



Corporate risk and corporate governance: another view

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Abstract

Purpose – The purpose of this paper is to investigate the effect of corporate governance strength as measured by the Gompers governance index (gindex) and other related factors on corporate risk as measured by implied volatility of returns.

Design/methodology/approach – The research incorporates implied volatility as the measure of risk, as compared to earlier studies that have used historic volatility measures. Governance variables include the Gompers Index, as well as other measures to control for firm size, ownership and leverage.

Findings – The findings indicate that corporate risk is significantly inversely-related with the gindex, which essentially gauges how extensively antitakeover provisions are adopted by a firm. Firm size is the other variable significant in both univariate and multivariate models. Financial leverage and the percentage of outsiders on the board are significantly related to firm risk when not controlling for other factors. Board percentage of voting power does not appear to affect firm riskiness statistically.

Research limitations/implications – Future research needs to examine specifically why higher takeover defenses lead to lower implied volatility. This includes exploring whether the lower level of expected volatility is due to lower levels of takeover activity or whether firms with poor governance assume a suboptimal amount of risk.

Originality/value – The paper contributes to the literature by the use of implied volatility as the measure of risk. The results are robust and provide further support for the relationship between corporate governance and risk. While counter to initial expectations, these results suggest, at the very least, a firm with good governance may not necessarily have low implied volatility in its stock price.

Keywords Corporate governance, Corporate strategy, Risk management, Financial performance, Returns

Paper type Research paper

Introduction

Greater attention to corporate governance developed out of the background of agency theory and is based on the premise of shareholder value maximization. That is, appropriate corporate governance should result in a focus on maximization of shareholder wealth. Jensen and Meckling (1976) define an agency relationship as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent. If both parties to the relationship are utility maximizers, there is a good reason to believe that the agent may not always act in the best interest of the principal. In the case of a corporation, the shareholders are the principals contracting with management, who serve as the agents. Since the goal of the company is shareholder value maximization, a potential for agency conflicts exists. Corporate governance, generally speaking, is the collection of provisions and strategies to reduce agency conflicts and ensure that shareholder wealth is maximized. The effect



of corporate governance on equity prices and the distribution of returns is an important issue in corporate finance. There are a number of factors widely known to influence the quality of corporate governance, including board structure, ownership structure, executive compensation, and anti-takeover provisions.

Why might there be a negative relation between corporate governance and risk? Strong governance should lead to fewer missed opportunities and fewer negative net present value projects. Strong governance should lead to less misleading or self-serving statements by managers to the press or in financial statements and other filings. Strong governance should lead to greater transparency and/or credibility of the firm. All of this should increase the amount of reliable information available and reduce uncertainty in the market. This should reduce the market's perceived risk of the firm.

Perhaps less obvious is why there might be a positive relation between corporate governance and risk. Strong governance should result in managers assuming an appropriate level of risk for the firm. This is the view of Litov *et al.* (2006), who assert that greater governance reduces private benefits. This may force conservative managers, more interested in increasing the stability of their personal cash flows rather than the volatility associated with potential future gains, to take on greater risk than they otherwise would, to the benefit of all shareholders. One example would be a manager who prefers to have little to no debt. While this diminishes the likelihood of bankruptcy, interference by creditors, and risk of cash flows, it results in an under-levered firm that does not benefit from a greater interest tax shield. Litov *et al.* (2006) also point out that banks, unions, and the government may constrain risk. Well-diversified shareholders would benefit from a higher degree of leverage and risk. In addition, when stronger corporate governance is characterized by fewer takeover defenses, it may result in such firms being in play to potential acquirers, which may also increase the volatility of returns, but to the benefit of shareholders. Such a relationship is consistent with Ferreira and Laux (2005), who find that a firm's idiosyncratic risk decreases as its insulation from takeovers increases.

Despite the research that has been done on the relationship among corporate value, corporate governance, and corporate risk, limited analysis has been done specifically attempting to investigate the relationship between corporate risk and corporate governance, the latter of which is measured by the widely acknowledged governance index constructed by Gompers *et al.* The purpose of this research is to further explore the specific nexus between corporate risk and corporate governance. More specifically, the implied volatility of stock prices is incorporated as a forward-looking measure of firm risk. While the variance of past stock prices is often used as a measure of risk, it provides no information to the market about expected future volatility. One is left assuming that past volatility perfectly predicts future volatility. Changes in corporate governance that result in lower perceived risk will not affect past volatility. Implied volatility, however, is the market's assessment of future volatility and is a more appropriate measure.

Data for the study are from OptionMetrics and RiskMetrics as well as Compustat. Using a sample of 6,176 biannual firm-year observations spanning 1998-2006, we relate the implied volatility to a number of variables designed to capture the relationship with corporate governance as measured by the Gompers's index. The model also includes a number of variables to control for other firm-specific factors. The empirical results suggest that dictatorship firms (as defined by Gompers (2003)) are less risky than non-dictatorship firms. Democracy firms are riskier than non-democracy firms.

Further, anti-takeover provisions tend to be associated with a reduction in risk, particularly short-term risk. In terms of the control variables such as firm size and firm debt levels, the signs are as one would expect. Likewise, the percentage of outsiders on a board has a positive relationship with good governance. Overall, the results complement the body of literature regarding corporate governance and firm risk by the use of implied volatility measures.

The second section of this paper consists of a literature review of the commonly accepted aspects of corporate governance, including anti-takeover provisions and Gompers *et al.*'s index, as well as research examining the relationship between firm value and corporate governance. In the third section, the conceptual and estimated models are presented with the specific hypotheses to be tested. In the subsequent section, the data and variables are defined in greater detail and summary statistics presented. This is followed by the empirical results and discussion of those results. The paper concludes with implications and suggestions for future research.

Literature review

1. Measures of risk

Risk is a concept that denotes the precise probability of specific eventualities. In finance, risk is the probability that an investment's actual return will be different than expected. However, in most cases, investors are more concerned with the probability of downside risk in their investment. Corporate risk is commonly measured using historic equity price volatility, that is, the standard deviation of the stock price of a publicly listed company.

An alternative risk measure for equity is implied volatility of stock price, which traditionally can be calculated using either the Black-Scholes formula (Black and Scholes, 1973) or the Cox-Ross-Rubinstein binomial model (Cox *et al.*, 1979), and can be interpreted as the market's assessment of the average volatility over the remaining life of the stock option. Mayhew (1995) systematically summarizes the literature concerning implied volatility.

