( \bar{p} < p < p_f^I \) and \( \bar{p} < \pi_b < \pi_g \), the shareholders’ expected payoff is \( 2G + p(1 + \pi_g)[L + \pi_g(H - L)] + (1 - p)(1 + \pi_b)[L + \pi_b(H - L)] \) and the manager’s expected payoff is \( \pi_iB - c \), where \( i \in \{g, b\} \).

4. When \( p < \bar{p} \) and \( \bar{p} < \pi_b < \pi_g \), the shareholders’ expected payoff is \( 2G \) and the manager’s expected payoff is \( 0 \).

Of course, the above analysis assumes that the board is not willing to pay a positive wage to attract the manager to participate. Suppose now that a positive wage \( W \) is offered when \( \bar{p} < p < p_f^I \) and \( \pi_b < \pi_g < \frac{\pi_g}{2} \). The manager will then accept the job if \( W > c - \pi_iB \) where \( i \in g, b \). This does not imply that the board can offer a wage \( c - \pi_gB < W < c - \pi_bB \) and identify the real growth opportunity. As discussed previously, if the board believes the project is value-creating, it will never terminate the project when the output is low. Thus, the manager who observes no growth opportunity will also accept the offer.

When mixed strategies are not allowed, the board can then compensate the manager \( c - \pi_bB \). Because of the compensation, the manager is willing to work for the firm. However, the firm’s expected payoff will now become \( 2G + p(1 + \pi_g)[L + \pi_g(H - L)] + (1 - p)(1 + \pi_b)[L + \pi_b(H - L)] - c + \pi_bB \).
Therefore, the board will initiate a project when \( \frac{-(1 + \pi_b)(L + \pi_g(H - L)) + c - \pi_b B}{(\pi_g - \pi_b)(H + (\pi_b + \pi_g)(H - L))} = \tilde{p} < p < p_f \). It is possible that the amount of compensation is so large that it is not a feasible option. In the following analysis I will assume away the possibility of this kind of compensation.

D. Board Structure Choice

Corollaries 1, 2 and 3 highlighted the shareholders’ expected payoffs under the three board structures. The current board thus chooses the structure that maximizes shareholder value.

**Proposition 2** Based on the expected payoffs derived from the three board structures, the current board makes the following new board structure decision:

1. When \( p > p_f \), the current board is indifferent toward these three board structures.\(^{18}\)

2. When \( \tilde{p} < p < p_f \) and \( \pi_b < \pi_g < \frac{\pi_b}{\pi_f} \), a management-friendly board is preferred.

3. When \( p < \tilde{p} \) and \( \pi_b < \pi_g < \frac{\pi_b}{\pi_f} \), an independent board (either with or without an initiation option) is preferred.

4. When \( \tilde{p} < p < p_f \) and \( \frac{\pi_b}{\pi_f} < \pi_b < \pi_g \), an independent board (either with or without an initiation option) is preferred.

5. When \( p_f < p < \tilde{p} \) and \( \frac{\pi_b}{\pi_f} < \pi_b < \pi_g \), an independent board with an initiation option is preferred.

6. When \( p < p_f \) and \( \frac{\pi_b}{\pi_f} < \pi_b < \pi_g \), an independent board (either with or without an initiation option) is preferred.

Figure 2.2 visualizes the board structure choices. When growth prospects are very promising \( (p > p_f) \), the expected payoffs are exactly the same under these three board structures. This is due to the fact that even though a more independent board structure is chosen, the board’s best

---

\(^{17}\)In fact, this suggests that the initiation option may not be free. Excessive compensation in fact can be a result of a very strong governance structure.

\(^{18}\)If the current board needs to pay a small cost \( \epsilon \) (e.g., outside director compensation or extra monitoring expense) to adopt an independent board, the board will prefer a friendly board when growth prospects are very promising.
policy is still to continue the project regardless of the initial performance. In Aghion and Tirole’s (1997) terminology, the manager in fact has the “real authority.”

Figure 2.2: Board Structure Choices

When $p > p_t^L$, board structure choice is irrelevant. An independent board will act exactly like a management-friendly board. When $p < p < p_t$ and $\pi_g < \frac{\pi_b}{B}$, the current board should choose a management-friendly board to motivate the manager to undertake the risky project. When $p < \tilde{p}$ and $\pi_g < \frac{\pi_b}{B}$, an independent board will be chosen. If $\tilde{p} < \pi_b$ and $\tilde{p} < p < p_t^L$ or $p < p_t^H$, an independent board can be adopted. However, the board has to hold an additional termination option to avoid any project being implemented when $\tilde{p} < \pi_b$ and $p_t^H < p < \tilde{p}$. If $\pi_b < \tilde{p} < \pi_g$, there exists no pure strategy equilibrium. Only mixed strategy equilibria are possible in this range.

Moreover, when $\pi_b < \pi_g < \frac{\pi_b}{B}$ and $\tilde{p} < p < p_t^L$, if the board holds the termination option the manager will readily forgo the risky project to avoid having his efforts wasted. However, ex ante, from the shareholders’ perspective, the project’s expected payoff is in fact positive. The problem is that the board cannot commit to continuing the project if the date 1 output turns out to be low. To solve this inefficiency, the current board can voluntarily yield the termination option by choosing a management-friendly board. This is ex-ante beneficial for the firm.

When $\pi_b < \pi_g < \frac{\pi_b}{B}$ and $p < \tilde{p}$, yielding the termination option to the manager will generate losses if the project is implemented. Therefore, it is best to choose a board in which a termination
option is held. The manager recognizes his cost of undertaking a project is higher than the expected private benefits he can enjoy in the second period. He will choose not to pursue the risky project regardless of project profitability.

When $\hat{\gamma} < \pi_b < \pi_g$ and $\hat{p} < p < p_f^H$, a management-friendly board is not desirable. This is because the manager always wants to continue the project even when a poor initial performance is observed. Therefore, the current board benefits from choosing to keep the termination option. When the initial outcome is not favorable, the board can terminate the project to avoid further losses. Underinvestment will not be a problem in this case, since the manager's expected private benefits outweigh the efforts he must exert in implementing the project.

When $\hat{\gamma} < \pi_b < \pi_g$ and $p_f^H < p < \hat{p}$, although the board holds a termination option, ex-ante shareholders' expected payoff from the risky project is still negative. This results from the fact that the board cannot commit to terminating the project when the output is high. Realizing the board's termination policy, the manager will undertake the risky project regardless of the project profitability. Unfortunately, the implemented project is very likely to be value-destroying since growth opportunities are scarce. This implies that the current board should choose a new board with both initiation and termination options to avoid implementation of this potentially unprofitable project.

When $\hat{\gamma} < \pi_b < \pi_g$ and $p < p_f^H$, the board can now commit to terminating the project even when the date 1 performance is good. Knowing that he cannot enjoy his private benefits, the manager will always forgo the risky project. In other words, the termination option is an effective mechanism with regard to disciplining the manager's behavior. In this case, the expected payoffs are the same for an independent board and an independent board with an additional initiation option.

### 2.3 Empirical Implications of the Basic Model

In this section, I focus on how existing evidence can be explained by the basic model. I provide some caveats regarding the interpretations commonly found in the empirical literature. Moreover,
I discuss some untested predictions generated from my model.

One of the main implications of the basic model is that when growth prospects are promising, board independence can be irrelevant. In fact, a friendly board can even be chosen to maximize shareholder value. This occurs when the manager's expected private benefits are low or his project implementation cost is too high. On the other hand, when growth prospects are weak, an independent board is indeed beneficial. Failing to adopt an independent board structure when growth prospects are weak may cause reduced firm performance.

Empirical evidence concerning the relationship between growth opportunities and governance choices is not conclusive. The results are crucially dependent on the scope of the study (cross-country study vs. single country study); firms in the sample (IPO firms vs. larger, more established firms); sample period; and the proxies for growth opportunities and governance mechanisms.

In firm-level studies, there is evidence that growth prospects are negatively related to board independence. Generally, this relation is stronger in larger US firm samples. However, the definition of growth opportunities varies among these studies. For example, Lehn et al. (2004) and Gillan et al. (2003) find that firm-level market to book ratio is negatively correlated with board independence, while Denis and Sarin (1999) find that only industry median market to book ratio can explain board composition. Bhagat and Black (2002) use sales growth as the proxy for growth opportunities and find that future industry growth is negatively correlated with board independence. On the other hand, using a small US IPO firm sample, Boone et al. (2004) fail to find a strong relationship between growth opportunities and board composition.

These studies tend to suggest that insider managers in high growth firms are usually much better informed than outsiders. It is thus advantageous to give managers more decision making power, which will allow them to bring valuable information to the boards.\(^{19}\) It is also suggested that high growth firms tend to operate in a volatile environment in which internal governance mechanisms such as board monitoring are less effective. Therefore, these firms have to rely on external governance mechanisms to discipline their managers.

My model provides a different rationale for these findings. When growth prospects are very

\(^{19}\)This rationale is sometimes argued on the grounds that insiders have an advisory role. This role is particularly valuable for high growth firms.
promising, real authority will be awarded to the manager regardless of the board structure. Board structure is irrelevant. Therefore, for studies focused on smaller, IPO or high growth firms, it might be difficult to find a significant relationship between board independence and growth opportunities. On the other hand, when growth prospects are not extremely strong or weak, it is possible that firms must adopt a friendly board structure to encourage risky project implementation. This may explain why, for larger firms with modest to low growth prospects, a negative relationship is more easily observed.20

Another implication of my model is that managerial characteristics \((\frac{\pi_b}{B})\) or project characteristics \((\pi_g, H, L)\) also have a great impact on governance choices. For example, other things being equal, within the range where \(\hat{p} < p < p^L\), the firm will be able to choose an independent board if the manager has a lower cost to benefit ratio. Conversely, if the firm has a manager whose cost to benefit ratio is high, then the firm must use a friendly board to motivate the manager to undertake the project. The firm value under an independent board will be higher, although both structures maximize shareholder value (see Figure 2.3). Therefore, if researchers fail to control for these characteristics, they may find that firms with independent boards are correlated with better performance (e.g., market to book ratio). However, this result is misleading, since the firms in the sample may have already chosen the best governance structures available to them. Of course, this finding is not new. Hermalin and Weisbach (2003) also point out that this kind of problem causes great difficulties in interpreting the empirical relationship (or non-relationship) between board structure and firm performance. Nevertheless, my model indicates some particular factors that determine both firm value and board choices. Future study can thus directly control for these factors.

From the basic model, it can also be observed that when growth prospects are promising (i.e. \(p > p^L\)), unexpected investment announcements should have a similar price effect across firms with different board structures. The impact of earnings announcements should not be significantly different across these firms, either. This is due to the fact that board structure is irrelevant when

20If a firm's growth follows "high growth-modest growth-low growth" pattern, the model suggests that the firm is more likely to adopt an independent board in the late stage of its life cycle. In the very early stage, this firm may not need to care about its governance structure. This is the "life cycle" interpretation of the basic model.
In regime (a), the firm will choose an independent board structure. When $p_f^H < p < p$, an independent board with an initiation option is also required for the firm with a lower $\frac{\gamma}{p}$ manager. In regimes (b) and (c), the firm with a lower $\frac{\gamma}{p}$ manager will be able to adopt an independent board. Conversely, for the firm with a higher $\frac{\gamma}{p}$ manager, it has to choose an independent board in regime (b), but a management-friendly board in regime (c). In regime (d), board structure is irrelevant.

When growth prospects are modest (i.e. $\bar{p} < p < p_f^L$), a friendly board can be optimally chosen if the manager's cost to benefit ratio is large. However, because the board does not hold the valuable termination option, the value of the firm will be lower. This implies that an unexpected investment announcement should have a smaller (positive) price effect on firms with a friendly board structure. Furthermore, firms with a friendly board structure should experience a larger value change after an unexpected earnings announcement. This intuition is straightforward. Suppose there are two firms that differ only in their managers' cost to benefit ratios and in turn their board structures.
As discussed previously, the firm with an independent board will have a higher firm value. When
there is positive news, i.e. the date 1 output is high, both firms will have the same firm value after
the news is released, because the projects will be continued in the second period. Since the firm
with a friendly board has a lower initial value, this implies that the increase in firm value will be
larger. On the other hand, when there is bad news for a firm with an independent board, the firm
will be able to terminate the project to avoid further losses. However, for a firm with a friendly
board, the project will be continued. Therefore, the value drop will be larger for the firm with a
friendly board. Bad news has a greater effect on this firm as well.²¹

The model also has empirical implications for the director appointment announcement. When
growth prospects are very promising, adding an outsider to the board is not an issue of importance.
However, when growth prospects are modestly high, an announcement that the board will become
independent by appointing more outsiders may reveal a shock in managerial or firm characteristics
(i.e., \( \frac{g}{2} \)). For example, when the manager’s cost to benefit ratio becomes smaller, the board will
be able to hold the termination option. Therefore, the announcement will have a positive price
effect. However, this positive price effect does not imply that board independence is beneficial for
all firms. Mistakenly adding outsiders to the boards can in fact be value-destroying.

2.4 Robustness of the Results

In this section, I relax some assumptions made in the previous section. First, I discuss the feasibility
of incentive contracts. If the board can easily design an incentive contract for the manager, the
results shown in the previous section might be less likely to occur. Second, in the basic model,
the payoff distribution is assumed to be identical across periods. However, in the real world, many
profitable projects have the feature that positive payoffs are more concentrated in the latter period.
Therefore, I will allow the payoff distribution to differ across periods and show how this change

²¹Before the bad news announcement, the value difference between an independent board and a friendly board is
\(-\{p(1-\pi_a)[L + \pi_a(H-L)] + (1-p)(1-\pi_b)[L + \pi_b(H-L)]\}\). This is always positive when \( \hat{p} < p < p^c \): After the
announcement, the value difference between these two boards is \(-\{p^c[L + \pi_a(H-L)] + (1-p^c)[L + \pi_b(H-L)]\}\), where
\( p^c = \frac{p(1-\pi_a)}{p(1-\pi_a)+ (1-p)(1-\pi_b)} \). Using algebra, it can be shown that the value difference widens after the announcement.
Since the firm with an independent board has a higher initial value than the firm with a friendly board, this implies
that the percentage drop in value is larger for the firm with a friendly board.
affects the equilibrium outcomes. Third, there are some regimes in the basic model where pure strategy equilibrium does not exist. This means the manager and the board might play mixed strategies. Mixed strategy equilibria will thus be considered as well.

2.4.1 Incentive Contract

In the basic model, I do not consider the possibility of an incentive contract. If an incentive contract is allowed, perhaps the current board should be able to design a contract that motivates the manager to pursue a growth opportunity but to forgo every value-destroying deal. In this subsection, I will discuss the structure of this incentive contract and its feasibility.

The incentive contract is needed only in the beginning of the first period, because I assume there is no project implementation decision in the second period. The current board can design an incentive scheme in the following way:

- If the risky project is implemented and the date 1 output is found to be high, the manager will receive $W_H$
- If the risky project is implemented and the date 1 output is found to be low, the manager will receive $W_L$
- If the risky project is not implemented, the manager will receive $W_Q$

Since the incentive contract should effectively sort out good and bad projects, the board should not terminate the project in the second period. I assume that if the manager’s payoffs are the same for pursuing a growth opportunity and forgoing the opportunity, the manager prefers the former. Also, if the payoffs are the same for undertaking a value-destroying deal and focusing on “business as usual,” the manager prefers the latter.

**Proposition 3** The incentive contract awards the manager $W_G = B - c$ when business as usual is chosen. If a project is implemented, the manager’s wage is zero, i.e. $W_H = W_L = 0$, regardless of the date 1 output.

**Proof** See Appendix 2.3.
The intuition for the above incentive contract is straightforward. The firm has to offer the manager a positive wage when he chooses "business as usual." This can be thought of as a bribe to avoid his misdeed. On the other hand, once the project is implemented, the manager's wage will be independent of the realized date 1 output. This is due to the fact that the manager can enjoy his private benefits in the second period.22

This simple wage structure can indeed solve the agency problem.23 Unfortunately, the board may not be able to offer the contract. First, the payment $B - c$ can be so large that it does not pay for the board to "bribe" the manager. Second, even if $B - c$ is small, it can well be argued that the contract is not legally enforceable. In reality, it can be extremely difficult for a court to verify whether the firm is engaging in "business as usual" activities or implementing new risky projects. This implies that the board will not commit to this contract. Once the manager reveals the project quality, the board can refuse to pay the amount $B - c$. Anticipating he will not receive the reward, the manager may have no incentive to tell the truth. The contract thus may not be a feasible way to solve the problem.

In fact, one potential solution to making the incentive contract feasible is to find a mechanism under which the board will commit to the contract. As discussed earlier, a friendly board can be used as a commitment device. In other words, if a friendly board can commit credibly not to taking advantage of the manager, a managerial incentive contract may be an effective way to avoid a bad project implementation. From the governance activists' point of view, this friendly board is

22 The contract can also be interpreted as follows: if the manager told the board the project is value-creating and should be implemented, he receives zero reward. On the other hand, if the manager told the board the project is value-destroying and should be avoided, he receives $B - c$.