One problem with historic volatility is that it is backward-looking, and those using historic volatility assume that stock prices in the future will follow the same distribution as in the past, an assumption that is often violated in the real market. Compared with historic volatility, implied volatility is a forward-looking measure. As was stated earlier, historic volatility (i.e. the variance of past stock returns) provides no information to the market about future volatility. Further, changes in corporate governance that lead to a reduction in perceived risk will have no effect on past volatility. This is the main reason that implied volatility is preferred to historic volatility as a proxy measuring future corporate risk. Latané and Rendleman (1976), Schmalensee and Trippi (1978), Chiras and Manaster (1978) and Beckers (1981) all find that implied volatility is better than historical standard deviation at forecasting future realized volatility.

In 1993, the first VIX (volatility index), a weighted measure of the implied volatility of eight S&P 100 at-the-money put and call options, was introduced by the Chicago Board Options Exchange. Now, the index has expanded to use options based on a broader index, the S&P500, which allows for a more accurate view of investors' expectations on future market volatility. This index is commonly used as a proxy for market risk.

By the same token, the implied volatility for a specific firm can be calculated from at-the-money options if the firm has options outstanding. This research utilizes a ready

source of implied volatility for firms from OptionMetrics[1], a provider of information on historical volatility and implied volatility. Since prior work (Donders and Vorst, 1996; Donders *et al.*, 2000; Isakov and Perignon, 2001) finds that implied volatility changes around earnings announcements, the estimate of implied volatility is measured 30 days following the earnings announcement to remove transient changes in volatility surrounding the announcement, and is defined as the implied volatility for the closest at-the-money option. In the case where a firm has multiple options trading that are equally close to at the money, implied volatility is defined as the average implied volatility of all closest to at-the-money options.

2. Measures of corporate governance and related indices

Board structure, ownership structure, executive compensation, and anti-takeover provisions are acknowledged as the main drivers influencing the quality of corporate governance.

A. Board structure. Regarding board structure, we are mainly interested in two major issues. One is whether the firm has a staggered board (i.e. classified board), and the other is the percentage of outsiders sitting on the board. A staggered board of directors is one that is comprised of three different classes of directors. Elections for the directors of staggered boards usually happen on an annual basis with each board member serving for a three-year term.

Generally, proponents of staggered boards cite two main advantages over traditionally elected boards: board continuity and takeover protections. Since hostile acquirers have a difficult time gaining control of companies with staggered boards. Opponents of staggered boards, however, argue that directors are less accountable to shareholders than annually elected boards and that staggering board terms tends to breed a fraternal atmosphere inside the boardroom that serves to protect the interests of management above those of shareholders.

Outside board members are often considered to be better than insiders as monitors because they are not subordinated to management. A number of studies have identified beneficial effects of having outside board members. Rosenstein and Wyatt (1990) report that the market reacts positively to the announcement of outside director appointments. Byrd and Hickman (1992) find that bidding firms with a majority of independent outside directors earn higher announcement abnormal returns than do firms without a majority of independent directors. Other similar studies include Brickley *et al.* (1994), Cotter *et al.* (1997) and Weisbach (1998).

Bebchuk *et al.* (2002) cite that in the nine months after a hostile takeover bid is announced, shares in companies with staggered boards increase only 31.8 percent, compared to the average of 43.4 percent return to stockholders of companies with non-staggered boards, which means staggered boards may deter hostile takeovers that otherwise maximize shareholder wealth, although they are fairly rare occurrences. Collectively, the evidence illustrates the importance of outside directors during specific corporate events.

B. Ownership structure. Ownership structure refers to the breakdown of ownership claims held by insiders (management) and outsiders (investors with no direct role in the management of the firm) (Jensen and Meckling, 1976). A low percentage of director ownership may not be a sufficient incentive for directors to effectively monitor the performance of the management on behalf of shareholders. However, excessive

ownership by directors may inevitably entrench these directors who may maximize their own interests within the firm at the expense of shareholder wealth. Manjón (2004) develops a model and finds the predictions of the model agree with the extant empirical evidence that changes in the characteristics of governance, in the information available to the investor and in the size of the firm affect ownership concentration. Therefore, the level of ownership of different stakeholders matters.

Morck *et al.* (1988) investigate the relationship between management ownership and market value of the firm, and find that the market valuation of a firm (as measured by Tobin's Q) first increases, then declines, and finally rises slightly as ownership by the board of directors rises. This indicates that the aforementioned relationship is nonlinear.

McConnell and Servaes (1990) find a significant curvilinear relation between Tobin's Q and the fraction of common stock owned by corporate insiders. The curve slopes upward until insider ownership reaches approximately 40-50 percent and then slopes slightly downward. The results are consistent with the hypothesis that corporate value is a function of the structure of equity ownership. Holderness *et al.* (1999) give a new reference for ownership structure, which is not treated as an exogenous factor, but as the outcome of an optimization process that determines the most effective use of control devices to maximize firm value.

Moreover, due to the fact that shares are dispersely held by outsiders, common shareholders do not, or strictly are not able to, oversee the performance of the management with due diligence. Beyond monitoring by the board, the task of oversight is more likely undertaken by blockholders, commonly institutional investors such as mutual funds, pension funds, endowments, etc.

Blockholders are shareholders with an ownership greater than 5 percent of the firm's outstanding shares. They are hypothesized to be more active in monitoring the performance of the management due to their large investment in certain stocks. Hartzell and Starks (2003) find that institutional investors contribute to private information collection and trading. Piotroski and Roulstone (2005) also find that institutional trading is positively associated with idiosyncratic volatility. Thus, large institutional investors potentially serve as effective monitors of corporate behavior.

C. Executive compensation. Executive compensation schemes can be designed to align the incentives of managers with those of shareholders. However, the effectiveness of incentive pay in resolving the agency problem and providing the desirable business and societal outcomes is being frequently questioned by a number of economists and business academics. Bebchuk and Fried (2003) argue that, while executive compensation is typically viewed as a potential solution to the agency problem, it is in fact likely to be part of the agency problem. In this sense, excessive pay for executives may actually cause, rather than solve, managerial problems. Varian (2002) recognizes that, given the powerful incentive provided by stock options, "the temptation to inflate stock prices artificially will also be strong," leading to the executive's moral risk. Nobel Laureate Joseph Stiglitz argues that high-powered incentives and stock options give executives "more incentive to misreport (corporate) incomes" (Meyers, 2003). In support of these ideas, researchers have empirically examined the link between high levels of CEO incentive compensation and the likelihood of financial misrepresentation, finding that such malfeasance is increasingly likely as the level of incentive compensation rises (Harris and Bromiley, 2005). Graham *et al.* (2011) find that firms with over-paid managers use less debt, consistent with the theoretical prediction that managers tend to

choose a suboptimal capital structure in order to secure their compensation by shirking good projects and evading taking necessary risk to maximize shareholder value.

D. Anti-takeover provisions. There are some special provisions in by-laws or charters of companies that may impact the soundness of corporate governance. Among those provisions, poison pills and greenmail are the most typical. In general, proponents argue that such measures allow managers to focus on long run decisions. Opponents contend that such provisions simply provide job protection for managers, a view referred to as the management entrenchment hypothesis.

(a) Poison pills. In finance, a poison pill is a term referring to one type of strategy that a target company uses to defend itself against unwanted takeover bids. It is especially interesting that poison pills have the potential to either benefit or harm shareholders, but are adopted by the board of directors without a shareholder vote. Malatesta and Walkling (1989) indicate that poison pill defenses reduce stockholder wealth by a statistically significant amount, and the firms that adopt poison pill defenses are significantly less profitable than the average firm in their industries during the year prior to adoption. In addition, they find that the managers of these firms hold statistically significantly smaller fractions of their own firms' stock than the average fraction held by managers of other firms in the same industries.

In poison pill provisions, golden parachutes are commonly used. They are severance agreements that provide cash and non-cash compensation to senior executives upon an event such as termination, demotion, or resignation following a change in control. While such payments would appear to deter takeovers by increasing their costs, one could argue that these parachutes also ease the passage of mergers through contractual compensation to the manager of the target company (Lambert and Larcker, 1985). Although the net impact on managerial entrenchment and shareholder wealth is ambiguous, the more important effect is the clear decrease in shareholder rights. Silver parachutes are similar to golden parachutes in that they provide severance payments upon a change in corporate control, but differ in that a larger number of a firm's employees are eligible for these benefits. Other poison pills make additional shares available to current shareholders at a favorable price.

(b) Greenmail. Greenmail refers to a transaction between a large shareholder and a company in which the shareholder agrees to sell his stock back to the company, usually at a premium, in exchange for the promise not to seek control of the company for a specified period of time. Antigreenmail provisions prevent such arrangements unless the same repurchase offer is made to all shareholders or approved by a shareholder vote. Gompers *et al.* (2003) argue that antigreenmail is like a defense and code it as a decrease in shareholder rights.

E. Corporate governance index. There are a variety of measures which either integrally or separately address the quality of corporate governance for a firm. One highly cited measure is Gompers *et al.*'s G index. Their G index uses data from RiskMetrics, which publishes detailed listings of corporate governance provisions for individual firms (Rosenbaum, 1990, 1993, 1995, 1998). RiskMetrics tracks 22 charter provisions, bylaw provisions, and other firm-level rules plus coverage under six state takeover laws; duplication between firm-level provisions and state laws yields 24 unique provisions, which are divided into five groups by Gompers and his colleagues, such as tactics for delaying hostile bidders (delay), voting rights (voting), director/officer protection (protection), other takeover defenses (other), and state laws (state). The index

construction is straightforward: for every firm, one point is added for every provision that restricts shareholder rights (increases managerial power), and the bigger the index, the poorer the corporate governance of the firm. Gompers *et al.* (2003) analyze the empirical relationship between the index and corporate performance, and find that corporate governance is strongly correlated with stock returns during the 1990s.

3. Relationship among equity price, corporate risk, and corporate governance

Evidence suggests that governance practices can directly influence equity prices (Gompers *et al.*, 2003; Cremers and Nair, 2005). Constraints and incentives for managers are generally posited as the mechanism by which corporate governance influences prices. Gompers *et al.* (2003) argue that in the early 1990s investors might not have fully appreciated the agency costs engendered by weak governance. Their paper extends the current understanding by showing how governance provisions and informed trading interact to influence the incorporation of information into stock prices.

Cremers and Nair (2005) find that external (market for corporate control) and internal (shareholder activism) governance mechanisms are strong complements associated with both long-term abnormal returns and accounting measures of profitability. The proxies for external governance used are the index developed by Gompers *et al.* and an alternative takeover index proposed by Cremers and Nair. The proxies for internal governance used are the percentage of share ownership by public pension funds and the percentage of share ownership by the largest blockholder.

Ferreira and Laux (2005) find that idiosyncratic risk is decreasing in firms' degree of insulation from takeovers. Within the interpretation of idiosyncratic risk as an index of information flow, their finding implies a tight link between openness to the market for corporate control and openness of private information flows to the market. However, openness to the market for control is linked to information flow in a way not captured by the openness of a firm's financial reporting. They also show that an institutional trading link is one mechanism for the relationship from governance to idiosyncratic risk. That is, the governance-risk relationship is more pronounced for firms subject to intense trading by institutional investors, and particularly those that have recently been involved in risk arbitrage around mergers.

Litov *et al.* (2006) assert that better investor protection reduces private benefits and may therefore induce riskier but value-enhancing investment policy. Managers/insiders may skip risky but value-enhancing projects to protect their expected private benefits, leading to underinvestment of capital. They also present that non-equity stakeholders, such as banks, labor unions, and the government, may constrain value-enhancing corporate risk-taking to protect their claims.

Hypotheses of this study

The main hypothesis tested is whether Gompers *et al.*'s governance index, as a proxy of corporate governance, affects corporate risk and whether other potential factors such as firm size, leverage, level of board control, and outsiders on the board matter in affecting a firm's riskiness. The hypotheses are given below.

Hypothesis I:

H₀. Gompers *et al.*'s governance index does not affect corporate risk.

H_a. Gompers *et al.*'s governance index affects corporate risk.

Hypothesis II:

Ho. Firm size, leverage, level of board control, and outsiders on the board do not affect corporate risk.

Ha. Firm size, leverage, level of board control, and outsiders on the board affect corporate risk.

Conceptual and estimated model

From the literature review, it can be concluded that corporate performance and corporate risk are impacted by various factors of corporate governance, such as board structure, ownership structure, and anti-takeover provisions. As firm risk may be influenced by firm size as well as leverage, control variables must be included.

Based on these factors, a conceptual model is formulated as follows:

$$\text{IMPLIED VOLATILITY} = f(\text{GOVERNANCE INDEX}, \text{FIRM SIZE}, \\ \text{LEVERAGE}, \text{BOARD STRUCTURE}, \\ \text{OWNERSHIP STRUCTURE}, \\ \text{ANTITAKEOVER PROVISIONS})$$

The estimated model is formulated as follows:

$$\text{impl_vol} = \beta_0 + \beta_1 \text{g_index} + \beta_2 \text{g_m} + \beta_3 \text{g_h} + \beta_4 \text{g_l} + \beta_5 \text{ta_ln} \\ + \beta_6 \text{dr} + \beta_7 \text{pcnt_ctrl} + \beta_8 \text{pcnt_afile} + \varepsilon$$

where the variables are defined as follows (the cross-sectional regression analysis is executed for the following five years, respectively: 1998, 2000, 2002, 2004, and 2006).