23 Another kind of incentive contract is a linear incentive contract. In other words, the manager is awarded $\beta$ share of the date 1 output. The optimal $\beta = \frac{e - c}{L - H}$ can be easily solved. Again, the board may have an incentive to alternate the sharing rule to $\beta = 0$ when it observes that no risky project has been implemented. Therefore, this scheme may be infeasible, either. In addition to the linear sharing rule, the board can use an option contract to motivate the manager. Suppose the underlying asset is the firm's output. The option has to be exercised at date 1. To avoid the agency problem discussed here, the option contract should satisfy the following constraints:

$$
\pi_y \text{Max} \left(0, H - e\right) + (1 - \pi_y) \text{Max} \left(0, L - e\right) - c + B > \text{Max} \left(v(0, G - e) \right)
$$

$$
\pi_y \text{Max} \left(0, H - e\right) + (1 - \pi_y) \text{Max} \left(0, L - e\right) - c + B < \text{Max} \left(v(0, G - e) \right)
$$

$$
e \geq 0, \quad v \geq 0
$$

where $e$ is the exercise price and $v$ is the share of the option given to the manager. From these constraints, it can be shown that exercise price $e < G - \frac{\pi}{\pi_y} H - \frac{B - c}{u(1 - \pi_y)} < G$. Therefore, the firm has to award an in-the-money option to the manager to discourage him from engaging in a bad project. This may be undesirable due to reasons outside the model, such as tax considerations.
simply paying too much to the manager for doing nothing.  However, they fail to recognize that “excessive” compensation might be the price a firm has to pay to ensure project quality.

2.4.2 Different Payoff Distributions Across Periods

The basic model assumes payoff distributions are identical in both periods. However, in some industries growth opportunities have the characteristic that profit in the early period is low (or even negative), but is expected to be enormous in the latter period. These industries include emerging industries and high-tech industries. In this section, I discuss how changes in payoff distribution can affect firms’ governance choices.

Suppose the payoff distributions of the risky growth opportunity in the two periods become:

\[
\begin{align*}
  y_1 &= \begin{cases} 
  G + H & \text{with probability } \pi_g - \theta \\
  G + L & \text{with probability } 1 - (\pi_g - \theta)
\end{cases} \\
  y_2 &= \begin{cases} 
  G + H & \text{with probability } \pi_g + \theta \\
  G + L & \text{with probability } 1 - (\pi_g + \theta)
\end{cases}
\end{align*}
\]

where \(0 < \theta < \pi_g < 1 - \theta\). In this case, the growth opportunity is more likely to result in a low outcome at date 1. Conversely, at date 2, the project is more likely to result in a high output. The total expected payoff from the two periods is the same as in the basic model.

Based on this structure the board has the following termination policy:

- When the date 1 output is \(H + G\), the project will be continued if

\[
\frac{2}{\gamma} > \frac{-(1-p)(\pi_g)(H-L)}{\pi(\pi_g-\theta)(H-L)}.
\]

- When the date 1 output is \(L + G\), the project will be continued if

\[
\frac{2}{\gamma} > \frac{-(1-p)(1-\pi_g)(L+\pi_g-\theta)}{p(1-\pi_g+\theta)(L+(\pi_g+\theta))(H-L)}.
\]

---

24 It should be noted that wage paid for doing nothing can also be in the form of perks such as private jets or a large office. These perks can thus be viewed as “productive input” used to avoid unproductive activities.

25 Of course, it is also quite possible that a friendly board may actually offer an excessive compensation to the manager independent of the reason described in the essay. Nevertheless, this is an empirical question.

26 I can also assume the destroying deal generates \(G + H\) with probability \(\pi_b - \theta\) at date 1 and \(\pi_b + \theta\) at date 2. This will not significantly change the result.
On the other hand, the manager’s project implementation policy will be:

- When a growth opportunity exists, the manager will pursue a growth opportunity \((q = 1)\) if
  \[
  \frac{\hat{c}}{f} < I_L + (\pi_g - \theta)(I_H - I_L)
  \]
  
- When a growth opportunity does not exist, the manager will undertake a value-destroying project \((\gamma = 1)\) if
  \[
  \frac{\hat{c}}{f} < I_L + \pi_b[I_H - I_L]
  \]

**Proposition 4**

1. If \(p > \frac{-(1-\pi_b)[L+\pi_b(H-L)]}{(1-\pi_g+\theta)[L+(\pi_g+\theta)(H-L)]-(1-\pi_b)[L+\pi_b(H-L)]} = p_t^L\ast\), the current board is indifferent to the various board structures.

2. When \(\hat{p} < p < p_t^L\ast\) and \(\text{Max}(\pi_b, \pi_g - \theta) < \frac{\hat{c}}{f}\), a management-friendly board is preferred.

3. When \(p < \hat{p}\) and \(\text{Max}(\pi_b, \pi_g - \theta) < \frac{\hat{c}}{f}\), an independent board (either with or without an initiation option) is preferred.

4. When \(p < \frac{-\pi_b[L+(\pi_b(H-L))]}{(\pi_g-\theta)[L+(\pi_g+\theta)(H-L)]-\pi_b[L+(\pi_b(H-L))] = p_t^H}\ast\), an independent board (either with or without an initiation option) is preferred.

5. When \(\hat{p} < p < p_t^H\ast\) and \(\frac{\hat{c}}{f} < \text{Min}(\pi_b, \pi_g - \theta)\), an independent board (either with or without an initiation option) is preferred.

6. When \(p_t^H < p < i\) and \(\frac{\hat{c}}{f} < \text{Min}(\pi_b, \pi_g - \theta)\), an independent board with an initiation option is preferred.

If the board determines that current poor performance is a result of certain project characteristics, and believes that a large amount of positive cash inflow will be realized in the latter period, it will be less likely to intervene in the project, even when an unfavorable performance is observed. This is due to the fact that the poor date 1 performance may not be a good indicator of the true quality of the project. Hence, board independence becomes less important, since eventually the manager has the “real authority” in decision making.

One direct implication is that when the research sample contains mainly firms in the high-tech or emerging industries, it might be very unlikely to observe a negative relationship between growth
prospects and board independence. Moreover, since the manager will be given real authority, it will also be difficult to observe board intervention in these industries. Furthermore, if a manager's career is closely related to the project termination decision, controlling for other factors, managerial turnover should also be lower in the high-tech and emerging industries even when the firm's performance is unsatisfactory. Finally, the results suggest that if the manager can successfully sell an unrealistic vision to the board, the board will then behave just like a friendly board. I illustrate this point in more detail when I discuss board over-optimism in the extensions section.

2.4.3 Mixed Strategy

Results provided in the previous sections consider only the pure strategy equilibrium. It has been shown that when \( \pi_b < \frac{\gamma}{\beta} < \pi_g \), there exists no pure strategy equilibrium. In this section, I allow the players to play mixed strategies.

If mixed strategies are allowed, the manager can pursue the growth opportunity with probability \( q \in [0, 1] \) and undertake a value destroying-deal with probability \( \gamma \in [0, 1] \) when he has the project initiation option. Similarly, the board can continue a low performance project with probability \( I_L \in [0, 1] \) and a high performance project with probability \( I_H \in [0, 1] \).

**Lemma 5** The randomized strategies for the manager and the board are as follows:

- For manager: \( q \in [0, 1] \) if \( \frac{\gamma}{\beta} = I_L + \pi_g[I_H - I_L] \); \( \gamma \in [0, 1] \) if \( \frac{\gamma}{\beta} = I_L + \pi_b[I_H - I_L] \).

- For the board: \( I_H \in [0, 1] \) if \( \frac{\gamma}{\beta} = -\frac{(1-p)\pi_g[L+\pi_g(H-L)]}{p\pi_g[L+\pi_g(H-L)]} \); \( I_L \in [0, 1] \) if \( \frac{\gamma}{\beta} = -\frac{(1-p)(1-\pi_g)[L+\pi_g(H-L)]}{p(1-\pi_g)[L+\pi_g(H-L)]} \).

Since \( \pi_g \) is larger than \( \pi_b \) by assumption, this directly implies \( -\frac{(1-p)(1-\pi_g)[L+\pi_g(H-L)]}{p(1-\pi_g)[L+\pi_g(H-L)]} \) is less than \( \frac{-(1-p)(1-\pi_g)[L+\pi_g(H-L)]}{p(1-\pi_g)[L+\pi_g(H-L)]} \). Therefore, if the board randomizes its strategy when a high performance is observed (\( I_H \in [0, 1] \)), its best strategy when a poor performance is observed is to terminate the project (\( I_L = 0 \)). On the other hand, if the board randomizes its strategy when a low performance is observed (\( I_L \in [0, 1] \)), it must keep the project when a high performance is observed (\( I_H = 1 \)).

From the Lemma it can also be shown that except for the case where \( I_L = I_H = 0 \) or \( I_L = I_H = 1 \), the value of \( I_H - I_L \) must be positive. This observation suggests that \( I_L + \pi_g[I_H - I_L] \) is always

larger than \( I_L + \pi_b [I_H - I_L] \) if the board plays a mixed strategy. This in turn suggests that if the manager’s best strategy is to undertake the value-creating project with probability \( q \in [0, 1] \), his best strategy when there exists only a value-destroying project is not to undertake it at all (\( \gamma = 0 \)). On the other hand, if the manager’s best strategy is to undertake a value-destroying project with probability \( \gamma \in [0, 1] \), his best strategy when there exists a growth opportunity is to undertake the project with probability 1 (\( q = 1 \)).

It should also be noted that \( \gamma = 0 \) will never be the best strategy for the manager. If the board expects \( \gamma = 0 \), it can never commit credibly to terminating the project if an unfavorable outcome is observed. Hence, the manager will be better off if he undertakes the value-destroying project with some probability \( \gamma > 0 \).

**Proposition 5** On an independent board, if mixed strategies are allowed, the equilibria are as follows:

1. \( \pi_b > \frac{\pi_g}{B} \) and \( p < p^H \): The board keeps the high output project with probability \( \frac{\pi_g}{B \pi_b} \), and always terminates the low output project. The manager always pursues a growth opportunity when one exists. If a growth opportunity does not exist, he undertakes a value-destroying project with probability \( \frac{p \pi_g [L + \pi_g (H - L)]}{(1 - p) \pi_b [L + \pi_b (H - L)]} \).

2. \( \pi_b < \frac{\pi_g}{B} \) and \( p < p^L \): The board always keeps the high output project, but only keeps the low output project with probability \( \frac{1}{1 - \pi_b} \left[ \frac{\pi_b}{B} - \pi_b \right] \). The manager always pursues a growth opportunity when there one exists, but if a growth opportunity does not exist, he undertakes a bad project with probability \( \frac{p (1 - \pi_b) [L + \pi_g (H - L)]}{(1 - p) (1 - \pi_b) [L + \pi_b (H - L)]} \).

3. \( \pi_b < \pi_g < \frac{\pi_b}{B} \) and \( p < p^L \): The board always keeps the high output project, but only keeps the low output project with a probability less than \( \frac{1}{1 - \pi_b} \left[ \frac{\pi_b}{B} - \pi_b \right] \). The manager forgoes any project regardless of project profitability.

4. \( p < p^H \) or \( p^H < p < p^L \) and \( \pi_b < \pi_g < \frac{\pi_b}{B} \): The board keeps the high output project with a probability less than \( \frac{\pi_g}{B \pi_b} \), but always terminates the low output project. The manager forgoes any project regardless of project profitability.
In the first case, the shareholders' date 1 expected payoff from the risky project is \( p[L + \pi_g(H - L)][1 - \frac{\pi_g}{\pi_b}] \), which is always negative. Therefore, if the current board expects mixed strategies will be played, it will choose to hold an initiation option to avoid any project implementation.

In the second case, the manager receives a positive payoff if the project is value-creating, and zero payoff if the project is value-destroying. The shareholders' expected payoff from the risky project is \( 2p[L + \pi_g(H - L)][\frac{\pi_g - \pi_b}{1 - \pi_b}] \), which is always positive. In the last two cases, the manager forgoes the risky project, no matter how profitable it is.

The above analysis shows that if the players in the game are sophisticated enough (i.e., the players can play mixed strategies), the board may not need to yield the termination right to the manager by adopting a management-friendly board. However, it is not clear why the manager would prefer one equilibrium over the other. This is especially true when the project is value-destroying, since forgoing the project and undertaking the project both give the manager zero expected payoff.

It should also be noted that even when the players in the game are capable of playing the mixed strategies, the misbehavior still cannot be completely eliminated. In fact, even in the most desirable case, the probability that the manager implements a value-destroying project increases with the growth prospects.

### 2.5 Extensions

In the previous sections the agency problem results from the board’s inability to detect the true quality of the project. This agency conflict is different from the asset diversion behavior discussed widely in the investor protection literature. In subsection 2.5.1, I add this diversion behavior and analyze how investor protection and firm-level governance structure interact with each other. Another managerial misbehavior that has attracted a lot of attention is earnings manipulation. Subsection 2.5.2 discusses the impact of earnings manipulation on equilibrium outcomes. In subsection 2.5.3, I focus on the situation in which the manager has a reputational loss if his project is terminated. Subsection 2.5.4 allows the board or the manager to be biased about the growth prospects or project quality. I also try to interpret the model from a macro perspective in Subsection 2.5.5.
2.5.1 Investor Protection and Board Structure

The agency conflict discussed in relation to the basic model focuses mainly on the project implementation decision. The manager may implement a value-destroying project that allows him to enjoy non-pecuniary private benefits. Of course, this is not the only way for the manager to pursue private benefits. He may also divert the firm's assets and consume pecuniary private benefits.

This kind of asset diversion behavior has been studied in the investor protection literature. In this line of research, it is argued that in the regime where legal protection is weak, managers are more likely to divert firms' assets. This in turn affects financiers' incentives to fund the firms, and thus profitable growth opportunities might be discarded. Even if the project is funded, the fund providers may receive only a very small fraction of the cash flow generated. Therefore, in the standard investor protection model, weaker investor protection is predicted to be negatively correlated with firm growth (e.g., Shleifer and Wolfenzon, 2002).

In this section, I include the asset diversion incentive in the model explicitly and discuss the relationship between investor protection and firm-level governance structure. The premise of my model is that legal protection and firm-level governance have quite different roles in disciplining the manager's behavior. More specifically, legal protection aims to reduce asset diversion behavior, while the board structure chosen aims to promote a potentially value-creating strategic direction or to avoid a potentially value-destroying path. In addition to the assumptions made in the basic model, some further assumptions are needed:

- Similar to the investor protection literature, a monitoring technology that detects the manager's asset diversion behavior is assumed. With probability $\delta$, the manager will be caught if he diverts the asset. The parameter $\delta$ thus measures the degree of legal protection. For simplicity, I discuss only two polar cases: $\delta = 0$ (weak investor protection regime) and $\delta = 1$ (strong investor protection regime).\(^\text{27}\) The degree of investor protection does not change across periods.

\(^\text{27}\) Allowing $\delta$ to be continuous will not change the results dramatically. Some other equilibria indeed can occur. However, these equilibria tend to occur in extreme situations such as when the manager has very large potential private benefits.
- Asset diversion can happen only when output is $G + H$. After the manager observes the high output, he must decide whether to steal $H - L$ or not. When the realized outcome is $G + L$ or $G$, the manager's diversion behavior can be easily inferred. Therefore, he has no incentive to divert in these situations.\(^{28}\)

- The manager incurs a cost $D$ when diverting the firm's assets. I assume $D < H - L$ to avoid the uninteresting case in which the manager never desires to divert the assets. This $D$ can be thought of as the actual asset diversion cost related to accounting manipulations and efforts spent in covering up the fraud. It can also be the psychological cost associated with the fear of a damaged reputation.

- Private benefits are consumed completely in each period immediately before the manager's asset diversion decision.\(^{29}\)

- Output verification happens right after the manager's diversion decision. If the manager's reported output is verified as inaccurate, the manager must immediately return the diverted assets.

Contrary to the basic model, after the date 2 output is realized, if the output turns out to be high, the manager must now decide whether to divert the amount $H - L$ or to report the actual output truthfully. He will divert if:

$$(1 - \delta)(H - L) - D > 0$$ \quad (2.7)

Based on this decision rule, it can be observed that in a weak investor protection regime, i.e. $\delta = 0$, the manager will always have incentive to divert $H - L$ and misreport the date 2 output. Conversely, in a strong protection regime, i.e. $\delta = 1$, the manager will behave honestly and report the actual date 2 output truthfully. I focus first on the situation in which investor protection is weak.

\(^{28}\) Although the output can be non-verifiable, stealing behavior is probably verifiable.

\(^{29}\) In fact, this assumption is not essential to the analysis. I can also assume that after the reporting date, the residual private benefits are $B'$. However, this will not provide additional insight.
When investor protection is weak and a management-friendly board is chosen, the manager will steal the date 1 and the date 2 outputs if the realized outcomes are $G + H$ at both dates. Since the board will not be able to stop the project and control the losses, the manager will always implement the risky project.

**Lemma 6** If a management-friendly board is chosen in a weak investor protection regime (i.e. $\delta = 0$), the shareholders' expected payoff will be $2G + 2L$, while the manager's expected payoff will be $B - c + 2[\pi_i(H - L - D)]$ where $i \in g, b$.

Lemma 6 shows that all gains from implementing the project will be transferred to the manager's pocket. This transfer is inefficient in the sense that the manager needs to exert $D$ to cover up the fraud.

Conversely, if an independent board is chosen, the board will have the option of terminating the project. Since continuing the project under a weak investor protection regime allows the manager to further expropriate from the shareholders, the board will definitely choose to terminate the project. In the basic model, this credible threat of termination will be able to discipline the manager in the sense that the manager will choose not to undertake any project. However, because of the potential gains from stealing the date 1 output, the manager still have an incentive to implement the project. This occurs if:

$$\pi_i(H - L - D) - c > 0 \quad \text{where } i \in g, b \quad (2.8)$$

**Lemma 7** If an independent board is chosen in a weak investor protection regime (i.e. $\delta = 0$):

1. When $c > \pi_g(H - L - D)$, the manager will not implement the risky project. The shareholders' expected payoff is $2G$, while the manager's payoff is 0.