Dependent variable:

impl_vol – annualized implied volatility for a specific company (percent), which is defined as the average implied volatility for the closest to outstanding at-the-money options measured 30 days following the earnings announcement. The reason to measure implied volatility this way is only to remove transient changes in volatility surrounding the announcement. The data for implied volatility are obtained from OptionMetrics.

Independent variables:

g_index – governance index constructed by Gompers *et al.* (2003). The index has a possible range from 1 to 24. The higher the index, the more anti-takeover provisions a firm employs. The relationship can be interpreted as the higher the index, the worse the quality of governance, and the less the shareholders' rights are protected. The data for the governance index are obtained from RiskMetrics.

g_m – dummy variable built upon the governance index. When the governance index is equal to or more than 9, the value for *g_m* is equal to one. Otherwise, *g_m* is equal to zero. Nine is the median of the *g_index* used in regressions for the five sample years, so it is

-
- chosen as the cutoff point for building this dummy variable. This variable is built to check whether the firms with better governance than median firms in term of Gomper's gindex are better than below median gindex firms. It is expected that the sign of the coefficient for this variable is the same as that of the coefficient for the *g_index*.
- g_h* – dummy variable built upon the governance index. When the governance index is equal to or more than 14, the value for *g_h* is equal to one. Otherwise, *g_h* is equal to zero. In total, 14 is the critical point chosen by Gompers *et al.* (2003) to divide the dictatorship portfolio firms from the rest and 14 is the upper decile of the *g_index*. The dictatorship portfolio firms are characterized as ones with poor shareholder rights protection.
- g_l* – dummy variable built upon governance index. When the governance index is equal to or less than 5, the value for the *g_l* is equal to one. Otherwise, *g_l* is equal to zero. Five is the critical point chosen by Gompers *et al.* to divide the democracy portfolio firms from the rest and 5 is the lower decile of the *g_index*. The democracy portfolio firms are characterized as ones with good shareholder rights protection.
- ta_ln* – natural logarithm of total assets. The transformation does not change the significance of total assets or the sign of the coefficient for total assets in the model. The data of total assets are provided by COMPUSTAT North America.
- dr* – debt ratio. This is calculated as total long-term debt divided by total assets (book value). The higher the debt ratio, the more leverage the firm has, and hence the firm is viewed as more risky. The data for long-term debt are from COMPUSTAT North America.
- pcnt_ctrl* – percentage control of voting power for board members. This variable shows the extent to which the interest of board members is associated with the performance of the firm. The higher the percentage control of voting power the board members have, the more due diligence will be executed by board members, and the higher the probability that a firm has better governance. The data of this variable are accessed from the directors dataset in RiskMetrics.
- pcnt_afili* – percentage of outsiders on board. This variable is calculated as the number of independent directors sitting on the board divided by the total number of directors on the board. The higher the percentage of outsiders, the stronger the supervision the board executes on the management, and the more likely governance will be sound and robust. The data for the number of the outside directors and the total number of the board member are from the directors dataset in RiskMetrics.

Data description and summary statistics

The sources of data include OptionMetrics, RiskMetrics, and the COMPUSTAT North America database. Some variables are annual, while others are only provided once

every two years. Since data come from different sources, a specific firm may have some missing values for corresponding variables. Due to the potential problem of autocorrelation of the data for the same firms across different years, cross-sectional regression analysis is done separately for each year, which includes 1998, 2000, 2002, 2004, and 2006. Due to the issue of missing values for some variables, different years and models may have different numbers of observations, and there is a prominent difference in observation numbers between descriptive analysis and regression models. Figure 1 shows the implied volatility is positively skewed for each sample year in this study, and therefore medians for implied volatility are better than means for each year to determine the true center of the distribution.

Descriptive statistics are presented in Table I. The means of *g_index*, *g_m*, *ta_ln*, and *pcnt_affili* all have an increasing trend from 1998 to 2006, while the mean of *g_l* is

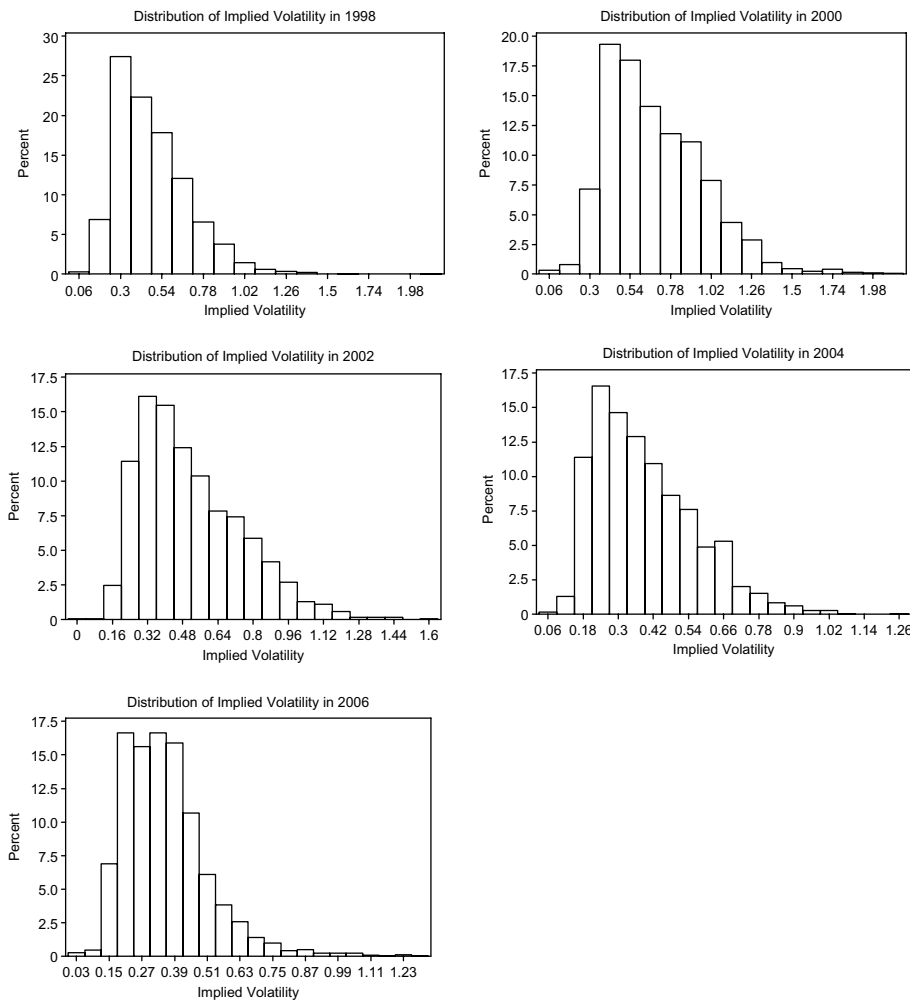


Figure 1.
Distribution of implied volatility for each sample year

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|--|--------------------------------|--------------------------------|--------------------------------|-------------------------------|-------------------------------|
| Implied volatility (impl_vol) | 0.4824 (0.4355) [1,763] | 0.6880 (0.6316) [1,780] | 0.5168 (0.4708) [1,699] | 0.3906 (0.3540) [1,775] | 0.3585 (0.3374) [2,117] |
| Governance index (g_index) | 8.7833 (9) [1,938] | 8.9828 (9) [1,921] | 9.0329 (9) [1,916] | 9.0593 (9) [1,989] | 9.0173 (9) [1,907] |
| Governance index (g_h) | 0.0454 (0) [1,938] | 0.0458 (0) [1,921] | 0.0491 (0) [1,916] | 0.0427 (0) [1,989] | 0.0388 (0) [1,907] |
| Governance index (g_l) | 0.1398 (0) [1,938] | 0.0973 (0) [1,921] | 0.0872 (0) [1,916] | 0.0830 (0) [1,989] | 0.0745 (0) [1,907] |
| Governance index (g_m) | 0.5258 (1) [1,938] | 0.5617 (1) [1,921] | 0.5637 (1) [1,916] | 0.5767 (1) [1,989] | 0.5752 (1) [1,907] |
| Logarithm of total asset (ta_ln) | 4.8128 (4.8057) [11,483] | 4.9381 (5.0700) [11,181] | 4.9199 (5.1599) [10,179] | 5.1621 (5.3911) [9,738] | 5.4540 (5.614) [9,115] |
| Debt ratio (dr) | 0.2764 (0.0996) [11,451] | 0.3901 (0.0858) [11,165] | 0.3877 (0.0906) [10,160] | 0.3502 (0.0800) [9,719] | 0.2146 (0.0761) [9,097] |
| Percentage control of voting power (pcnt_ctrl) | 12.3290 (2.85) [1,794] | 13.7518 (3.5) [1,789] | 9.7728 (2.7) [1,457] | 10.7647 (3.9) [1,136] | 17.8597 (4) [1,082] |
| Percentage of outsiders (pcnt_affili) | 0.5938 (0.625) [1,794] | 0.6080 (0.6364) [1,789] | 0.6593 (0.6667) [1,457] | 0.7026 (0.7143) [1,484] | 0.7198 (0.75) [1,425] |

Notes: The data on implied volatility come from OptionMetrics; governance index, percentage control of voting power, and percentage of outsiders come from RiskMetrics; median values are presented below the mean values in parentheses, and the numbers of observations are presented below medians in brackets; impl_vol is the annualized average implied volatility for the closest to outstanding at-the-money options measured 30 days following the earnings announcement; g_index is the governance index constructed by Gompers *et al.* (2003), ranging 1-24, where a higher index indicates more anti-takeover provisions; g_h is a dummy variable equal to 1 for firms with a governance index greater than or equal to 14, and zero otherwise, indicating poor shareholder rights protection; g_l is a dummy variable equal to 1 for firms with a governance index less than or equal to 5, and zero otherwise, indicating strong shareholder rights protection; g_m is a dummy variable equal to 1 for firms with a governance index greater than or equal to 9 (the median), and zero otherwise; ta_ln is the natural logarithm of total assets; dr is the debt ratio, calculated as total long-term debt divided by total assets (book value); pcnt_ctrl is the percentage control of voting power for board members; pcnt_affili is the percentage of outsiders on the board

Table I.
Descriptive statistics

decreasing during the same period. Although the medians of g_index and related dummy variables remain constant over the sample period, the medians of ta_ln and pcnt_affili are decreasing. There are no other obvious change patterns in means of other variables. Table II presents the means of impl_vol, ta_ln, dr, pcnt_ctrl, and pcnt_affili classified by different levels of g_m, g_h, and g_l. Firms with higher g_index show less implied volatility, higher debt ratio, lower percentage control of voting power, and higher