2. When $\pi_b(H - L - D) < c < \pi_g(H - L - D)$, the manager will only implement a project when the project is able to generate a positive expected payoff. The board will terminate the project to avoid the manager's further expropriation at date 2. The shareholders' expected payoff is $G + L$, while the manager's payoff is $\pi_g(H - L - D) - c$.  

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3. When \( c < \pi_b(H - L - D) \), the manager will implement any risky project. The board will terminate any project to avoid further losses. The shareholders' expected payoff is \( G + L \), while the manager's payoff is \( \pi_i(H - L - D) - c \) where \( i \in g, b \).

Lemma 7 shows that in a weak investor protection regime, holding only a termination option can be insufficient to avoid losses from the risky project. Therefore, the board might need to hold a project initiation option to avoid any project being implemented.

**Lemma 8** If the board holds both initiation and termination options in a weak investor protection regime, the board will not initiate any risky project. Therefore, the shareholders' expected payoff will be \( 2G \), while the manager's expected payoff will be 0.

From Lemmas 6, 7 and 8, the following proposition can be obtained:

**Proposition 6** In a weak investor protection regime:

1. When \( c > \pi_g(H - L - D) \), an independent board, either with or without an initiation option, should be chosen.

2. Otherwise, the chosen board should hold both project initiation and termination options. The board would rather forgo the growth opportunity to avoid the manager's expropriation behavior.

The proposition suggests that in the regime in which investor protection is very weak, a growth opportunity no longer provides any growth potential for the shareholders. Allowing the risky project to be implemented only gives the manager an opportunity to expropriate from the shareholders. Therefore, the best thing the current board can do is to control the project initiation decision and to avoid any risky project implementation. The shareholders in a weak investor protection regime would thus be better off if they ask the manager to focus only on "business as usual" activities.

Conversely, in a stronger investor protection regime (i.e., \( \delta = 1 \)), the manager has no incentive to steal, since he would certainly be caught. Thus, all equilibrium outcomes will be exactly the same as those in the basic model. Because of the strong investor protection, the current board has more leeway to choose a value-maximizing board. Therefore, a firm in a strong protection regime may be able to pursue growth opportunities and have higher firm value than a firm in a weaker
protection regime. Though the rationales are different, this result is consistent with the findings in the investor protection literature that firm growth is higher in the strong protection regime.

My result indicates that firms in the weaker investor protection regime will be better off if they choose a very strong board. This prediction seems to be inconsistent with the empirical evidence that in weaker investor protection countries, firm-level governance also tends to be weaker (e.g., Durnev and Kim 2004). One potential explanation is that in these countries with weak investor protection, boards are often controlled by large shareholders (especially family members). The agency conflicts between the controlling shareholders and the manager in fact may be less severe than those between controlling shareholders and minority shareholders. If this is the case, then these firms might indeed pursue the growth opportunities. Unfortunately, all the gains will be transferred to the controlling shareholders.\footnote{These controlling shareholders sometimes have a very low cash flow right.} Therefore, the value and real growth prospects for these firms can be even lower than firms with very strong boards.

One implication of this analysis is that improvement in firm-level governance can indeed help firms in a weaker investor protection regime increase their values. Therefore, board independence requirements imposed by the government or regulatory authorities may be beneficial. Nevertheless, the fundamental key to improving firm growth and value still lies in strong legal enforcement and protection. On the other hand, for firms in a strong investor protection regime, regulatory authorities' intervention may prove to be fruitless, or even harmful, for firm growth and value. In this regime, it would be beneficial to give firms more flexibility in designing their firm-level governance structures.

The result also illustrates an example in which firm-level governance can be a complement for investor protection, rather than a substitute. Both governance mechanisms aim to protect shareholders and to discipline managerial misbehavior. However, my result demonstrates that in a strong investor protection regime, firms may adopt an independent or friendly firm-level governance structure according to growth prospects. This suggests that observing the adoption of strong or weak firm-level governance mechanisms in a regime with strong macro-level governance mechanisms does not necessarily imply these two mechanisms are substitutes or complements. Macro-level and
firm-level governance mechanisms may simply play quite different roles in disciplining managers.

### 2.5.2 Earnings Manipulation

Under a more independent board structure, the manager may not be able to secure his private benefits if the board decides to terminate the project due to poor performance. The manager can thus have an incentive to overstate the date 1 earnings in the hope that the project can be continued. In other words, the manager may report $G + H$ at date 1 although the real output is $G + L$. Of course, the manager’s ability to manipulate earnings depends on the board’s expertise in accounting or finance. Supposedly, a board with sufficient financial or accounting expertise can prevent this kind of manipulation. In this subsection, I discuss how earnings manipulation can affect the equilibrium outcomes in the basic model.\(^{31}\)

I assume with probability $\phi$ that the board will be able to detect the earnings manipulation immediately after the the manager reports the date 1 output. As in the investor protection subsection, I focus only on two polar cases: $\phi = 1$ and $\phi = 0$. In the case where $\phi = 1$, the board has sufficient accounting expertise to detect any manipulation, while in the case where $\phi = 0$, the board does not have such expertise. Furthermore, the manager must exert a non-negative effort $M < B - c$ when engaging in the manipulation. This implies that earnings manipulation is socially inefficient. Since the firm is liquidated at date 2, any earnings manipulation will eventually be revealed at that time. It should be noted that the manager does not incur a “penalty cost” if he is caught overstating the output. However, the manager may lose his private benefits in such a circumstance.

In the case where the board can detect manipulation (i.e., $\phi = 1$), the manager’s manipulation decision is quite straightforward. If he engages in earnings manipulation, he must exert an effort $M$. But his effort will be wasted, since manipulation can always be detected. This implies that it does not pay for the manager to engage in manipulation activities. Hence, all the previous equilibrium outcomes in the basic model hold.

In the case where the board cannot detect manipulation (i.e., $\phi = 0$), the manager may have

\(^{31}\)As in the basic model, I only consider pure strategy equilibria.
an incentive to misreport. The interesting question is when the manager has such an incentive. It turns out that board structure is a crucial factor. As assumed in the basic model, depending upon the board structure, either the manager or the board has to make the project continuation decision after the date 1 output is reported. If the decision maker is the manager, he always prefers to continue the project and to enjoy his private benefits. In this case, the manager’s private benefits are secured and he has no incentive to engage in costly manipulation activities. This result demonstrates that earnings manipulation should not occur in a firm with a friendly board structure.

When the board has an option to make the project continuation decision, the manager may find earnings manipulation beneficial. Since my focus is on the pure strategy equilibria, the board can have three actions when it receives the earnings report. First, the board can continue the project even when the reported output is $G + L$. Second, the board can continue the project only when the date 1 reported output is $G + H$. Finally, the board can terminate the project regardless of the reported output. Each scenario is discussed below:

If the board is willing to continue the project even when it observes a poor report, the manager does not need to overstate the date 1 output. Therefore, the board continues the project if:

$$\frac{p \pi_g}{p(1 - \pi_g) + (1 - p)(1 - \pi_b)} [L + \pi_g(H - L)] + \frac{(1 - p)(1 - \pi_b)}{p(1 - \pi_g) + (1 - p)(1 - \pi_b)} [L + \pi_b(H - L)] > \omega$$

The above inequality implies that if $p > \frac{(1 - \pi_b)[L + \pi_b(H - L)]}{(1 - \pi_g)(L + \pi_g(H - L)) - (1 - \pi_b)[L + \pi_b(H - L)]} = p^*_f$, the board will always continue the project. Since the independent board is able to commit to the non-intervention policy within this range, the manager has no incentive to misreport. Moreover, the project is always implemented.

Under what circumstances will the board choose to continue a project only when the reported output is $H + G$? If this is indeed the board’s best policy, the manager will always have the incentive to misreport when the true output is $G + L$. By doing so, the manager can enjoy his private benefits. Of course, the board anticipates this potential problem and realizes the reported output will always be $H + G$. This implies that the date 1 reported output is not informative at all and the board must use its prior to make the project continuation decision. Hence, the board
should adopt this policy if:

\[ p[\pi_g H + (1 - \pi_g) L] + (1 - p)[\pi_b H + (1 - \pi_b) L] > 0 \]  

(2.10)

The above inequality does not include a term for the expected output decrease due to the potential earnings manipulation. The reason is that the expected output decrease occurs regardless of whether the project is continued or terminated. From the inequality, it can also be shown that the project will be continued when \( p \geq \frac{L + \pi_b(H - L)}{(H - L)(\pi_g - \pi_b)} = \hat{p} \). However, the previous result suggests that the board always continues the project when \( p > p^K \). Hence, the manager has an incentive to manipulate the earnings when growth prospect \( p \) is between \( p^K \) and \( \hat{p} \). Within this range, the board always anticipates a high reported output (i.e., \( G + H \)) and the project is always implemented and continued.

When \( p < \hat{p} \), the board cannot continue the project if the reported output is high. If the board follows this policy, all the reported output will be \( G + H \) and the expected payoff of continuing the project will be negative. Since the project will be terminated regardless of the date 1 outcome, the manager will have no incentive to implement the project if he has the project initiation option. Even when the board has the project initiation option, it will not be able to find any manager to implement the project. Therefore, no risky project will be implemented when \( p < \hat{p} \). Based on the cases discussed above, I obtain the following proposition:

**Proposition 7** When the board is friendly or when the board cannot credibly terminate a project (i.e., \( p > p^K \)), the manager will not have the incentive to engage in accounting manipulation. Conversely, when an independent board is chosen and the board does not have accounting expertise, the manager will engage in earnings manipulation within the range \( \hat{p} < p < p^K \). The project will thus only be implemented when \( p > \hat{p} \).

The major empirical implication is derived from the situation where \( \hat{p} < p < p^K \). If an independent board is chosen optimally in this growth range, a firm’s value is higher if its board has sufficient accounting expertise. This result suggests that there can be a positive abnormal return if an accounting expert is unexpectedly added to the board. Conversely, adding an accounting expert
should not make a large difference if the board is friendly. A friendly board does not intervene and the manager does not have an incentive to manipulate earnings. Accounting experts in this situation do not need to deal with any manipulation. This suggests there should not be any significant price effect when a firm adds an accounting expert to a weak board.

Another empirical implication relates to earnings announcements. If the board has sufficient accounting expertise, the date 1 output will be informative. Therefore, earnings announcements will have a larger price impact for an independent board with sufficient accounting expertise. For a firm with a board lacking sufficient accounting expertise, earnings announcements are not informative at all. Therefore, even favorable earnings news will not have any price impact. However, it should be noted that firms with a friendly board structure still undergo the largest price effect after an earnings announcement (either good or bad). My model also predicts that although the friendly board and an independent board with insufficient accounting expertise can have the same initial value, earnings announcements will have quite a different price effect on these firms.\footnote{This implies that the board is indifferent between choosing a friendly board and an independent board with insufficient expertise. However, from the social welfare perspective, a friendly board is preferred, since the manager does not need to engage in the costly manipulation activities.}

One such prediction has already been tested in DeFond et al. (2004). They find that cumulative abnormal returns (CARs) are only positive when the newly appointed outside directors (accounting experts) are added to firms in which relatively strong corporate governance has been adopted prior to appointing the new directors.

### 2.5.3 Stigma of Failure

One assumption made in the basic model is that when the project is terminated, the manager loses only his private benefits. However, it is also possible that when a strategic direction is abandoned by the board, the manager's reputation may be ruined and his ability to manage a firm can also be challenged. This implies the manager may experience a significant loss if the project is terminated.

To capture this possibility, I assume the manager incurs a disutility $R < 0$ if the project is terminated. Because of the reputational concerns, the manager will become more conservative when making project implementation decisions. In the basic model, if the success probability of a
growth opportunity is low, i.e. \( \pi_b < \pi_g < \frac{g}{B} \), the manager will behave conservatively if his private benefits are not secured. When the manager also has reputational concerns, he may not undertake the project if \( \pi_b < \pi_g < \frac{\phi + R}{B + R} \). The fact that \( \frac{\phi + R}{B + R} > \frac{g}{B} \) implies that under an independent board, with the same project characteristics and growth prospects, a project may be forgone by a manager with a larger \( R \), but implemented by a manager with a small \( R \). In the extreme, when \( R \to \infty \), the manager will never undertake any project if his private benefits are not secured. Therefore, the board may need to give up the termination right to the manager and adopt a management-friendly board when \( R \) is large.

This result has direct empirical implications that can be examined through cross-country study. Landier (2002) has pointed out that in some countries, the "stigma of failure" is more severe than others.\(^{33}\) For example, in Europe and Asia, people tend to avoid failure because the societies generally see failure in a negative way. Conversely, in the US, the stigma of failure is much less a problem. If this is true, my model predicts that firms in the high stigma regime should be more likely to have a friendly board structure. Essentially, social norms can have a great impact on managerial behavior. Since a high level of stigma in some sense can be viewed as a disciplinary mechanism, firm-level governance structures thus must focus more on motivating the manager to pursue the potential growth opportunities. This implies that the empirical test should not ignore possible cultural influences on board structure choices.

2.5.4 Board/manager Over-optimism

The board and the manager's beliefs about growth prospects and project quality are assumed to be unbiased in the basic model. However, it is possible that the board or the manager can display behavioral bias and be overly optimistic. This kind of behavioral bias has generated attention in the recent literature. For example, Bolton et al. (2003) study how overconfident boards may affect the design of executive compensation.\(^{34}\) Malmendier and Tate (2004), on the other hand, study

\(^{33}\)There is another way to incorporate the "stigma of failure" idea into my basic model. Similar to Landier, if the level of stigma is high, the board can always terminate the project when an unfavorable outcome is observed. In this case, the manager will be less likely to undertake a project with a low success probability. Thus, this suggests the firm may still need to have a friendly board to commit to continuing a potentially profitable project.

\(^{34}\)In their model, the board's objective is the same as that of the controlling shareholders.
overconfident managers’ investment decisions.

If the board is overly optimistic, instead of having an unbiased belief \( p \), it may believe the probability of having a value-creating project is \( p + \psi \) where \( p < p + \psi < 1 \). This implies that the current board might mistakenly choose a friendly board structure. Or it might continue a project when the project should in fact be terminated. Therefore, the board’s over-optimism tends to give the manager more “real authority.” Of course, if the bias is not very large, the chosen board can still be optimal. In the extreme, when \( p + \psi \to 1 \), an independent but optimistic board always acts exactly like a friendly board. This suggests that the current focus on board independence, rather than what the board members can bring to the shareholders, may be misleading.

**Proposition 8** If the board is overly optimistic about the risky project, it might mistakenly adopt a friendly board or fail to terminate the project even when the board holds the termination option. This implies that the manager is awarded the real authority.

Generally, having an overly optimistic board does not increase firm value. In fact, it may even decrease firm value if the bias is so large that the board becomes too friendly, while independence is desired. However, when regulatory agencies impose board independence requirements on firms, an overly optimistic board may actually add value. When growth prospects are modest, it is possible that the current board may deliberately find a new board which is comprised of independent but overly optimistic directors. In this case, the manager will be willing to undertake the risky project. In other words, these overly optimistic directors can credibly commit to the non-intervention policy.

Sometimes, the board has unbiased belief, but the manager may be overly optimistic and tend to overestimate the quality of the project. For example, when evaluating the risky project, the manager may believe the success probability is \( \pi_i + \eta \), where \( i \in \{g, b\} \) and \( \pi_b < \pi_g + \eta < 1 \). This suggests the manager may sometimes undertake a negative NPV project unintentionally. He simply cannot overcome his psychological biases. In this case, only the manager’s project implementation rule will change. He would be less likely to forgo the risky project, since \( \frac{\pi}{g} \) is now more likely to be less than \( \pi_g + \eta \). Therefore, the current board may not need to adopt a friendly board structure to encourage the manager to invest.
Proposition 9 If the manager is over-optimistic, the board is less likely to yield the termination option to him. In other words, a more independent board structure should be associated with firms with over-optimistic managers.

As discussed in the previous section, when growth prospects are modestly strong, a firm with an independent board can have a higher valuation than a firm with a friendly board, even though the board structure is optimally chosen. This suggests that if a board can select its manager, it might prefer an overly optimistic manager.\(^{35}\)

2.5.5 A Macro-perspective Interpretation of the Basic Model

Another way to interpret the basic model is to assume that there are infinite number of firms in the economy. Each firm has an opportunity to implement the same risky project. However, only a fraction \(p\) of the firms is able to generate positive NPV. Whether the firms have the ability to generate positive payoffs is known only to the managers, not to the boards.\(^{36}\) In other words, the boards know only the fraction \(p\). If these boards expect growth prospects to be promising (for example, in a high demand period), they will infer that more firms in the economy will be able to attain positive expected payoffs. Therefore, the fraction \(p\) should be higher.

Following the results from the basic model, if only pure strategy equilibria are allowed, the managers choose not to engage in negative NPV projects when growth prospects \(p\) are weak. Conversely, in a boom period, managers will have incentives to implement value-destroying projects even when the board structures are independent. Moreover, these firms' governance structures can be more friendly in a boom period, either because board structure is irrelevant, or decision making power will be voluntarily yielded to the managers in order to motivate project implementation. These results suggest overall governance structure choices may be related to the business cycle and macroeconomic factors.\(^{37}\)

\(^{35}\)Gervais et al. (2003) also suggest that managerial overconfidence and optimism may increase firm value. In their model, overconfidence and optimism may help the manager become less risk-averse. Therefore, the cost of an incentive contract can be lower. In my model, managerial optimism allows the firm to choose an independent board, which potentially may increase firm value as well.