| | 1998 | 2000 | 2002 | 2004 | 2006 | 1998 | 2000 | 2002 | 2004 | 2006 |
|---|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------|-----------------------------|-------------------------------|-------------------------------|-----------------------------|
| <i>By g_m</i> | | | | | | | | | | |
| Implied volatility (imp_vol) | 0.4427 (0.4130) [530] | 0.6377 (0.6098) [465] | 0.5301 (0.4882) [530] | 0.3782 (0.3564) [546] | 0.3237 (0.3184) [582] | 0.3783 (0.3468) [592] | 0.5396 (0.4878) [597] | 0.4266 (0.3696) [702] | 0.3193 (0.2879) [796] | 0.2924 (0.2725) [836] |
| Logarithm of total asset (ta_ln) | 7.0237 (6.7281) [814] | 7.3505 (7.0932) [696] | 7.1029 (6.7753) [764] | 7.4946 (7.2347) [772] | 7.7858 (7.5360) [717] | 7.6435 (7.4796) [879] | 7.7939 (7.6545) [877] | 7.6565 (7.5029) [1,005] | 7.8284 (7.7146) [1,061] | 7.9947 (7.8721) [976] |
| Debt ratio (dr) | 0.2154 (0.1726) [809] | 0.2051 (0.1508) [693] | 0.1897 (0.1311) [762] | 0.1872 (0.1400) [770] | 0.1879 (0.1286) [714] | 0.2216 (0.2140) [875] | 0.2289 (0.2139) [875] | 0.2152 (0.1961) [1,002] | 0.2028 (0.1738) [1,057] | 0.1999 (0.1644) [973] |
| Percentage control of voting power (pcent_ctrl) | 17.930 (5.2) [825] | 18.885 (6.1) [691] | 14.018 (5.05) [524] | 14.583 (5.52) [430] | 12.886 (5) [413] | 6.8808 (1.5) [931] | 7.1118 (1.6) [874] | 7.0294 (1.9) [857] | 7.9906 (3.2) [640] | 21.468 (3) [583] |
| Percentage of outsiders (pcent_affili) | 0.5407 (0.5555) [825] | 0.5550 (0.5714) [691] | 0.6141 (0.625) [524] | 0.6737 (0.6666) [517] | 0.7054 (0.7142) [517] | 0.6400 (0.6666) [931] | 0.6641 (0.7) [874] | 0.6887 (0.7142) [857] | 0.7218 (0.75) [889] | 0.7362 (0.75) [810] |
| <i>By g_h</i> | | | | | | | | | | |
| Implied volatility (imp_vol) | 0.4113 (0.3764) [1,075] | 0.5864 (0.5274) [1,019] | 0.4764 (0.4194) [1,173] | 0.3456 (0.3181) [1,287] | 0.3068 (0.2915) [1,358] | 0.3502 (0.3451) [47] | 0.4927 (0.4448) [43] | 0.3686 (0.3424) [59] | 0.2878 (0.2738) [55] | 0.2693 (0.2370) [60] |
| Logarithm of total asset (ta_ln) | 7.3186 (7.1060) [1,617] | 7.5793 (7.3678) [1,499] | 7.3841 (7.1623) [1,679] | 7.6656 (7.4814) [1,754] | 7.8880 (7.6827) [1,625] | 7.9176 (7.8507) [76] | 7.9701 (7.8299) [74] | 8.0385 (7.9503) [90] | 8.1818 (8.1624) [79] | 8.3425 (8.4311) [68] |
| Debt ratio (dr) | 0.2183 (0.1921) [1,608] | 0.2173 (0.1925) [1,494] | 0.2037 (0.1675) [1,674] | 0.1968 (0.1621) [1,748] | 0.1957 (0.1541) [1,619] | 0.2263 (0.2158) [76] | 0.2401 (0.2408) [74] | 0.2122 (0.2113) [90] | 0.1846 (0.1616) [79] | 0.1752 (0.1442) [68] |
| Percentage control of voting power (pcent_ctrl) | 12.352 (3) [1,673] | 12.699 (3) [1,488] | 10.037 (2.7) [1,299] | 10.974 (3.9) [1,018] | 18.544 (3) [951] | 6.4277 (0) [83] | 4.7831 (1.4) [77] | 4.0426 (1.95) [82] | 4.0901 (2.3) [52] | 4.4888 (2) [45] |

(continued)

Table II.
Distribution of data by
different levels of
G_index derived dummy
variables

Table II.

| | 1998 | 2000 | 2002 | 2004 | 2006 | 1998 | 2000 | 2002 | 2004 | 2006 | 2004 | 2006 |
|--|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|------|
| Percentage of outsiders (pcnt_afflii) | 0.5910 (0.6153) [1,673] | 0.6126 (0.6363) [1,488] | 0.6567 (0.6666) [1,299] | 0.7014 (0.7142) [1,331] | 0.7228 (0.75) [1,262] | 0.7228 (0.75) [1,262] | 0.6419 (0.6666) [83] | 0.6794 (0.6923) [77] | 0.7200 (0.7272) [82] | 0.7521 (0.7777) [75] | 0.7513 (0.8) [65] | |
| <i>By g_l</i> | | | <i>g_l = 0</i> | | | | | <i>g_l = 1</i> | | | | |
| Implied volatility (impl_vol) | 0.4006 (0.3630) [968] | 0.5767 (0.5216) [967] | 0.4633 (0.4026) [1,135] | 0.3406 (0.3115) [1,242] | 0.3034 (0.2843) [1,327] | 0.3034 (0.2843) [1,327] | 0.4596 (0.4395) [154] | 0.6423 (0.6083) [95] | 0.5626 (0.5300) [97] | 0.3754 (0.3550) [100] | 0.3312 (0.3289) [91] | |
| Logarithm of total asset (ta_ln) | 7.4348 (7.2643) [1,453] | 7.6228 (7.4353) [1,412] | 7.4512 (7.2610) [1,621] | 7.6952 (7.5369) [1,676] | 7.9181 (7.7554) [1,565] | 7.9181 (7.7554) [1,565] | 6.8049 (6.5592) [240] | 7.3781 (7.0365) [161] | 7.0468 (6.7824) [148] | 7.6090 (7.3518) [157] | 7.7609 (7.4408) [128] | |
| Debt ratio (dr) | 0.2188 (0.1989) [1,445] | 0.2198 (0.1976) [1,407] | 0.2060 (0.1753) [1,618] | 0.1985 (0.1677) [1,670] | 0.1978 (0.1574) [1,561] | 0.1978 (0.1574) [1,561] | 0.2180 (0.1777) [239] | 0.2055 (0.1680) [161] | 0.1839 (0.0859) [146] | 0.1723 (0.0812) [157] | 0.1579 (0.0836) [126] | |
| Percentage control of voting power (pcnt_ctrl) | 10.189 (2.3) [1,520] | 11.109 (2.6) [1,409] | 8.9687 (2.4) [1,299] | 10.143 (3.7) [997] | 17.967 (3) [927] | 17.967 (3) [927] | 24.194 (9.95) [236] | 23.155 (7.2) [156] | 20.967 (8.15) [82] | 17.426 (7.1) [73] | 17.130 (8) [69] | |
| Percentage of outsiders (pcnt_afflii) | 0.6067 (0.625) [1,520] | 0.6244 (0.6666) [1,409] | 0.6664 (0.6666) [1,299] | 0.7091 (0.7142) [1,324] | 0.7286 (0.75) [1,247] | 0.7286 (0.75) [1,247] | 0.5072 (0.5) [236] | 0.5394 (0.5454) [156] | 0.5655 (0.5714) [82] | 0.6236 (0.6) [82] | 0.6554 (0.6666) [80] | |

Notes: Results report mean (median) (number of observations); impl_vol is the annualized average implied volatility for the closest to outstanding at-the-money options measured 30 days following the earnings announcement; g_index is the governance index constructed by Gompers *et al.* (2003), ranging 1-24, where a higher index indicates more anti-takeover provisions; g_h is a dummy variable equal to 1 for firms with a governance index greater than or equal to 14, and zero otherwise, indicating poor shareholder rights protection; g_l is a dummy variable equal to 1 for firms with a governance index less than or equal to 5, and zero otherwise, indicating strong shareholder rights protection; g_m is a dummy variable equal to 1 for firms with a governance index greater than or equal to 9 (the median), and zero otherwise; ta_ln is the natural logarithm of total assets; dr is the debt ratio, calculated as total long-term debt divided by total assets (book value); pcnt_ctrl is the percentage control of voting power for board members; pcnt_afflii is the percentage of outsiders on the board

percentage of outsiders on the board. Table III encompasses the distribution of sample data by industry and year. The dataset is not dominated by any industry. However, it is worth mentioning that there exist more than 20 percent of firms from utilities and financial industries, and further analysis will examine the impact of these firms.

Results and discussion

One univariate model with implied volatility is run against each independent variable of interest and one full model for each year. According to the classification of the governance index constructed by Gompers *et al.* (2003), the specific relationship between corporate risk and corporate governance for all the firms is investigated.

Models 1.1, 1.2, 1.3, 1.4, 1.5, and 1.6 are univariate regression models. Model 1.1 examines the relationship of the governance index for each sample year with implied volatility. Model 1.2 addresses the effect of dummy variable of the governance index for each sample year. Models 1.3, 1.4, 1.5, and 1.5 deal with the effects of firm size, leverage, board percentage of voting power, and percentage of outsiders, respectively, on implied volatility.

Models 2.1 and 2.2 are multiple regression models. Model 2.1 is designed to compare the difference of implied volatility between democracy portfolio firms, dictatorship portfolio firms and the rest. Model 2.2 is a full model that includes the *g_index* and all the other relevant factors in this research.

| Industry | 1998 | 2000 | 2002 | 2004 | 2006 |
|--|-----------------|-----------------|-----------------|-----------------|-----------------|
| Agriculture, forestry, and fishery [SIC = 0] | 5 (0.45%) | 3 (0.28%) | 3 (0.24%) | 2 (0.15%) | 4 (0.28%) |
| Mining and construction [SIC = 1] | 51 (4.55%) | 40 (3.77%) | 55 (4.46%) | 66 (4.92%) | 71 (5.01%) |
| Manufacturing [SIC = 2] | 203 (18.09%) | 158 (14.88%) | 190 (15.42%) | 197 (14.68%) | 211 (14.88%) |
| Transportation, communication, electric, gas, and sanitary services [SIC = 3, 4] | 391 (34.85%) | 356 (33.52%) | 450 (36.53%) | 476 (35.47%) | 489 (34.49%) |
| Wholesale and retail [SIC = 5] | 120 (10.70%) | 122 (11.49%) | 131 (10.63%) | 152 (11.33%) | 146 (10.30%) |
| Finance, insurance, and real estate [SIC = 6, 7] | 223 (19.88%) | 243 (22.88%) | 309 (25.08%) | 339 (25.26%) | 342 (24.12%) |
| Services [SIC = 8] | 20 (1.78%) | 24 (2.26%) | 42 (3.41%) | 45 (3.35%) | 52 (3.67%) |
| Public administration [SIC = 9] | 2 (0.18%) | 3 (0.28%) | 3 (0.24%) | 3 (0.22%) | 2 (0.14%) |
| Not listed | 107 (9.54%) | 113 (10.64%) | 49 (3.98%) | 62 (4.62%) | 101 (7.42%) |
| Total | 1,122 (100%) | 1,062 (100%) | 1,232 (100%) | 1,342 (100%) | 1,418 (100%) |

Notes: The data are broken down into eight industry groups based on the one digit SIC code for observations containing both the G index and implied volatility data; percentages of the industry groups per year are presented below the numbers of firms from the corresponding industries in parentheses; SIC codes are below the industry description in brackets

Table III.
Distribution of sample by industry and year

The results of the ordinary least square (OLS) regressions are shown in Table IV. Table IV presents the results for several specifications for the main model for each sample year.

The primary focus lies on the coefficient for *g_index* and the other relevant factors. From model 1.1, it is obvious that corporate governance affects the implied volatility because the coefficients for *g_index* are significant across years. Therefore, the null hypothesis can be rejected with the conclusion that Gompers *et al.*'s governance index is related to corporate risk. The negative sign for the coefficient of the *g_index* means that implied volatility is inversely associated to the value of the *g_index*. Essentially, the *g_index* is an anti-takeover provision index, which captures the acquisition potential for firms. Hence, an argument can be made that the greater barriers to acquisition that a firm faces, the less implied volatility that firm has. The argument may seem contrary to expectations because more anti-takeover provisions are hypothesized to imply weak governance, and weak governance is hypothesized to be associated with higher volatility. However, in fact, more anti-takeover provisions may make the firm less attractive on the open market and drive away potential investors, resulting in less takeover activity and lower implied volatility of the firm. Therefore, implied volatility decreases with the introduction of anti-takeover provisions. Since implied volatility is calculated using short-term outstanding options, the potential risk of a firm in a long run cannot be captured by it.

Model 1.2 examines the impact of the *g_index* as a dummy variable, equal to one if the index level is above the median and zero otherwise. The results of model 1.1 are confirmed in model 1.2. Models 1.3 and 1.4 find that firm size and leverage are significantly related to the riskiness of a firm. In model 1.5, board percentage of voting power is insignificant in explaining the variability of implied volatility. In model 1.6, the coefficient for percentage of outsiders on the board is significant across sample years, and outsiders sitting on the board do affect firm riskiness as expected.

Gompers *et al.* (2003) proposed an investment strategy that purchases shares of democracy portfolio firms and short sells shares of dictatorship portfolio firms. The strategy would have earned an abnormal return of 8.5 percent per year in the 1990s. Model 2.1 examines the relationship of these firms with implied volatility. On average (simple average across sample years), firms have implied volatility of 0.4205 percent during the sample years, while dictatorship portfolio firms have an implied volatility of 0.3542 percent, and democracy portfolio firms have an implied volatility of 0.4747 percent.

Model 2.2 includes all of our control variables. The results of models 1.1 and 1.2 are confirmed, as the coefficient for *g_index* is negative and significant in all periods. However, the significance of the firm's leverage and outsiders on the board become inconsistent across sample years while the *g_index* and firm size remain significant. Further, model 2.2 is tested for the presence of multicollinearity using variance inflation factors (VIF). No serious problem of multicollinearity exists (Appendix 1).