\(^{36}\)The managers only know the project profitability of their own firms, not others.

\(^{37}\)Philippon (2003), in a general equilibrium model, also argues that in a boom period, managerial misbehavior is
One direct implication from the model is that when government or regulatory agencies try to impose additional firm-level governance structure requirements on firms, these requirements may have different impacts in a boom period and in a recession period. For example, in a recession period, tougher requirements may not have a significant impact on firm growth, because firms will voluntarily adopt a strong governance structure to avoid managerial misbehavior. However, in a boom period, good governance may not be a value-maximizing practice for some firms. Therefore, these additional requirements may impede growth in a boom period.

2.6 Conclusion

A firm’s board structure can be viewed as the manner in which various decision making rights are allocated to different parties. Recently, many governments, regulatory agencies and governance activists assert that an independent board that is actively involved and even intervenes in a firm’s strategic decisions will improve firm performance. Some restrictions on board composition have already been adopted in the Sarbanes-Oxley act, which requires audit committee members to be independent. Stock exchanges such as the NYSE also require companies to have a nominating committee a compensation committee, and an audit committee comprised solely of independent directors. In this essay I provide a model to illustrate that these requirements may not always increase firm value. In fact, they can be counterproductive. Accordingly, care is needed when considering policies that might force particular structures on firms for which they may be ill suited.

In my model, when growth prospects are very promising, an independent board may act exactly like a friendly board. Although the independent board holds an option to terminate the project, it will never exercise this option. A firm may also voluntarily use a friendly board structure as a commitment device to facilitate profitable project implementation. When growth prospects are weak, a firm has to adopt a more independent board structure to reduce possible losses resulting from managerial misbehavior. These results may explain why a non-positive relationship between
board independence and growth opportunities can be observed empirically (as discussed in Section 2.3).

The model also shows that a government policy regime with strong investor protection can give a firm more flexibility in choosing its firm-level governance structure. Conversely, weak investor protection limits the firms’ governance choice set and thus the firm must adopt a strong governance structure to avoid agency conflicts. The results indicate that the flexibility for firms to choose their own optimal governance structure is valuable in the sense that it can increase firm value and growth. Therefore, tougher firm-level governance requirements may actually reduce this flexibility and destroy value and growth opportunities. To the extent that my model captures the key problem, government and regulatory agencies should focus more on promoting a business environment with strong investor protection and legal enforcement, rather than forcing every firm to adopt an independent board structure.

The results from this essay send a very clear message. There is no one-size-fits-all governance structure. Different firms will choose different governance systems precisely because they are solving different problems. As in the Google IPO case, the firm’s investors may not be as naive as some governance activists suggest. Investors may be simply giving management more power in exchange for greater future growth potential.
Chapter 3

The CEO as Principal and Agent: An Agency-Theoretic Account of Social Compensation Theory and Evidence

3.1 Introduction

How do firms determine the incentive scheme for their CEOs? This question has attracted researchers from various disciplines. The dominant view within economics-based disciplines (e.g., finance and accounting) comes mainly from the insights of the principal-agent framework. The standard agency model à la Holmstrom (1979) assumes that there exists a risk neutral principal who cannot observe the effort exerted by his risk-averse agent. To alleviate this moral hazard problem and to encourage the agent to work harder, the principal can offer the agent an incentive contract that links the agent’s wage to the noisy output of the firm. However, the agent has to be compensated for the increased risk of having a volatile income. This implies that there should be a tradeoff between risk and incentive when the contract is optimally designed.
Using this standard framework to analyze CEO compensation, researchers expect uncertainty to be an important factor in determining the incentive contract setting. Unfortunately, the empirical evidence regarding the determinants of CEO compensation does not strongly support this risk-incentive tradeoff.\(^1\) One potential explanation for this lack of supportive evidence is that the assumptions about decisions related to CEO compensation may be oversimplified in the standard agency model. It is questionable whether CEO compensation is designed by an unbiased principal who is perfectly aligned with shareholders.

On the other hand, researchers in strategy, law, organizational behavior and sociology have quite different perspectives on the determinants of CEO compensation. They recognize that in reality shareholders usually delegate compensation decisions to the board of directors. Who are these directors of US corporations? Lorsch and MacIver (1989) find that approximately 63 percent of the board members of Fortune 1000 directors are CEOs of other companies. O'Reilly et al. (1988) suggest that 65 percent of the members sitting on compensation committees are CEOs or retired CEOs. Do these CEOs from other companies share exactly the same interests as the shareholders? Researchers from these non-economics disciplines seem to disagree.

Westphal and Zajac (1997) apply social exchange theory and argue that directors who come from other corporations (hereafter, "corporate directors") offer favorable compensation contracts to the CEOs. The rationale is that corporate directors expect to be treated in the same way in their home companies. Based on social psychological studies, Westphal and Zajac (1995) also propose that corporate directors evaluate CEOs favorably when the CEOs have "similar" backgrounds to their own. O'Reilly et al. (1988) claim that "social comparison" incentives lead corporate directors to use their own compensation schemes as the reference point when setting other CEOs' compensation.

Although these explanations for the determinants of CEO compensation are not exactly the same, they have one thing in common. They all disagree with the standard assumption in the agency model, which states that compensation decisions are made by an unbiased principal. They suggest that CEO compensation research should focus more on the dynamics or social interactions

\(^1\)Prendergast (2002) reviews the empirical evidence of the tradeoff model (although he does not focus solely on CEO compensation). He also builds alternative models which yield a positive relation between risk and incentives.
between the boards and the CEOs. The directors in the real world rarely act as diligent delegates for the shareholders as assumed in the economics-based agency model. In this essay, I take these management researchers' criticism seriously and attempt to modify the standard agency model in line with their findings. With simple modifications of the standard agency model, I find that risk-based agency framework can in fact account for the predictions of three major social compensation theories. The model also has testable implications about how and where these sociology-based predictions will fail.

More specifically, instead of having a risk neutral principal, my model incorporates a risk-averse director. Economists usually assert that the assumption of a risk neutral principal is reasonable, because shareholders (the principal) can better diversify their wealth, while the agent cannot. However, as argued by the management researchers, compensation decisions in the real world are usually delegated to the board of directors. These delegated directors are usually undiversified executives from other companies. Therefore, it may not be reasonable to treat the principal in the CEO compensation model as risk neutral.

If a corporate director is indeed risk averse and cannot well diversify his risk, presumably this director would have an incentive to share some risk with the CEO when designing the compensation contract. Of course, simply assuming a risk-averse principal is almost a trivial exercise. Instead, the main point of this essay is that the corporate director concerns not only the risk resulting from his own incentive contract, but also the potential reputation risk resulting from being a director. These two sources or risk can be correlated and the corporate director is exposed to the so-called "covariance risk." Consequently, the exposure to the covariance risk may affect the corporate director's compensation decision. Thus, a relationship between the compensation contracts of the

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2 Also, see Belliveau et al. (1996). They write "...greater attention should be paid to the characteristics of targets of social influence, in this case, compensation committee chairs."

3 Although some economists are also interested in the boards, they seem to have different assumptions regarding director and CEO behavior. For example, the social theories mentioned in this paragraph indicate that directors make biased decisions because their sociological concerns lead them to do so voluntarily. However, in economics the focus is usually on how poorly-disciplined CEOs manipulate the boards and influence them to make biased decisions. (e.g., Bertrand and Mullainathan, 2000).

4 For example, recent papers such as Aggarwal and Samwick (1999), Aggarwal and Samwick (2003), Garvey and Milbourn (2003) and Milbourn (2003) all assume a risk-neutral principal. Although Jin (2003) indeed assumes a risk-averse principal, in his model, the principal in fact represents the well-diversified shareholders.

5 Although shareholders can vote down a board's compensation proposal, this rarely happens.
Based on this simple idea, I show that the incentive intensity of a CEO's compensation contract is determined not only by the CEO or firm characteristics, but also by the characteristics of the directors and the directors' home companies. Under certain conditions, I also demonstrate that the following predictions from the social compensation theories can in fact be rationalized in a relatively standard agency model.

1. Social comparison theory: Social comparison theory predicts a positive relationship between a CEO's incentive intensity and a director's own incentive intensity. In my model, if output shocks between the CEO firm (hereafter: "receiver firm") and the director firm (hereafter: "sender firm") are positively correlated, generally a higher incentive intensity in the sender firm induces the director to share more risk with the CEO. This leads to a higher incentive intensity for the CEO of the receiver firm.

2. Social exchange theory: Social exchange theory predicts that the likelihood of an increase in incentive intensity will be lower if a higher proportion of the board members are CEOs from other companies. In my model, the corporate director sets the compensation contract based on his self-interested stance toward risk. Therefore, an exogenous change in the environment (e.g., a decrease in output uncertainty) does not necessarily lead to an increase in the incentive intensity. On the other hand, the non-corporate director will not have this concern and will increase the incentive intensity if there is a need. This implies that empirically, a non-corporate director is more likely to increase the incentive intensity when the business environment becomes less volatile.

3. Social similarity theory: Social similarity theory predicts that when the director and the CEO are more similar in their backgrounds, the director will evaluate the CEO favorably and thus set a lower incentive intensity. In this model, when covariance risk is positive and the director is more talented than the CEO, a lower incentive intensity for the receiver firm is expected if the director and the CEO are more similar. This is simply due to the fact that a more talented director is offered a higher incentive intensity from his home company. Therefore,
if covariance risk is positive and the director is not much more talented than the CEO (i.e., they are very similar), the corporate director should impose less risk on the CEO, hence a lower incentive intensity for the CEO of the receiver firm.

Unlike most of the behavioral models which explicitly incorporate psychological biases when studying agency issues - for example, favoritism (Prendergast, 2002), overconfident agent (Gervais et al., 2003), or overconfident principal (Bolton et al., 2003) - my model simply assumes that the director cares about his own wage and the personal benefits gained from being a director. This self-interested director does not have an explicit behavioral bias toward favoring the CEO. Moreover, the results predicted in my model do not come from a utility function that directly resembles the social comparison or social interaction behavior (e.g., Stone-Geary utility function\(^6\)). This assumption allows me to draw a clean line between the driving forces proposed in the sociology-based studies and in this model. Lastly, the seeming social comparison behavior in my model is not a result of "herd behavior."\(^7\) In my model, there is no learning process or any information acquisition activity. This means I assume away the possibility that the director tries to "copy" his own compensation scheme because he believes his wage contract is the better or safer practice.

In the next section, I briefly discuss related literature concerning boards and CEO compensation. The sociology-based theories will also be introduced. Following this, in Section 3.3, I build a very simple agency model that can generate similar results to those predicted by the social compensation theories. I show that the corporate director's incentive to diversify his risk can create a link between the compensation practices in the sender firm and the receiver firm. Section 3.4 gives a simple numerical example of my model. Then, in Section 3.5, I discuss the empirical implications of the model. I also provide alternative explanations that can account for the predictions of the social compensation theories. Section 3.6 concludes the chapter.

\(^6\)Recently, Fershtman et al. (2003) use the utility function to study the relative performance evaluation puzzle. In their model, the CEO receives extra utility if his performance is better than that of his competitor.

\(^7\)For example, Zwiebel (1995) studies corporate conservatism and relative performance evaluation based on the idea of herd behavior.
3.2 Related Literature and Empirical Evidence

Economics-based CEO compensation models commonly ignore many of the institutional details in the real world. These models tend to focus on a world where the shareholders can optimally set the contract for the CEOs. However, in reality, it is the directors who design the compensation contract for the CEOs. In a recent review of a large number of economics-based corporate governance research, Becht et al. (2004) point out that "there has been no attempt to analyze the determination of executive pay...by explicitly modelling the bargaining process between CEO, the remuneration committee and the board, as well as the process of selection of committee and board members."

Hermalin and Weisbach (1998) may be an excellent exception. They try to incorporate the bargaining process between the CEO and the director into their model. However, since the main focus of their model is on the director selection process, the determination of CEO compensation setting does not receive much attention. Also, in their model it is managerial talent, rather than effort that determines the CEO's wage. The moral hazard problem is not studied. Warther (1998) also writes about theoretical model of board dynamics. He tries to understand how managerial power can affect director effectiveness, and thus does not include incentive pay in his model. Adams and Ferreira (2003) argue that directors have the responsibility of being the advisors and monitors to the CEOs. In some circumstances, a friendly board (i.e., a board which monitors less) is needed as a commitment device. Again, however, compensation determination is not discussed in their paper. This lack of attention to the relationship between boards and CEO compensation exists not only in theoretical papers. Surprisingly, economics-based empirical CEO compensation papers also usually largely ignore a board related factors. Even when board behavior is considered, the main focus is still on determinants such as insider-outsider ratio or interlocking board contexts (e.g., Hallock, 1997).\footnote{Only about eight percent of CEOs are reciprocally interlocked with another CEO to Hallock's (1997) sample of Forbes 500 companies. Also, after controlling for firm and CEO characteristics, he finds that the compensation gap between interlocked and non-interlocked firms is small and statistically insignificant.}

Contrary to the economists, management researchers take the board's impact on compensation design much more seriously. Some of these researchers argue sociology-based theories can better explain the factors that determine CEO compensation. Three major sociology-based theories are
social comparison theory, social exchange theory and social similarity theory. In the following, I introduce these three theories briefly and discuss how management researchers apply the theories when setting CEO compensation setting. Some empirical support found by these researchers is also provided.

Social comparison theory is proposed by Festinger (1954). The basic idea is that when individuals make evaluations, they usually need to find a “standard” or “reference” for comparison. Laboratory studies demonstrate that people tend to make comparisons to someone with better ability.9 In their executive compensation application, O'Reilly et al. (1988) adopt this theory and argue that the most immediate comparisons available to the directors are their own compensation schemes. These researchers thus hypothesize a positive relationship between the director's compensation and the CEO’s.

Using only cash compensation information from a relatively small sample (105 firms) from 1985, O'Reilly et al. (1988) find that for an increment of $100,000 per annum in the average salary of the outside director, the expected salary of the focal CEO raises by $30,000 to $51,000, depending on different regression settings. Moreover, they find that “director-related factors” have a much larger effect on CEO compensation than “economic fundamentals” such as sales.

Social exchange theory (see, for example, Blau, 1977) asserts that individuals engage in certain activities because they expect to receive rewards from others. Westphal and Zajac (1997) argue that there is a “network for corporate leaders.” This implies that the actions of CEOs can affect the perceived basis of the social exchange in this network. Since CEOs want to survive in the social network, they generally do not seek to challenge the norms. Deviating from the norms may affect a CEO’s expected rewards from other members in the network.

Westphal and Zajac further argue that CEOs are risk averse and thus do not prefer a high power incentive plan. Since these corporate directors understand fully how undesirable a high power incentive plan can be, they will attempt to avoid an increase in the incentive intensity for the CEOs of the receiver firms. These directors follow the social norms with the hope that the corporate directors in their home companies will treat them in the same manner. Westphal and

9However, it should be noted that there are ongoing debates in sociology on whether people tend to make “upward comparison” or “downward comparison.” See Suls and Wheeler (2000).
Zajac thus conclude that a lower likelihood of an increase in compensation contingency should be observed if a larger proportion of the directors comes from other corporations. Using firms drawn from the Forbes and Fortune 500 indexes for the years 1982 to 1992, they find evidence supporting their hypothesis.

Social similarity theory suggests that the biased evaluation may result from the similarity between the evaluator and the person being evaluated. Byrne et al. (1966) claim similarity enhances interpersonal attraction and provides “mutual reinforcement or consensual validation of each individual’s belief.” Therefore, people tend to favor demographically similar individuals. Westphal and Zajac (1995) apply this theory to the study of CEO compensation. They argue corporate directors may favor CEOs with compatible characteristics. Since CEOs dislike high power incentive plans, the demographically similar directors will seek to set a low power incentive plan for the CEOs. Using data from the Forbes and Fortune 500 indexes for the years 1987 to 1990, they provide evidence of a negative relationship between similarity and incentive intensity.

These sociology-based theories provide great insight into the interactions between boards and CEOs. However, the predictions of these theories are usually not very clear. Also, many explanations are not exclusive. Therefore, it is difficult for empiricists to distinguish among different theories. I have no intention of arguing that these sociology-based theories are incorrect. The main motivation is to find a cleaner, testable theories. Some of the predictions from the following model are consistent with the sociology-based theories. However, the model also indicates the conditions under which sociology-based predictions may fail.

### 3.3 The Model

In this section, I describe the model setting and the equilibrium predictions of the model. Subsection 3.3.1 presents the production technologies of the firms. Subsection 3.3.2 illustrates the wage contracts considered in the model. In subsection 3.3.3, I discuss the maximization problems of the directors. Next, the sequence of the game is introduced. Finally, I demonstrate the solution and predictions of the game in subsection 3.3.5.
3.3.1 The Firms

In this simple model, I assume there are two companies, firm 1 and firm 2. Firm 1 is the "sender firm" and firm 2 is the "receiver firm." These two firms have the following output function:

\[ \hat{y}_i = e_i + \epsilon_i \quad i = 1, 2 \]

where \( e_i \) is CEO \( i \)'s effort. The error terms \( \epsilon_1 \) and \( \epsilon_2 \) are assumed to be bivariate normal. They have zero mean and variance \( \sigma_1^2 \) and \( \sigma_2^2 \), respectively. The correlation coefficient is \( \rho_{12} \). For simplicity, the marginal productivity is assumed to be the same for both CEOs. However, this does not mean the two CEOs are identical. CEO heterogeneity is captured by the different effort aversion and risk aversion coefficients, which I discuss later.

3.3.2 The Wage Contract

Both firms offer linear wage contracts \( \tilde{W}_i = a_i + b_i \hat{y}_i \) to their managers. \( a_i \) is the fixed salary for CEO \( i \), while \( b_i \) is the incentive intensity of the variable pay. The higher the incentive intensity, the more risk the CEO must bear. The linear wage contract assumption may not be completely realistic. However, it makes my analysis much more tractable.

In the model, I do not allow the use of relative performance evaluation (for example, a wage contract contingent upon the market or competitors' performance). Relative performance evaluation has received very little empirical support. Allowing relative performance evaluation may also induce some complex behavior (e.g., collusion). I do not want the complex behavior to drive the predictions of my model. Furthermore, a relative performance evaluation contract is simply the kind

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of contracts with "comparison" flavor. Therefore, not allowing the use of a relative performance evaluation contract is in fact biased against finding the comparison behavior.

3.3.3 The CEOs

The CEOs in these two firms are called "CEO 1" and "CEO 2." CEO 1 sits on firm 2's board and he makes the compensation decision for CEO 2. Unlike CEO 1, who has two jobs (i.e., CEO 1 and Director 2), CEO 2 is assumed to be a pure CEO. He does not hold any directorship position in another firm.

In the model, the reason CEO 1 sits on firm 2's board is treated exogenously. As discussed previously, management research demonstrates that it is quite common for firms to have directors from other companies. These corporate directors are responsible for setting the incentive contract for the CEOs. Shareholders usually do not contract directly with the CEOs. One potential reason is that it is too costly for diverse shareholders to make compensation decisions.

As to why firm 1 does not hire a non-corporate director, it can be argued that CEO 1 has an information advantage in evaluating or monitoring CEO 2. For example, shareholders and the non-corporate director may have imprecise signals about CEO 2's performance. This can lead to an inefficient incentive contract. Also, the non-corporate director may fail to contribute valuable knowledge or benefits to the firm. Therefore, although shareholders are aware that a corporate director may set a biased incentive contract, they nevertheless believe it is worthwhile to have a corporate director if the benefits of having a corporate director outweigh the costs.

Since my main focus is on how firm 1's contract affects firm 2's contract, for simplicity I assume there is a risk neutral non-corporate director who makes the compensation decision for CEO 1. I can also assume the director in firm 1 is risk averse. However, this only complicates the analysis without contributing substantial insight.

The two CEOs are assumed to have negative exponential utility function and zero reservation utility. The CEOs in these two firms are not treated as homogeneous. First, they are permitted to have different degrees of risk aversion, which is modelled by different constant absolute risk aversion coefficients $\gamma_1$ and $\gamma_2$. Second, they are permitted to differ in their degree of effort aversion $\gamma$. The
disutility function for the two CEOs is assumed to have the form \( c_1 \frac{d^2}{2} \). The higher the \( c_1 \), the less talented the CEOs.

The utility function for CEO 2 is quite standard. Since he does not have any outside job, CEO 2's utility function can be written as:

\[
U_2 = -e^{-\gamma_2 (\bar{w}_2 - c_2 \frac{d^2}{2})}
\]

On the other hand, CEO 1's utility function deserves more explanation. I assume CEO 1's utility can be expressed as:

\[
U_1 = -e^{-\gamma_1 [\bar{w}_1 + \theta (\bar{w}_2 - \bar{w}_2) - c_1 \frac{d^2}{2}]}
\]

The above utility function shows CEO 1 not only cares about his own wage, but also firm 2's shareholder wealth. I assume there is no direct cost of being a director. Also, as a director, CEO 1 does not receive any monetary reward.\(^{12}\) Firm 2's shareholder wealth enters CEO 1's utility function purely in the form of non-pecuniary private benefits. The private benefits can be thought of as CEO 1's reputation or the self-satisfaction gained from being a director.

The assumption that CEO 1 cares about firm 2's shareholder wealth is not unrealistic. Fama and Jensen (1983) indicate that CEOs can use their director job to signal their abilities. Therefore, they have little incentive to risk their reputation and expropriate from shareholders by colluding with the managers. Empirically, Gilson (1990) notes that directors in bankrupt firms hold less seats in other firms following their resignations from the bankrupt firms. Shivdasani (1993) provides evidence that outside directors' additional directorships are negatively correlated with the takeover likelihood of the firms for which they sit on the boards. These two pieces of empirical evidence indicate that outside directors of under-performing firms will be viewed as less reputable directors and lose

\(^{12}\)This assumption is consistent with the survey results of Lorsch and MacIver (1989) p.26. They show that monetary reward is not the major reason for a director to join a board. The top five reasons for joining a board are quality of top management, opportunity to learn, challenge as director, prestige of the firm and potential growth of the firm.
important career opportunities. Therefore, the mechanism of “market for directors” should force directors to incorporate shareholder wealth into their utility consideration. One recent news story (Kerr, 2002)\(^{13}\) provides even stronger reasoning for corporate CEOs to care about the performance of firms for which they are board members. In 2002, Credit Suisse fired its CEO Lukas Muhlemann partly due to his bad performance as a board member in the bankrupt firm Swissair and a troubled Argentine Bank.

The parameter \(\theta\) is assumed to be strictly positive in CEO 1’s utility function.\(^{14}\) This \(\theta\) can have two different interpretations. It can be viewed as a “converter” that measures the non-pecuniary benefits in monetary terms. \(\theta\) can also be viewed as the relative importance CEO 1 attaches to his director job. A large \(\theta\) means CEO 1 cares more about firm 2’s shareholder wealth. For simplicity, I assume \(\theta\) is exogenously given.\(^{15}\) If the second interpretation is reasonable, I expect \(\theta\) to be very close to zero. This can be rationalized by the fact that CEOs generally spend much more time on their own job than on their director job.\(^{16}\)

I also assume the CEOs cannot make any market portfolio trades. However, even if the CEOs are allowed to trade market portfolio, my results will not change dramatically as long as there is correlation between the two firms’ non-systematic risks.\(^{17}\)

With the above assumptions about the firms, the contract and the CEOs, the two CEOs’

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\(^{13}\)Also see news report from www.swissinfo.ch on May 31, 2002

\(^{14}\)If \(\theta\) is zero, the corporate director will not care about firm 2’s shareholder wealth. This implies that no meaningful prediction could be derived from the model.

\(^{15}\)In a more complex model, it is reasonable to treat \(\theta\) as an endogenous variable which is decided by CEO 1. Alternatively, \(\theta\) can still be treated as exogenously given, but firm 2 can choose its directors from a pool of directors with different \(\theta\). Nevertheless, the current paper focuses only on compensation decisions. The interactions between executive compensation decisions and optimal board structure choices are left for future work.

\(^{16}\)In the current model, CEO 1 only enjoys the non-pecuniary benefits as a director. However, it is also possible that CEO 1 receives equity-based compensation from firm 2. This implies that the benefits can also be pecuniary. Moreover, the additional utility derived from firm 2 can be interpreted as firm 1’s shareholdings in firm 2. In this case, \(\theta\) is the percentage of firm 2’s shares held by firm 1.

\(^{17}\)Generally, the solution depends on non-systematic risk, rather than “total” risk if trading the market portfolio is allowed.
certainty equivalents are:

\[ CE_1 = E(\bar{W}_1 + \theta(\bar{y}_2 - \bar{W}_2)) - \frac{\gamma_1}{2} Var(\bar{W}_1 + \theta(\bar{y}_2 - \bar{W}_2)) - \frac{c_1 e_1^2}{2} \]
\[ = a_1 + b_1 e_1 + \theta[(1 - b_2) e_2 - a_2] \]
\[ - \frac{\gamma_1}{2} b_1^2 \sigma_1^2 - \frac{\gamma_1}{2} (1 - b_2)^2 \theta^2 \sigma_2^2 - \gamma_1 b_1 \theta (1 - b_2) Cov(\bar{y}_1, \bar{y}_2) - \frac{c_1 e_1^2}{2} \]

\[ CE_2 = E(\bar{W}_2) - \frac{\gamma_2}{2} Var(\bar{W}_2) - \frac{c_2 e_2^2}{2} \]
\[ = a_2 + b_2 e_2 - \frac{\gamma_2}{2} b_2^2 \sigma_2^2 - \frac{c_2 e_2^2}{2} \]

From the above certainty equivalents, it can be found that when the random shocks of the two firms are correlated, CEO 1 will face a covariance risk generated from being a director. The covariance risk can actually be negative. This implies that when firms' output shocks are negatively correlated, a bad performance in one firm may be accompanied by a good performance in another firm. Therefore, CEO 1 can enjoy the seeming diversification effect through the negative covariance risk.

On the other hand, if two firm's output shocks are positively correlated, CEO 1 will not be able to enjoy the diversification benefit. As firm 2's director, CEO 1 has to bear the positive covariance risk in addition to any variance risk. CEO 1 will thus consider this covariance risk (either positive or negative) when designing the compensation contract for CEO 2. This explains why CEO 1's compensation contract may impact CEO 2's compensation contract. Of course, this idea is not new. It is the basic concept of the financial portfolio theory.

As mentioned previously, I assume the appointment of the director to be exogenously given. This means I do not consider the receiver firm's willingness to appoint this director or the sender firm and CEO 1's willingness to accept the director position. Nevertheless, it can be assumed that CEO 1 is able to contribute a fixed amount \( S^* \) to the receiver firm's output. This \( S^* \) is large enough to guarantee CEO 1's incentive to be a director, as well as firm 2's incentive to appoint CEO 1 as its director. Adding this relatively large \( S^* \) will not change my results. I simply ignore this additional benefit \( S^* \) in the following analysis.
3.3.4 The Sequence of the Game

The sequence of the game is straightforward. At date 1, risk neutral director 1 offers CEO 1 an incentive contract \((a_1, b_1)\). If CEO 1 accepts the contract, he must decide the effort level required to produce the output. Then, as firm 2’s director, CEO 1 needs to design a compensation contract for CEO 2. If CEO 2 accepts the contract \((a_2, b_2)\), he must make his effort decision as well. At the end of period 1, outputs for both firms are realized. CEOs and shareholders in both firms receive a fraction of the outputs based on the sharing rules stated in the contracts. The simple time line of the game is shown in figure 3.1.\(^{18}\)

![Figure 3.1: Time Line of the Game](image)

3.3.5 The Solution of the Game

Solving the model backward, CEO 1 chooses \((a_2, b_2)\) to maximizes his own utility:

\[
\max_{e_2,a_2,b_2} CE_1 \\
\text{s.t. } CE_2 \geq 0 \\
e_2 \in \arg\max CE_2
\]

\(^{18}\)In fact, CEO 1’s effort decision and his incentive contract decision for CEO 2 can be simultaneously determined. CEO 1’s effort decision can also occur after he has set the contract \((a_2, b_2)\). These changes in the sequence of the game will not change my result. This is because, as will be shown later, CEO 1’s optimal effort choice rule is always \(e_1^* = \frac{a_1}{b_1}\), which is independent of any firm 2 or CEO 2 characteristics. This implies according to my model that only changes in firm 1’s compensation contract can impact firm 2’s contract, but not vice versa.
It can be shown that the optimal effort level $e_2^*$, incentive intensity $b_2^*$ and fixed salary $a_2^*$ are:

$$b_2^* = \begin{cases} 
0 & \text{if } 1 + \gamma_1c_2 \left[ \theta \sigma_2^2 + b_1 \text{Cov}(\tilde{y}_1, \tilde{y}_2) \right] \leq 0 \\
1 & \text{if } \frac{b_1 \text{Cov}(\tilde{y}_1, \tilde{y}_2)}{\sigma_2^2} \geq \frac{\gamma_2}{\eta_1}
\end{cases}$$

$$e_2^* = \frac{1}{c_2} b_2^*$$

$$a_2^* = -b_2^* c_2^* + \frac{\gamma_2 c_2^*}{2} \sigma_2^2 + \frac{c_2^*}{2} e_2^*$$

The restriction imposed on the incentive intensity $b_2^*$ makes the contract more realistic. In the real world, firms rarely offer incentive intensity greater than one or less than zero.

Returning to director 1’s problem, he maximizes:

$$\max_{e_1, a_1, b_1} (1 - b_1) e_1 - a_1$$

s.t. \( a_1 + b_1 e_1 - \gamma_1 b_1 \sigma_1^2 - \frac{c_1}{2} e_1^2 \geq 0 \)

$$e_1 \in \text{argmax } CE_1$$

It should be noted that the participation constraint in director 1’s problem is not $CE_1 \geq 0$. In other words, I assume that director 1 cannot extract the private benefits from CEO 1. This assumption is similar to that made in Chen and Jiang (2004). Due to the assumption, director 1’s maximization problem follows the standard principal agent problem.\(^{19}\) The optimal effort level $e_1^*$,\(^{19}\)

\(^{19}\)It is irrelevant whether director 1 knows or does not know CEO 1 is (or will be, with some probability) director 2. After all, director 1 cannot expropriate anything from CEO 1’s non-monetary gain of being director 2.
incentive intensity $b_1^*$ and fixed salary $a_1^*$ have the standard expressions:

$$
\begin{align*}
    b_1^* &= \frac{1}{1 + c_1 \sigma_1^2 \gamma_1} \\
    e_1^* &= \frac{1}{c_1} b_1^* \\
    a_1^* &= -b_1^* e_1^* + \frac{\gamma_1}{2} \sigma_1^2 \sigma_1^* + \frac{c_1}{2} e_1^* \sigma_1^*
\end{align*}
$$

After solving $b_1^*$, I can rewrite firm 2's incentive intensity as:

$$
    b_2^* = \begin{cases} 
        0 & \text{if } 1 + \gamma_1 c_2 \left[ \theta \sigma_2^2 + \frac{1}{1 + c_1 \sigma_1^2 \gamma_1} \text{Cov}(\tilde{y}_1, \tilde{y}_2) \right] \leq 0 \\
        1 & \text{if } \frac{1}{1 + c_1 \sigma_1^2 \gamma_1} \text{Cov}(\tilde{y}_1, \tilde{y}_2) \geq \frac{\gamma_1}{2} \\
        \frac{1 + \gamma_1 c_2 [\theta \sigma_2^2 + \frac{1}{1 + c_1 \sigma_1^2 \gamma_1} \text{Cov}(\tilde{y}_1, \tilde{y}_2)]}{1 + c_1 \sigma_1^2 \gamma_1} & \text{otherwise}
    \end{cases}
$$

How do these results relate to the social theory? In the following, I define formally the predictions of the sociology-based theories with the same notations used in this model.

1. If social comparison is the main determinant of CEO compensation, in my model, CEO 1 will use his own compensation contract as the reference point when setting CEO 2's compensation contract. This implies a positive relation between $b_1$ and $b_2$. More precisely, social comparison theory predicts:

$$
\frac{db_2^*}{db_1^*} > 0
$$

2. If social exchange is the determining factor of CEO compensation, then in this model CEO 1 will be less likely to initiate an increase in incentive intensity for CEO 2 when there are changes in firm or CEO characteristics. This is because CEO 1 expects to receive the same treatment (i.e., low incentive intensity) from his home company. If firm 2 appoints a non-corporate director, this
director should not be concerned with social reciprocity, and he can initiate an increase in incentive intensity if there is a need. Hence, based on social exchange theory, the likelihood of increasing incentive intensity is lower for a corporate director than for a non-corporate director. Formally, this can be written as:

\[ \text{Prob}(\Delta b_2^* > 0| \text{noncorporate director, } \sigma_2^2 \downarrow \text{ or } \gamma_2 \downarrow \text{ or } c_2 \downarrow ) \]

\[ \geq \text{Prob}(\Delta b_2^* > 0| \text{corporate director, } \sigma_2^2 \downarrow \text{ or } \gamma_2 \downarrow \text{ or } c_2 \downarrow ) \]

3. If social similarity theory explains CEO compensation well, incentive intensity \( b_2 \) should depend on the level of similarity between CEO 1 and CEO 2. In social theory, similarity is defined in several dimensions. These dimensions include the CEOs’ functional backgrounds, prior work experiences, education levels, the prestige of the schools they were attended and their ages. Although my model does not incorporate these dimensions explicitly, I argue that degree of effort aversion \( c_i \) can be viewed as a good proxy for these demographical dimensions, because \( c_i \) can be interpreted as the level of talent of the CEOs. Presumably, if two CEOs have similar educational backgrounds, work experiences, and they are in the same age cohort, they might have similar talents and tend to employ similar strategies.\(^{20}\) Hence, it is reasonable to use \( c_i \) to measure the similarity between the two CEOs. Then, the degree of similarity between the two CEOs can be defined as \( |c_1 - c_2| = |\Delta| \).

Social similarity theory predicts that when CEO 1 and CEO 2 are more similar, CEO 1 should make a favorable evaluation when he sets the compensation contract for CEO 2. In other words, CEO 1 will set a low incentive intensity since he knows that CEO 2 dislikes the high risk imposed by a high power contract. Formally, this social reasoning can be written as:

\[ \frac{\partial b_2^*}{\partial |\Delta|} > 0 \]

\(^{20}\)In fact, in the standard agency model, the optimal “effort” chosen by an agent can also be viewed as the optimal “action” chosen by him. Since degree of effort aversion \( c \) can affect the agent’s optimal action decision, this implies, other things being equal, that agents with similar \( c \) will choose similar actions. If \( c \) is in fact a good proxy for things such as educational backgrounds and age, empirically, we should observe that managers with a high degree of similarity take similar corporate actions. One recent piece of evidence is from Bertrand and Schoar (2003). They find that the older generation of managers are financially more conservative. They also find that managers with MBA degrees follow more aggressive strategies.
From the results of the agency model and the predictions of social-compensation theories, I can make the following proposition:

**Proposition 10** 1. When a change in incentive intensity $b_1^*$ is driven by a change in CEO 1's degree of effort aversion $c_1$:

(a) if $\rho_{12} > 0$, a social comparison prediction $\left(\frac{db^*}{dc_1} > 0\right)$ can be observed.

(b) if $\rho_{12} < 0$, a reverse social comparison prediction $\left(\frac{db^*}{dc_1} < 0\right)$ can be observed.

2. When a change in incentive intensity $b_1^*$ is driven by firm 1's output uncertainty $\sigma_1^2$ and under the assumption that $1 - \gamma_1 c_1 \sigma_1^2 > 0$:

(a) if $\rho_{12} > 0$, a social comparison prediction $\left(\frac{db^*}{d\sigma_1^2} > 0\right)$ can be observed.

(b) if $\rho_{12} < 0$, a reverse social comparison prediction $\left(\frac{db^*}{d\sigma_1^2} < 0\right)$ can be observed.

3. When a change in incentive intensity $b_1^*$ is driven by a change in the degree of managerial risk aversion $\gamma_1$:

(a) if $\rho_{12} > 0$, a reverse social comparison prediction $\left(\frac{db^*}{d\gamma_1} < 0\right)$ can be observed.

(b) if $\rho_{12} < 0$, a social comparison prediction $\left(\frac{db^*}{d\gamma_1} > 0\right)$ can be observed.

**Proof** The proof can be demonstrated by simply calculating the following total derivatives:

$$\frac{db_2}{db_1} \bigg|_{\gamma_1, \sigma_1^2 \text{ constant}} = \frac{\gamma_1 c_1 \text{Cov}(y_1, y_2)}{1 + c_2 \sigma_1^2 (\theta \gamma_1 + \gamma_2)}$$

$$\frac{db_2}{db_1} \bigg|_{\gamma_1, c_1 \text{ constant}} = \left(\frac{\sigma_1^2}{2} \gamma_1 (\gamma_1 - 1) c_2 \rho_{12} \sigma_2 \right)$$

$$\frac{db_2}{db_1} \bigg|_{\sigma_1^2, c_1 \text{ constant}} = -\frac{c_2 \sigma_1^2 \gamma_1 \left(\gamma_1 - \frac{b_1 \text{Cov}(\tilde{y}_1, \tilde{y}_2)}{\sigma_2^2} \right) + b_1^2 \text{Cov}(\tilde{y}_1, \tilde{y}_2) \left(1 + \frac{c_2 c_1 (\theta \gamma_1 + \gamma_2)^2}{\sigma_2^2 \gamma_1} \right)}{b_1^2 c_1 \sigma_1^2 \left(1 + \frac{c_2 c_1 (\theta \gamma_1 + \gamma_2)^2}{\sigma_2^2 \gamma_1} \right)^2}$$

For the first two derivatives, it can be observed that the signs of the derivatives depend on the sign of the correlation coefficient of the output shocks. The situation with the third total derivative is more complex. $\frac{\gamma_1}{\sigma_1^2} - \frac{b_1 \text{Cov}(\tilde{y}_1, \tilde{y}_2)}{\sigma_2^2}$ is positive when $b_2^*$ is set in the range between 1 and 0. This implies
the derivative is negative when the correlation coefficient is positive. The derivative can become positive only when the correlation coefficient is sufficiently negative.

Proposition 10 shows that a seeming "social comparison" behavior may be observed even though the corporate director does not use his own compensation scheme as the reference standard. This "seeming comparison" behavior results simply from CEO 1's desire to share his covariance risk with CEO 2. The higher the level of CEO 1's own incentive intensity \( b_1 \), the greater his exposure to the covariance risk.

When this covariance risk is positive, CEO 1 can reduce the risk by setting a high \( b_2 \) for CEO 2. However, CEO 1 usually cannot transfer the risk completely to CEO 2 by setting a very high \( b_2 \). The reason is consistent with the standard incentive/risk tradeoff. A high incentive intensity can be costly, since firm 2 must compensate CEO 2 for his high risk bearing. CEO 1 thus needs to find a balance between his own risk exposure and firm 2's shareholder wealth. This is the reason CEO 1 usually wants to increase CEO 2's incentive intensity when he experiences an increase in his own incentive intensity (which is driven by a decrease in \( \sigma_1^2 \) or \( c_1 \)).

The same explanation does not apply to a "risk aversion-driven" change in incentive intensity, because a decrease in risk aversion has two important effects. First, the incentive intensity for CEO 1 (i.e., \( b_1 \)) increases. CEO 1 thus has an incentive to increase \( b_2 \) in the hope that he can reduce his covariance risk. Second, CEO 1 is now able to tolerate more risk from firm 2 thanks to the decrease in his own degree of risk aversion. He will choose to let CEO 2 bear less risk by setting a lower incentive intensity. When covariance is positive, the second effect always dominates the first. Hence, if a change in CEO 1's incentive intensity is driven by a decrease in his degree of risk aversion, a reverse social comparison result (i.e., an increase in \( b_1 \) leads to an decrease in \( b_2 \)) can be observed when covariance risk is positive.

**Proposition 11** When two firms with the same CEO and firm characteristics \((c_2, \gamma_2, \sigma_2^2)\) are drawn randomly from the population, and both firms have experienced a decrease in environmental uncertainty, it is more likely to observe an increase in incentive intensity in the firm with a non-corporate director.
Proof If firm 2 has a non-corporate director, it can be assumed that he is risk neutral and his objective is to maximize firm 2's shareholder value. Therefore, his maximization problem is:

$$\max_{\alpha_2, \sigma_2, h_2, NCD} E(y_2 - \tilde{W}_2)$$

s.t. $CE_2 \geq 0$

$$\alpha_2 \in \arg\max CE_2$$

This gives standard incentive intensity $b^*_2, ncd, rn$, where the subscript $(2, ncd, rn)$ stands for risk neutral non-corporate director 2:

$$b^*_2, NCD, rn = \frac{1}{1 + c_2 \sigma_2^2 \gamma_2}$$

Hence, a decrease in $c_2$, $\sigma_2^2$, or $\gamma_2$ induces an increase in incentive intensity with probability one since

$$\text{Prob}(\frac{\partial b^*_2, NCD}{\partial c_2} < 0) = 1$$

$$\text{Prob}(\frac{\partial b^*_2, NCD}{\partial \sigma_2^2} < 0) = 1$$

$$\text{Prob}(\frac{\partial b^*_2, NCD}{\partial \gamma_2} < 0) = 1$$

On the other hand, a decrease in $c_2$, $\sigma_2^2$ or $\gamma_2$ does not necessarily lead to an increase in the incentive intensity if CEO 1 is appointed as director. This can be shown using the following partial

---

21If the director is a risk averse non-corporate director with absolute risk aversion coefficient $\gamma_2$, he will set $b_2, ncd, ra = \frac{1 + \gamma_2 c_2 \sigma_2^2}{1 + c_2 \sigma_2^2 (\gamma_2 + \gamma_2')}$, Nevertheless, with a decrease in $c_2$, $\sigma_2$ or $\gamma_2$, he will set a higher incentive intensity for CEO 2.
derivatives (assuming $b^*_2$ is in the range between 0 and 1):

$$\frac{\partial b^*_2}{\partial \gamma_2} = -\frac{1 + \gamma_1 c_2 [\theta \sigma_2^2 + \frac{1}{1 + \gamma_1 c_1 \gamma_1 \text{Cov}(\bar{y}_1, \bar{y}_2)}]}{[1 + c_2 \sigma_2^2 (\gamma_2 + \theta \gamma_1)]^2} c_2 \sigma_2^2 < 0$$

$$\frac{\partial b^*_2}{\partial \gamma_2} = \frac{\gamma_1 b_1 \rho_{1,2} \sigma_1 [1 - c_2 \sigma_2^2 (\gamma_2 + \theta \gamma_1)] - 2 \sigma_2 \gamma_2}{[1 + c_2 \sigma_2^2 (\gamma_2 + \theta \gamma_1)]^2} > 0$$

$$\frac{\partial b^*_2}{\partial c_2} = \frac{\gamma_1 b_1 \text{Cov}(\bar{y}_1, \bar{y}_2) - \sigma_2^2 \gamma_2}{[1 + c_2 \sigma_2^2 (\gamma_2 + \theta \gamma_1)]^2} < 0$$

From these partial derivatives, it can be observed that a decrease in $\gamma_2$ or $c_2$ is still associated with an increase in incentive intensity. However, a decrease in $\sigma_2^2$ does not necessarily lead to an increase in $b^*_2$ if the director is a corporate director. This implies that when there is a decrease in environmental uncertainty, the probability of observing an increase in $b_2$ should be lower if the director is the corporate director CEO 1.

Self-interested corporate directors may not always want to increase incentive intensity, as non-corporate directors do. In the model, CEO 1 has two different incentives when the output uncertainty of the receiver firm decreases. On the one hand, he wishes to increase the incentive intensity $b_2$, as the standard agency model would predict. Doing so can increase CEO 2's efforts and consequently firm 2's shareholder value.

On the other hand, a decrease in firm 2's output risk means either a decrease or an increase in CEO 1's covariance risk, depending on the sign of the correlation coefficient. If the correlation coefficient is negative, a decrease in $\sigma_2^2$ reduces the "diversification benefit" CEO 1 can enjoy. Therefore, CEO 1 would seek to decrease CEO 2's incentive intensity $b_2$ to "rebalance" his risk exposure and take further advantage of the diversification benefits generated from the negative covariance risk. This implies that the overall effect of a decrease in firm 2's environmental uncertainty depends on the relative magnitude of the "tradeoff" and "diversification" effects.

**Proposition 12** 1. When CEO 1 is more talented than CEO 2 (i.e., $c_1 < c_2$):

(a) if $\rho_{1,2} > 0$, a social similarity prediction can be found.

(b) if $\rho_{1,2} < 0$, a reverse social similarity prediction can be found.
2. When CEO 1 is less talented than CEO 2 (i.e., \( c_1 > c_2 \)):

(a) if \( \rho_{12} > 0 \), a reverse social similarity prediction can be found.

(b) if \( \rho_{12} < 0 \), a social similarity prediction can be found.

**Proof** When CEO 1 is more talented, the difference between \( c_1 \) and \( c_2 \) can be written as \( c_2 - c_1 = \Delta \).

Hence, \( c_1 = c_2 - \Delta \) and the incentive intensity \( b_2 \) can be rewritten as:

\[
b_2^* = \frac{1 + \gamma_1 c_2 [\theta \sigma_2^2 + \frac{1}{1 + (c_2 - \Delta) \theta \gamma_1} Cov(\bar{y}_1, \bar{y}_2)]}{1 + c_2 \sigma_2^2 (\gamma_2 + \theta \gamma_1)}
\]

Taking the partial derivative of \( b_2^* \) with respect to \( \Delta \), I get:

\[
\frac{\partial b_2^*}{\partial \Delta} = \frac{c_2 \gamma_1^2 \sigma_2^2 Cov(\bar{y}_1, \bar{y}_2)}{[1 + c_2 \sigma_2^2 (\gamma_2 + \theta \gamma_1)][1 + (c_2 - \Delta) \gamma_1 \sigma_1^2]^2}
\]

It is clear that the sign of the derivative depends on the sign of the covariance. When the covariance is positive, the whole term is positive. This implies that when the difference between \( c_1 \) and \( c_2 \) is larger, CEO 1 will choose to set a higher incentive intensity \( b_2 \) for CEO 2. A similar argument can be made to analyze the situation in which CEO 1 is less talented (i.e., \( c_1 > c_2 \)).

Proposition 12 is in fact simply a restatement of the partial derivative of \( b_2^* \) with respect to \( c_1 \). If CEO 1 is more talented, his incentive intensity \( b_1 \) is higher. This implies that when the output shocks are positively correlated, the more talented the CEO 1 (i.e., CEO 1 and CEO 2 are less similar), the higher the covariance risk he bears. Consequently, CEO 1 seeks to set a high incentive intensity for CEO 2 to decrease his level of covariance risk exposure. This is the risk-based explanation for the seeming “social similarity” prediction.
3.4 A Simple Numerical Example

In this section, I provide a simple numerical example of the model. The parameter values in this exercise come mostly from Haubrich (1994). Haubrich's model is a standard agency model with a risk neutral principal. Therefore, some of the parameter values in my model, such as $\theta$ and $\rho_{12}$ do not exist in his model.

Since covariance risk is important in this study, I choose two different correlation coefficients to demonstrate the impact of this particular risk. More specifically, I show the effect of a change in $b_1$ on $b_2$ when $\rho_{12} = 0.2$ and when $\rho_{12} = -0.2$. Initial $c_1$ is set to be 0.001 and $c_2$ is set to be 0.002. In Haubrich's paper, his $c$ is 0.002. The smaller $c_1$ implies that CEO 1 is more talented than CEO 2. Moreover, initially, the two firms have the same output risk, $\sigma_1 = \sigma_2 = 200$. $\theta$ is not observable in reality. I assume a relatively small number 0.001. Both CEOs also have the same coefficient of absolute risk aversion $\gamma_1 = \gamma_2 = 4$.

Table 3.1 shows the relationship between $b_1$ and $b_2$ when there is a change in firm 1's output risk. As shown in the previous section, change in $b_2$ indeed depends on the sign of the correlation coefficient. For example, a 1% decrease in firm 1's output risk will lead to a 2.02% increase in CEO 1's incentive intensity $b_1$. In the standard agency model, an increase in $b_1$ should not have any impact on firm 2's compensation practices. However, in my model, the increase in $b_1$ will lead to a 0.23% increase in CEO 2's incentive intensity if covariance risk is positive. This result is consistent with social comparison theory, although the driving force is totally different. On the other hand, if covariance risk is negative, an increase in $b_1$ in fact leads to a 0.43% decrease in CEO 2's incentive intensity.

Table 3.2 shows the relationship between $b_1$ and $b_2$ when there is a change in CEO 1's effort aversion $c_1$. From the table, a 1% decrease in CEO 1's effort aversion will lead to a 1.00% increase in CEO 1's incentive intensity $b_1$. Consequently, this leads to a 0.23% increase in CEO 2's incentive intensity if covariance risk is positive. This result is consistent with the social comparison theory. Moreover, when $c_1$ is more similar to $c_2$ (i.e., $c_1$ is larger) and covariance risk is positive, it can be shown that $b_2$ becomes smaller. This result is consistent with the prediction made according to
Table 3.1: The Relationship Between $b_1$ and $b_2$ When There is a Change in Firm 1’s Output Risk $\sigma_1$ 

$\gamma_1 = \gamma_2 = 4, \theta = 0.001, \sigma_2 = 200, c_1 = 0.001, c_2 = 0.002$ and $\rho_{12} = 0.2$ or -0.2. $b_1$ is CEO 1’s incentive intensity. $b_{2,p}$ is CEO 2’s incentive intensity when the correlation coefficient is positive ($\rho_{12} = 0.2$). $b_{2,n}$ is CEO 2’s incentive intensity when the correlation coefficient is negative ($\rho_{12} = -0.2$).

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<th>% change in $b_1$</th>
<th>$b_{2,p}$</th>
<th>% change in $b_{2,p}$</th>
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<td>10.73%</td>
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Table 3.2: The Relationship Between $b_1$ and $b_2$ When There is a Change in CEO 1’s Effort Aversion $c_1$ 

$\gamma_1 = \gamma_2 = 4, \theta = 0.001, c_1 = c_2 = 200, c_2 = 0.002$ and $\rho_{12} = 0.2$ or -0.2. $b_1$ is CEO 1’s incentive intensity. $b_{2,p}$ is CEO 2’s incentive intensity when the correlation coefficient is positive ($\rho_{12} = 0.2$). $b_{2,n}$ is CEO 2’s incentive intensity when the correlation coefficient is negative ($\rho_{12} = -0.2$).

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<th>% change in $b_1$</th>
<th>$b_{2,p}$</th>
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<td>0.541%</td>
<td>1.21%</td>
<td>0.281%</td>
<td>-2.25%</td>
</tr>
<tr>
<td>0.000095</td>
<td>-4%</td>
<td>0.647%</td>
<td>4.14%</td>
<td>0.540%</td>
<td>0.96%</td>
<td>0.282%</td>
<td>-1.78%</td>
</tr>
<tr>
<td>0.000097</td>
<td>-3%</td>
<td>0.640%</td>
<td>3.07%</td>
<td>0.538%</td>
<td>0.71%</td>
<td>0.283%</td>
<td>-1.32%</td>
</tr>
<tr>
<td>0.000098</td>
<td>-2%</td>
<td>0.634%</td>
<td>2.03%</td>
<td>0.537%</td>
<td>0.47%</td>
<td>0.285%</td>
<td>-0.87%</td>
</tr>
<tr>
<td>0.000099</td>
<td>-1%</td>
<td>0.627%</td>
<td>1.00%</td>
<td>0.536%</td>
<td>0.23%</td>
<td>0.286%</td>
<td>-0.43%</td>
</tr>
<tr>
<td>0.001000</td>
<td>0%</td>
<td>0.621%</td>
<td>0.00%</td>
<td>0.535%</td>
<td>0.00%</td>
<td>0.287%</td>
<td>0.00%</td>
</tr>
<tr>
<td>0.001011</td>
<td>1%</td>
<td>0.615%</td>
<td>-0.98%</td>
<td>0.533%</td>
<td>-0.23%</td>
<td>0.288%</td>
<td>0.42%</td>
</tr>
<tr>
<td>0.001032</td>
<td>2%</td>
<td>0.609%</td>
<td>-1.96%</td>
<td>0.532%</td>
<td>-0.45%</td>
<td>0.290%</td>
<td>0.84%</td>
</tr>
<tr>
<td>0.001053</td>
<td>3%</td>
<td>0.603%</td>
<td>-2.90%</td>
<td>0.531%</td>
<td>-0.67%</td>
<td>0.291%</td>
<td>1.25%</td>
</tr>
<tr>
<td>0.001074</td>
<td>4%</td>
<td>0.597%</td>
<td>-3.82%</td>
<td>0.530%</td>
<td>-0.88%</td>
<td>0.292%</td>
<td>1.65%</td>
</tr>
<tr>
<td>0.001095</td>
<td>5%</td>
<td>0.592%</td>
<td>-4.73%</td>
<td>0.529%</td>
<td>-1.10%</td>
<td>0.293%</td>
<td>2.04%</td>
</tr>
</tbody>
</table>

Table 3.3 shows the relationship between $b_1$ and $b_2$ when there is a change in CEO 1’s risk aversion $\gamma_1$. From the table, a 1% decrease in CEO 1’s effort aversion leads to a 1% increase in CEO 1’s incentive intensity $b_1$. Consequently, there will be a 0.19% decrease in CEO 2’s incentive intensity if covariance risk is positive, or a 0.34% decrease in CEO 2’s incentive intensity if covariance risk is negative. This implies, using the selected parameter values, if an increase in $b_1$ is driven by
the decrease of CEO 1’s risk aversion, the social comparison result will not be observed.

Table 3.3: The Relationship Between $b_1$ and $b_2$ When there is a Change in CEO 1’s Risk Aversion

<table>
<thead>
<tr>
<th>$\gamma_1$</th>
<th>$\gamma_2$</th>
<th>$\sigma_1$</th>
<th>$\sigma_2$</th>
<th>$c_1$</th>
<th>$c_2$</th>
<th>$\rho_{12}$</th>
<th>$b_{1,p}$</th>
<th>$b_{2,p}$</th>
<th>$b_{1,n}$</th>
<th>$b_{2,n}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.80</td>
<td>-5%</td>
<td>0.654%</td>
<td>5.23%</td>
<td>0.536%</td>
<td>-0.93%</td>
<td>0.282%</td>
<td>-1.72%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.84</td>
<td>-4%</td>
<td>0.647%</td>
<td>4.14%</td>
<td>0.531%</td>
<td>-0.75%</td>
<td>0.283%</td>
<td>-1.37%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.88</td>
<td>-3%</td>
<td>0.640%</td>
<td>3.07%</td>
<td>0.532%</td>
<td>-0.56%</td>
<td>0.284%</td>
<td>-1.03%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.92</td>
<td>-2%</td>
<td>0.634%</td>
<td>2.03%</td>
<td>0.533%</td>
<td>-0.37%</td>
<td>0.285%</td>
<td>-0.69%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.96</td>
<td>-1%</td>
<td>0.627%</td>
<td>1.00%</td>
<td>0.534%</td>
<td>-0.19%</td>
<td>0.286%</td>
<td>-0.34%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.00</td>
<td>0%</td>
<td>0.621%</td>
<td>0.00%</td>
<td>0.535%</td>
<td>0.00%</td>
<td>0.287%</td>
<td>0.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.04</td>
<td>1%</td>
<td>0.615%</td>
<td>-0.98%</td>
<td>0.536%</td>
<td>0.19%</td>
<td>0.288%</td>
<td>0.34%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.08</td>
<td>2%</td>
<td>0.609%</td>
<td>-1.95%</td>
<td>0.537%</td>
<td>0.37%</td>
<td>0.289%</td>
<td>0.69%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.12</td>
<td>3%</td>
<td>0.603%</td>
<td>-2.90%</td>
<td>0.538%</td>
<td>0.56%</td>
<td>0.290%</td>
<td>1.03%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.16</td>
<td>4%</td>
<td>0.597%</td>
<td>-3.82%</td>
<td>0.539%</td>
<td>0.75%</td>
<td>0.291%</td>
<td>1.37%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.20</td>
<td>5%</td>
<td>0.592%</td>
<td>-4.73%</td>
<td>0.540%</td>
<td>0.93%</td>
<td>0.292%</td>
<td>1.72%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.4 demonstrates that the corporate director will not always choose to increase the incentive intensity, as social exchange theory predicts. I change certain parameter values to illustrate this example. CEO 1 is very talented, with coefficient of effort aversion $c_1 = 0.0001$. CEO 1 also has a higher $\theta$ ($\theta = 0.1$). I choose different $\rho_{12}$ from -0.5 to 0.5 to show how covariance risk can effect CEO 1’s decision.

First, if firm 2 has a risk neutral non-corporate director (risk averse non-corporate director), a decrease in firm 2’s output risk $\sigma_2$ from 200 to 196 will lead to a 4.11% (0.01%) increase in incentive intensity. However, if firm 2’s compensation is set by CEO 1, a risk averse corporate director, his decision to increase or decrease the incentive intensity in fact depends largely on the covariance risk he faces. For example, if the correlation coefficient is -0.2, a decrease in firm 2’s output risk in fact leads to a 0.133% decrease in CEO 2’s incentive intensity. This implies that a non-corporate director always increases the incentive intensity when the output variance decreases, but that a corporate director does not necessarily do so. Therefore, on average, it is more likely to observe a non-corporate director increasing the incentive intensity than a corporate director, which is consistent with social exchange theory.

It should be noted that a positive relationship between risk and incentives can be observed in my model. This may provide one explanation why empirical evidence for the risk/incentive
tradeoff is inconclusive. Since corporate directors in the real world are not the "risk-neutral," "well-diversified," "unbiased" principals assumed in the agency model, they may not make decisions following the assumptions of a standard agency framework.

Table 3.4: Change of $b_2$ When There is a Change in Output Risk $\sigma_2$

<table>
<thead>
<tr>
<th>$\rho_{12}$</th>
<th>$\sigma_2 = 200$</th>
<th>$\sigma_2 = 196$</th>
<th>% change</th>
<th>$\sigma_2 = 200$</th>
<th>$\sigma_2 = 196$</th>
<th>% change</th>
<th>$\sigma_2 = 200$</th>
<th>$\sigma_2 = 196$</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.50</td>
<td>6.682%</td>
<td>6.639%</td>
<td>-0.651%</td>
<td>0.312%</td>
<td>0.324%</td>
<td>4.11%</td>
<td>50.078%</td>
<td>50.081%</td>
<td>0.01%</td>
</tr>
<tr>
<td>-0.40</td>
<td>7.215%</td>
<td>7.183%</td>
<td>-0.453%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.30</td>
<td>7.740%</td>
<td>7.727%</td>
<td>-0.282%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.20</td>
<td>8.282%</td>
<td>8.271%</td>
<td>-0.133%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.10</td>
<td>8.815%</td>
<td>8.815%</td>
<td>-0.003%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td>9.348%</td>
<td>9.359%</td>
<td>0.113%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.10</td>
<td>9.892%</td>
<td>9.903%</td>
<td>0.217%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.20</td>
<td>10.415%</td>
<td>10.447%</td>
<td>0.309%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.30</td>
<td>10.948%</td>
<td>10.991%</td>
<td>0.309%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.40</td>
<td>11.481%</td>
<td>11.535%</td>
<td>0.469%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>12.018%</td>
<td>12.079%</td>
<td>0.538%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.5 Empirical Implications and an Alternative Explanation for the Social Predictions

In this section, I discuss briefly the empirical implications of the simple model. The main point is that researchers should consider the "covariance risk" when studying CEO compensation decisions. I also provide another explanation for the social compensation predictions. The result suggests it is worth paying more attention to the true determinants of CEO compensation.

3.5.1 Empirical Implications

The key assumptions of my model are: (1) the principal is risk averse and is also an agent of another company; and (2) this risk averse principal cares about his wage from his home company and the non-pecuniary benefits gained from being a director. When he makes his decision, he considers
the risk related to these two jobs jointly, not separately (i.e., he cares about covariance risk). The second assumption is particularly important, because it creates a link between the incentive intensity of CEO 1 and CEO 2.

Table 3.5 summarizes the empirical predictions of my model, the standard agency model and the social compensation theories. Researchers can test the predictions by classifying directors according to the positive or negative covariance of the receiver firms and sender firms. The social compensation theory does not predict any difference in compensation decisions across these two groups. However, my model predicts that covariance risk should matter, and that the compensation decisions should be different between these two groups.

Table 3.5: Empirical Predictions of Three Different Theories

<table>
<thead>
<tr>
<th></th>
<th>Modified Agency Model</th>
<th>Standard Agency Model</th>
<th>Social Compensation Theories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director's and CEO's incentive intensity</td>
<td>$-1,3,4$ $+2,3,4,5$</td>
<td>No Effect</td>
<td>$+$</td>
</tr>
<tr>
<td>Similarity and incentive intensity</td>
<td>$-1,6or2,7$</td>
<td>No Effect</td>
<td>$-$</td>
</tr>
<tr>
<td>Likelihood of corporate-director initiating an increase in incentive intensity</td>
<td>Not Discussed $^8$</td>
<td>Lower</td>
<td></td>
</tr>
</tbody>
</table>

1. Covariance risk is positive.
2. Covariance risk is negative.
3. $1 - \gamma_1 c_1 \sigma_f^2 > 0$.
4. Change of $b_1$ is driven by a change in degree of effort aversion $c_1$ or output shock $\sigma_f^2$.
5. Change of $b_1$ is driven by a change in degree of risk aversion $\gamma_1$.
6. CEO 1 is more talented than CEO 2 (i.e., $c_1 < c_2$).
7. CEO 1 is less talented than CEO 2 (i.e., $c_1 > c_2$).
8. In the standard agency model, there is no difference between corporate director and non-corporate director. The unbiased director always increases the CEO's incentive intensity if there is a need for change.

It should also be stressed that most empirical CEO compensation studies examine the determinants of CEO compensation by focusing only on the receiver firm characteristics. However, this model shows the sender firm characteristics can also have an impact in determining CEO compensation.

Besides the direct implications of the model, the basic idea in this essay also suggests that
covariance risk may affect CEOs' decisions to join boards. A CEO may not want to become a director, because his exposure to the covariance risk is positive and relatively large. This implies that CEOs' incentives to be directors should depend on both sender and receiver firm characteristics.

3.5.2 An Alternative Explanation for the Social Comparison Prediction

The results shown in the previous section depend crucially on the assumption that the corporate director is risk averse and cares about the covariance risk between his wage and his reputation as a director. In this subsection, I provide another explanation that generates a similar social comparison prediction.

One important reason for firms to appoint CEOs of other firms to their boards is because these corporate directors may provide good advice and share their business experience with the CEOs of the receiver firms. This suggests the corporate directors are able to raise the marginal productivity of the CEOs. Of course, the receiver firm CEOs cannot learn anything if they do not exert any effort to learn from the corporate directors. On the other hand, the corporate directors will not be able to give good advice if they do not exert effort in gaining expertise in their own job. This implies that the output of the receiver firm can be written as:

$$y_2 = e_2[p_2 + \pi p_1 e_1] + \epsilon_2$$

Parameter $\pi$ may be viewed as CEO 1's "degree of contribution" to the receiver firm, and is assumed to be positive. $p_i$ is CEO $i$'s marginal productivity. The above equation suggests CEO 2's productivity is influenced by CEO 1's productivity (and effort). Unlike in previous section, I assume away any covariance risk (i.e., correlation coefficient is zero). This assumption ensures the result is driven by something different than the factors discussed in the previous sections. Moreover, since CEO heterogeneity has been captured by the coefficient of productivity $p_1$ and $p_2$, I assume that CEO 1 and CEO 2 have the same coefficient of effort aversion 1 (i.e., $c_1 = c_2 = 1$). Other assumptions remain the same. Based on these assumptions, CEO 1 and CEO 2's certainty equivalents can be written as:
The incentive intensities for these two CEOs are:

- CEO 1: Incentive intensity $b_1$:

$$b_1 = \frac{p_1^2}{p_1^2 + \gamma \sigma_1^2}$$

- CEO 2: Incentive intensity $b_2$:

$$b_2 = \frac{(p_2 + \pi p_1^2 b_1)^2 + \gamma_1 \theta \sigma_2^2}{(p_2 + \pi p_1^2 b_1)^2 + \sigma_2^2(\theta \gamma_1 + \gamma_2)}$$

It can thus be shown that:

$$\frac{\partial b_2}{\partial p_1} > 0, \quad \frac{\partial b_1}{\partial p_1} > 0, \quad \frac{\partial b_2}{\partial \sigma_1^2} < 0, \quad \frac{\partial b_1}{\partial \sigma_1^2} < 0, \quad \frac{\partial b_2}{\partial \gamma_1} \leq 0, \quad \frac{\partial b_1}{\partial \gamma_1} < 0$$

This implies that except for the risk-aversion-driven change in $b_1$, the social comparison behavior ($\frac{\partial b_1}{\partial p_1} > 0$) can be predicted. The intuition is straightforward. CEO 1 can increase CEO 2's productivity if he exerts more effort in his own firm. The effort CEO 1 chooses to exert depend on his incentive intensity $b_1$. When $b_1$ is higher, CEO 1 will exert more effort, and hence he is able to further increase CEO 2's productivity. Since CEO 2 has learned to become more productive, CEO 1 is able to set a higher incentive intensity for CEO 2. This creates a seeming social comparison prediction.
3.5.3 Total Compensation

Previously, this essay is focused mainly on the variable compensation (i.e., incentive intensity). I have shown that the incentive intensity of the sender firm and receiver firm can be related even without having a director who sets CEO pay based on “social comparison” incentives. However, the model is not able to explain the relationship between sender and receiver firms’ total compensation practices. The reason is that the participation constraint needs to be satisfied in the standard agency framework. Moreover, a reservation wage set to satisfy the constraint is assumed to be exogenously given. This implies that total compensation may not be related. In this subsection, I provide one simple explanation to show why total compensation can also be related as predicted by the social compensation theory.

In the previous subsection, the major benefit of having a corporate director is assumed to be an increase in CEO 2’s productivity. This increased productivity can be viewed as the result of skills the CEO learns from the corporate director. This suggests that the assumption that reservation wage is fixed may not be reasonable, since a CEO’s value should change with a change in his “skill set.”

I therefore assume that the labor market will value a CEO based on the skills he possesses. This implies the reservation wage will increase or decrease depending on the market demand for the skills. More specifically, the market prices for $p_1$ and $p_2$ are $\hat{P}_1$ and $\hat{P}_2$, respectively. I therefore simply assume that the reservation wage for CEO 1 is $p_1\hat{P}_1$, while the reservation wage for CEO 2 is $p_2\hat{P}_2 + \pi p_1\hat{P}_2$.

Based on this assumption, it can be hypothesized that the total compensation for the two CEOs should be related. For example, when the market values the skill $p_1$ more, the total compensation for both CEO 1 and CEO 2 should increase. When the demand for $p_1$ is lower, both CEOs’ total compensation should decrease. This creates a seeming social comparison behavior in total compensation.
3.6 Conclusion

In this essay, I relax some assumptions in the standard agency model and show that the predictions of social compensation theories can be explained with a modified agency framework. Three sociology-based theories are considered in this essay: social comparison theory, social exchange theory and social similarity theory.

Unlike the standard agency framework, in which the role of directors is overly simplified, I recognize the fact that those making decisions about CEO compensation are often CEOs of other companies (i.e., corporate directors). Because these corporate directors care about their own wage and their reputation as directors, they will set “biased” compensation schemes for the receiver firm CEOs. I have shown that covariance risk can be an important factor in determining CEO compensation.

Since the corporate director in the model wants to diversify his risk exposure, he shares the covariance risk with the CEO of the receiver firm. This creates a link between the incentive intensities of the two firms. I show that under certain conditions, the CEO’s incentive intensity and corporate director’s incentive intensity are positively correlated. This is consistent with the prediction of the social comparison theory, although the driving force is completely different.

I also show that the covariance risk may affect the corporate director’s incentive to increase incentive intensity when the environmental uncertainty of the receiver firm decreases. This is due to the fact that the corporate director may want to rebalance his risk exposure and take advantage of the diversification benefit resulting from the negative covariance risk. Therefore, a corporate director is less likely than a non-corporate director to increase the incentive intensity when an increase is needed. This prediction is consistent with social exchange theory.

Regarding social similarity theory, I show that when the covariance risk is positive and the corporate director is more talented than the receiver firm’s CEO, a less similar corporate director (i.e., a more talented corporate director) will prefer to set a higher incentive intensity for the receiver firm’s CEO to offset his own risk exposure. This result provides a different rationale for the behavior that is predicted by the social similarity theory.
This risk-based explanation provides sharper empirical implications than those of social comparison theory, social exchange theory and social similarity theory. I show how and where the predictions of these social compensation theories will break. Nevertheless, the main focus of the essay is not to claim that sociology-based theories are incorrect. Instead, the model simply shows that there can be many explanations for the sociology-based predictions. It is thus worth considering all these possibilities when conducting empirical research on CEO compensation. Such an empirical analysis is left for future work.
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Chapter 2


Chapter 3


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Appendix 1.1:

Definition of Variables Used in Volatility Regression

**Size:** Logarithm of book value of assets (log (data6))

**Book Equity:** [Book value of stockholders’ equity (data216)+ Balance sheet deferred taxes and investment tax credit (if available, data35) - the book value of preferred stock] Depending on availability, I use the redemption (data56), liquidation (data10), or par value (data130) (in that order) to estimate the book value of preferred stock. If data216 is not available, I use [book value of common equity (data60)+the par value of preferred stock (data130)] as the proxy. If this proxy is still not available, I use [book value of assets (data6)- total liabilities (data181)]

**Market Capitalization:** Market Capitalization is computed based on calendar year-end stock value. I get this data from CRSP. It is defined as Price (pri)\times Share outstanding (shrout).

**Market to Book Ratio:** log (Market Capitalization/Book Equity)

**Book Leverage Ratio:** [Debt in Current Liabilities (data34)+Long Term Debt Total (data9)]/ book value of assets (data6)

**Dividend Paying Dummy:** if Dividend Common (data21) is nonzero, then Dividend Paying Dummy is set to 1; otherwise, it is set to 0

**Earnings:** Income Before EI (data237) + Deferred Taxes (data50, if available) + Investment Tax Credit (data51, if available)

**ROE:** Earning/ Lag (Book Equity)

**Firm Age:** log [(date-date the stock first appear in CRSP)/30]

**Z-score:** 1.3[Working Capital (data179)/Total Assets]+1.4*[Retained Earnings (data36)/Total Assets] +3.3*[Earnings Before Interest and Tax (data178)/Total Assets]+0.6*{[Market Value of Equity (data199*data25)+Preferred Stock (data130)]/Total Liability (data181)}+0.999*[Net Sales (data12)/Total Assets]

**R&D Intensity:** Research and Development Expense (data46)/Total Assets

**Forecast Dispersion:** Standard Deviation of 5 year EPS growth forecast

**Forecast Error:** \((Forecast_{t}-actual_{t})/\)Fiscal year end stock price \(p_t\)
Appendix 1.2:

Classification of Compustat S&P Credit Ratings

<table>
<thead>
<tr>
<th>S&amp;P Ratings</th>
<th>Compustat Data280</th>
<th>Reclassification</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>AA+, AA, AA-</td>
<td>4,5,6</td>
<td>2</td>
</tr>
<tr>
<td>A+, A, A-</td>
<td>7,8,9</td>
<td>3</td>
</tr>
<tr>
<td>BBB+, BBB, BBB-</td>
<td>10,11,12</td>
<td>4</td>
</tr>
<tr>
<td>BB+, BB, BB-, B+, B, B-</td>
<td>13,14,15,16,17,18</td>
<td>5</td>
</tr>
<tr>
<td>CCC+, CCC, CCC-, CC, C</td>
<td>19,20,21</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>27</td>
<td>7</td>
</tr>
</tbody>
</table>
Appendix 1.3:

Effectiveness of the “Extreme Stock” Detection Algorithm

The goal of the algorithm provided in the second essay is to detect a small number of “extreme” firms that potentially have quite different return characteristics than those of the firms in the same portfolio.

To examine if the algorithm is effective in detecting the extreme stocks in the Gompers et al. (2003) portfolios, I consider the following simulation:

First, all firms in the CRSP database during September 1990 to December 1999 are obtained as my “potential firms” sample. This procedure allows the simulation sample period to be consistent with that of Gompers et al. (2003). 100 firms are randomly drawn from the above sample with replacement. This 100 firms constitute my “hypothetical portfolio.” Since this hypothetical portfolio is composed of real firms, firm entries and exits are automatically considered. Each firm in the portfolio is held throughout the sample period. The portfolio weight is determined by each firm’s previous month market capitalization. Since these 100 firms are drawn randomly, on average there should not be any significant abnormal return associated with this hypothetical portfolio.

After the hypothetical portfolio has been constructed, I try to create an “extreme stock” artificially. More specifically, I add a constant of 5%, 10%, 15% or 20% to each monthly return of the chosen “extreme” firm in the hypothetical portfolio. These added returns can be viewed as the source of abnormal returns.

I consider three different ways to choose this “extreme” firm:

1. A firm is randomly drawn from the hypothetical portfolio.

2. A firm with the largest average market capitalization during the sample period is chosen. “Market capitalization” is defined as the market capitalization in the beginning of each month

3. A firm with the smallest average market capitalization is chosen.

I also require the potential chosen firm to have at least 36 observations. A firm with too few observations during the sample period cannot have a meaningful impact on the portfolio return.
My main test is to examine whether my algorithm can detect this artificially chosen firm. To be conservative, I try to understand if the algorithm can detect the extreme stock in the first round. This means that I view my algorithm as ineffective if any non-extreme stock is detected in the first round, even though the algorithm may detect the extreme stock in the latter rounds. I repeat the procedures for 100 hypothetical portfolios. By doing so, I can detect the success rate of my algorithm. Table A1.3.1 presents the result.

Table A1.3.1: Detection Rate of the Algorithm

<table>
<thead>
<tr>
<th>Extreme Stock Chosen Method</th>
<th>Added Constant</th>
<th>Detection Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random</td>
<td>5%</td>
<td>53%</td>
</tr>
<tr>
<td>Random</td>
<td>10%</td>
<td>83%</td>
</tr>
<tr>
<td>Random</td>
<td>15%</td>
<td>96%</td>
</tr>
<tr>
<td>Random</td>
<td>20%</td>
<td>97%</td>
</tr>
<tr>
<td>Largest</td>
<td>5%</td>
<td>96%</td>
</tr>
<tr>
<td>Largest</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td>Largest</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>Largest</td>
<td>20%</td>
<td>100%</td>
</tr>
<tr>
<td>Smallest</td>
<td>5%</td>
<td>14%</td>
</tr>
<tr>
<td>Smallest</td>
<td>10%</td>
<td>43%</td>
</tr>
<tr>
<td>Smallest</td>
<td>15%</td>
<td>67%</td>
</tr>
<tr>
<td>Smallest</td>
<td>20%</td>
<td>82%</td>
</tr>
</tbody>
</table>

It can be observed from the table that the algorithm works most effectively when the added constant or the average market capitalization of the chosen firm is large. The intuition is that a large firm weighs more in the value-weighted portfolio. Therefore, the hypothetical portfolio return can be significantly affected by this one firm. Once this firm is removed, the abnormal return will become quite different and the algorithm detects this extreme stock.

Since the simulation uses real stock return data, it is possible that some stocks other than the artificially chosen stock can also have extreme returns. This implies that I am not able to distinguish whether the failure of the algorithm is due to the fact the I have detected these "true" extreme stocks or is due to the fact that the algorithm incorrectly detects the non-extreme stocks. On the other hand, successfully detecting the artificially extreme stock may also due to the fact
that I fail to detect an even more extreme stock in the sample. Nevertheless, since the added constants consistently affect the monthly return of the chosen firm and they are relatively large, the artificially-created stock should be the most extreme stock.

Another way to simulate the statistical properties of the algorithm is to construct the whole sample purely through the generation of random variables. This is probably the cleanest way to understand the effectiveness of the algorithm, compared to the method using real stock return data. For example, I can generate 100 time series of stock returns without any abnormal return. To test the effectiveness of the algorithm, I can artificially create an “extreme stock” and try to examine if the algorithm can detect this stock. I can also examine the situation in which no “extreme stock” has been created. This test will allow me to tell whether the algorithm incorrectly detect the non-extreme firms. The difficulty of implementing this simulation is that I need to create stock return series that should reasonably represent the true stock return process. Moreover, since value-weighted portfolio is my main focus, the market capitalization process associated with each stock should also been generated. Firm entries and exits in the real data can also be difficult to capture in this method. Hence, this method is left for future work.
Appendix 2.1: Proof of Proposition 1

Proof The board’s project termination policy can be summarized as follows:

- If first-period output is $H + G$, the project will be continued if $\frac{q}{\gamma} > \frac{-(1-p)\pi_1(L + \pi_b(1-H-L))}{p\pi_b(L + \pi_b(H-L))}$.
- If first-period output is $L + G$, the project will be continued if $\frac{q}{\gamma} > \frac{-(1-\gamma)(1-\pi_b)L + \pi_b(1-H-L))}{p(1-\pi_b)(L + \pi_b(H-L))}$.

On the other hand, the manager’s implementation decision will be:

- When there exists a real growth opportunity, the manager will pursue the growth opportunity $(q = 1)$ if $\frac{q}{\gamma} < I_L + \pi_g[I_H - I_L]$.
- When there exists a value-destroying deal, the manager will undertake a negative NPV project $(\gamma = 1)$ if $\frac{q}{\gamma} < I_L + \pi_b[I_H - I_L]$.

From the board’s project termination policy, it is obvious that if a project is continued when first-period output is low (i.e., $I_L = 1$), the project must also be continued if first-period output is high (i.e., $I_H = 1$). Moreover, if the manager’s best strategy is to undertake a project when no growth opportunity exists, pursuing a growth opportunity when one exists must be his best strategy. These results come from the fact that a positive NPV project always has a higher success probability ($\pi_g > \pi_b$).

Because I focus only on pure strategy, this means the board has the following three strategies:
(1) $I_H = I_L = 1$ (2) $I_H = I_L = 0$, (3) $I_H = 1, I_L = 0$. On the other hand, the manager’s implementation decision will be either $q = \gamma = 0$ or $q = \gamma = 1$. The strategy $q = 0, \gamma = 1$ is always a dominated strategy. On the other hand, the strategy $q = 1, \gamma = 0$ will not constitute a stable equilibrium. If the manager’s best strategy is not to undertake any bad project, the board should believe that an implemented project is good and should never be terminated. Anticipating this, the manager would never want to completely restrain himself ($\gamma = 0$). Therefore, this cannot be a pure strategy.

If the board’s strategy is $I_H = I_L = 1$, the manager’s best response is to implement any project available to him and enjoy the private benefits ($q = \gamma = 1$). From the board’s termination
policy, it can be shown that $p > \left(\frac{1-\pi_g}{1-\pi_g + \pi_b(H-L)}\right) \frac{-\pi_b(L + \pi_b(H-L))}{1-\pi_b} = p_l^f$ is required to ensure the equilibrium. The manager’s willingness to undertake a project is automatically satisfied.

The board can also implement a very tough strategy such that it terminates the project regardless of its realized outcome (i.e., $I_H = I_L = 0$). If $\frac{g_c}{B} < \pi_b < \pi_g$, the manager undertakes any project as long as the board will not terminate the project when output is high. Therefore, to make the policy $I_H = I_L = 0$ credible, $p < \left(\frac{\pi_b(L + \pi_b(H-L))}{\pi_b} - (1-\pi_b)(L + \pi_b(H-L))\right)^{-1}$ is required. If $p > p_l^H$ and $\frac{g_c}{B} < \pi_b < \pi_g$, the board will not be able to commit to the tough policy. This means that when $p < p_l^H$ and $\frac{g_c}{B} < \pi_b < \pi_g$, $L_H = 0, I_L = 0, q = 0, \gamma = 0$ will be a pure strategy equilibrium.

On the other hand, when $\pi_b < \pi_g < \frac{g_c}{B}$, the manager will not undertake any project if his private benefits are not secured in the second period. Therefore, when $\pi_b < \pi_g < \frac{g_c}{B}$ and $p < p_l^f$, $L_H = I_L = 0, q = 0, \gamma = 0$ will be a pure strategy equilibrium.

The board may terminate the project when first-period output is low (i.e., $I_H = 1, I_L = 0$). In this case, if $\frac{g_c}{B} < \pi_b < \pi_g$ and $p_l^H < p < p_l^f$, the manager still has an incentive to implement any project. Therefore, $I_H = 1, I_L = 0, q = \gamma = 1$ will constitute a pure strategy equilibrium.

If $p < p_l^f$ and $\frac{g_c}{B} < \pi_b < \pi_g$, as discussed previously, the manager will not invest in any project if his private benefits are not secured in the second period. Therefore, in this case, $I_H = 1, I_L = 0, q = \gamma = 0$ is also a pure strategy equilibrium.

Appendix 2.2: Proof of Lemma 4

Proof

• When $p > p_l^f$, the board initiates a project when $2\{p[L + \pi_g(H-L)] + (1-p)[L + \pi_b(H-L)]\} > 0$. Since the break-even $p = \frac{-\pi_b(L + \pi_b(H-L))}{\pi_b} < p_l^f$, a project will always be initiated.

• When $p < p_l^H$, the board initiates a project when $p[L + \pi_g(H-L)] + (1-p)[L + \pi_b(H-L)] > 0$. Since the break-even $p$ is less than $p_l^H$, no project will be initiated.

• When $p_l^H < p < p_l^f$, the board initiates a project when $p(1 + \pi_g)[L + \pi_g(H-L)] + (1-p)(1 + \pi_b)[L + \pi_b(H-L)] > 0$. This implies the board will initiate a project only when
Appendix 2.3: Proof of Proposition 3

Proof The incentive contract should ensure that the manager prefers undertaking a good project to forgoing one.

\[
\pi_g W_H + (1 - \pi_g) W_L + B - c \geq W_G
\]

The wage structure should also ensure that the manager prefers forgoing a bad project to undertaking one.

\[
\pi_b W_H + (1 - \pi_b) W_L + B - c \leq W_G
\]

Moreover, since the manager is assumed to be wealth-constrained and has only limited liability, the following constraints should also be satisfied.

\[
W_G \geq 0, \ W_H \geq 0, \ W_L \geq 0
\]

The manager's participation constraint is thus automatically satisfied.

Based on the above constraints, it can be shown that the incentive contract should be:

\[
W_L = 0
\]
\[
W_G = B - c
\]
\[
W_H = 0
\]
Appendix 2.4: Proof of Proposition 5

Proof Based on the board’s termination policy and the manager’s project implementation policy, possible mixed strategy equilibria are discussed below:

1. $I_H \in [0, 1], I_L = 0, q = 1, \gamma \in [0, 1]:$

   The manager’s bad project implementation probability $\gamma$ and the board’s termination policy $I_H$ can be easily computed:

   \[
   I_H = \frac{c}{B\pi_b} \\
   \gamma = \frac{p\pi_q[L + \pi_q(H - L)]}{-(1 - p)\pi_b[L + \pi_b(H - L)]}
   \]

   Due to the fact that $I_H$ and $\gamma$ should be within the range $(0, 1)$, two additional restrictions on parameter value are required: (1) $\pi_b > \frac{c}{B}$ and (2) $p < p_l^H$.

   This result also suggests $[I_H > \frac{c}{B\pi_b}, I_L = 0, q = \gamma = 1]$ may constitute a mixed strategy equilibrium as well. $q = \gamma = 1$ and $I_L = 0$ implies $p < p_l^H$. Within the range $p_l^H < p < p_l^L$, the board’s randomized policy is not credible, because continuation of the high output project can generate higher expected payoff without affecting the manager’s incentive to undertake the project. Therefore, only the pure strategy $I_H = 1$ will be reasonable. On the other hand, if $p < p_l^H$ and $q = \gamma = 1$, the board also has no incentive to keep the high output project with some probability. This implies $I_H = 0$. Therefore, $[I_H > \frac{c}{B\pi_b}, I_L = 0, q = \gamma = 1]$ does not constitute a mixed strategy equilibrium.

2. $I_H = 1, I_L \in [0, 1], q = 1, \gamma \in [0, 1]:$

   The board’s project termination policy $I_L$ and the manager’s project implementation policy
can be computed:

\[ I_L = \frac{1}{1-\pi_b} \left[ \frac{C}{B} - \pi_b \right] \]
\[ \gamma = \frac{p(1-\pi_g)(L + \pi_g(H - L))}{-(1-p)(1-\pi_b)(L + \pi_b(H - L))} \]

As before, since both \( I_H \) and \( \gamma \) are within the range \((0,1)\), two additional restrictions on parameter values are required: (1) \( \pi_b < \frac{C}{B} \) and (2) \( p < p^L \).

This result suggests that \([I_H = 1, I_L > 1-\pi_b[B - \pi_b], q = \gamma = 1]\) may also constitute a mixed strategy equilibrium. The fact that \( I_H = q - \gamma = 1 \) implies \( p > p^H \). If \( p > p^L \), the board will have an incentive to keep the project (i.e., \( I_L = 1 \)). Therefore, only pure strategy equilibrium is reasonable in this range. On the other hand, if \( p^H < p < p^L \), the board will have incentive to terminate the low profit project (i.e., \( I_L = 0 \)) if \( q = \gamma = 1 \). Therefore, \([I_H = 1, I_L > 1-\pi_b[B - \pi_b], q = \gamma = 1]\) will not constitute a reasonable mixed strategy equilibrium.

3. \( I_H = 1, I_L \in [0,1], q = \gamma = 0 \):

\( I_H = 1 \) and \( q = \gamma = 0 \) require \( I_L < \frac{1}{1-\pi_b} \left[ \frac{C}{B} - \pi_g \right] \). Since \( I_L \) cannot be negative, this implies \( \pi_g < \frac{C}{B} \). However, this equilibrium is not reasonable when \( p > p^H \). When \( p > p^L \), the manager knows that if he implements any project, the board will not terminate the project. Therefore, he can be assured that he will enjoy his private benefits. Therefore, forgoing any project will be a dominated strategy.

4. \( I_H \in [0,1], I_L = 0, q = \gamma = 0 \):

\( I_L = 0 \) and \( q = \gamma = 0 \) requires \( I_H < \frac{1}{1-\pi_b} \left[ \frac{C}{B} - \pi_g \right] \). However, as discussed in the previous case, this equilibrium is not reasonable when \( p > p^H \). Moreover, if \( p^H < p < p^L \) and \( \pi_b > \frac{C}{B} \), the board's policy of terminating the high output project will not be credible. Therefore, the manager expects higher payoff by adopting the strategy \( q = \gamma = 1 \) in this range. On the other hand, when \( \pi_b < \frac{C}{B} \) and \( p < p^L \), the policy is reasonable.