The results of the analysis indicate an inverse relationship between implied volatility and corporate governance using the proxy of *g_index*. Transformations on the dependent variable through the Box-Cox procedure, which ensures the models meet the homoscedastic assumption, are implemented and directional relationships between implied volatility and *g_index* hold the same as those presented in model 2.2. The inverse relationship seems contrary to expectations at first sight. However, the result is consistent with Ferreira and Laux (2005). They find that idiosyncratic risk is decreasing

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|---|------------------------|------------------------|------------------------|------------------------|------------------------|
| <i>Model 1.1</i> | | | | | |
| Intercept | 0.5178*** (33.10) | 0.7561*** (32.46) | 0.6914*** (31.41) | 0.4649*** (32.45) | 0.3705*** (32.10) |
| Governance index (g_index) | -0.0124*** (-7.32) | -0.0192*** (-7.76) | -0.0243*** (-10.41) | -0.0133*** (-8.80) | -0.0071*** (-5.86) |
| Number of observations | 1,122 | 1,062 | 1,232 | 1,342 | 1,418 |
| <i>Model 1.2</i> | | | | | |
| Intercept | 0.4428*** (63.42) | 0.6378*** (64.46) | 0.5301*** (66.38) | 0.3783*** (63.76) | 0.3237*** (67.81) |
| Governance index (g_m) | -0.0644*** (-6.7) | -0.0981*** (-7.43) | -0.1034*** (-8.30) | -0.0589*** (-7.65) | -0.0313*** (-5.03) |
| Number of observations | 1,122 | 1,062 | 1,232 | 1,342 | 1,418 |
| <i>Model 1.3</i> | | | | | |
| Intercept | 0.9928*** (63.34) | 1.2911*** (55.29) | 1.0228*** (55.11) | 0.8547*** (68.99) | 0.7747*** (70.50) |
| Logarithm of total assets (ta_ln) | -0.0729*** (-33.37) | -0.0836*** (-26.85) | -0.0703*** (-28.33) | -0.0621*** (-38.64) | -0.0556*** (-38.84) |
| Number of observations | 1,581 | 1,555 | 1,614 | 1,676 | 1,958 |
| <i>Model 1.4</i> | | | | | |
| Intercept | 0.5107*** (70.58) | 0.7030*** (74.97) | 0.5440*** (69.80) | 0.4048*** (71.73) | 0.3713*** (76.77) |
| Debt ratio (dtr) | -0.1157*** (-4.77) | -0.0975*** (-3.06) | -0.1686*** (-5.74) | -0.0764*** (-3.67) | -0.0590*** (-3.38) |
| Number of observations | 1,573 | 1,549 | 1,608 | 1,672 | 1,947 |
| <i>Model 1.5</i> | | | | | |
| Intercept | 0.4087*** (75.56) | 0.5948*** (79.05) | 0.4320*** (66.25) | 0.3419*** (69.00) | 0.308*** (94.14) |
| Percentage control of voting power (pcnt_ctl) | 0.0004*** (1.80) | 0.0001*** (3.60) | 0.0007*** (1.89) | 0.0001 (0.5) | 0.0000 (0.76) |
| Number of observations | 1,072 | 1,107 | 1,035 | 804 | 845 |
| <i>Model 1.6</i> | | | | | |
| Intercept | 0.4835*** (30.15) | 0.7335*** (34.23) | 0.5290*** (22.88) | 0.3821*** (20.79) | 0.3383*** (22.49) |

(continued)

Table IV.
OLS estimation: analysis of implied volatility

Table IV.

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|--|------------------------|-----------------------|------------------------|------------------------|------------------------|
| Percentage of outsiders (pctn_affili) | -0.1188*** (-4.65) | -0.2090*** (-6.24) | -0.1386*** (-4.08) | -0.0819*** (-3.22) | -0.0582*** (-2.86) |
| Number of observations | 1,072 | 1,107 | 1,035 | 1,078 | 1,145 |
| <i>Model 2.1</i> | | | | | |
| Intercept | 0.4033*** (75.38) | 0.5808*** (81.17) | 0.4686*** (69.90) | 0.3431*** (83.88) | 0.3069*** (97.52) |
| Governance index (g_h) | -0.0530*** (-2.18) | -0.0879*** (-2.59) | -0.0999*** (-3.40) | -0.0553*** (-2.84) | -0.0358** (-2.45) |
| Governance index (g_l) | 0.0564*** (3.99) | 0.0617*** (2.63) | 0.0941*** (4.04) | 0.0323*** (2.20) | 0.0261** (2.08) |
| Number of observations | 1,122 | 1,062 | 1,232 | 1,342 | 1,418 |
| <i>Model 2.2</i> | | | | | |
| Intercept | 0.8646*** (33.08) | 1.1573*** (28.27) | 0.9244*** (26.22) | 0.7214*** (25.69) | 0.5562*** (27.20) |
| Governance index (g_index) | -0.0064*** (-3.81) | -0.0119*** (-4.65) | -0.0130*** (-6.02) | -0.0089*** (-6.00) | -0.0034*** (-3.06) |
| Logarithm of total assets (ta_ln) | -0.0489*** (-17.16) | -0.0502*** (-12.6) | -0.0420*** (-13.14) | -0.0394*** (-16.94) | -0.0297*** (-16.46) |
| Debt ratio (dir) | -0.0618** (-2.49) | 0.0076 (0.21) | -0.0391 (-1.18) | 0.0476** (2.17) | -0.0270 (-1.48) |
| Percentage control of voting power (pctn_ctrl) | -0.001 (-0.70) | -0.0003 (-0.91) | -0.0005 (-1.58) | -0.0003 (-1.50) | 0 (1.00) |
| Percentage of outsider (pctn_affili) | -0.0204 (-0.80) | -0.1074*** (-2.98) | -0.0376 (-1.09) | 0.0042 (0.15) | 0.0254 (1.26) |
| Number of observations | 984 | 922 | 965 | 762 | 773 |

Notes: Significant at: * 10, ** 5, and *** 1 percent levels; *t*-statistics are in parentheses below the estimated coefficients; *impl_voi* is the annualized average implied volatility for the closest to outstanding at-the-money options measured 30 days following the earnings announcement; *g_index* is the governance index constructed by Gompers *et al.* (2003), ranging 1-24, where a higher index indicates more anti-takeover provisions; *g_h* is a dummy variable equal to 1 for firms with a governance index greater than or equal to 14, and zero otherwise, indicating poor shareholder rights protection; *g_l* is a dummy variable equal to 1 for firms with a governance index less than or equal to 5, and zero otherwise, indicating strong shareholder rights protection; *g_m* is a dummy variable equal to 1 for firms with a governance index greater than or equal to 9 (the median), and zero otherwise; *ta_ln* is the natural logarithm of total assets; *dir* is the debt ratio, calculated as total long-term debt divided by total assets (book value); *pctn_ctrl* is the percentage control of voting power for board members; *pctn_affili* is the percentage of outsiders on the board

in a firm's degree of insulation from takeovers, although idiosyncratic risk is just a part of total implied volatility.

One explanation for the inverse relationship is that the higher degree of insulation from takeovers and fewer potential takeover activities may decrease the expected volatility of a firm's stock price, thereby reducing corporate risk. As corporate governance improves with the decrease in anti-takeover provisions, the uncertainty of being acquired increases correspondingly, leading to a higher level of stock volatility and corporate risk.

An alternative explanation for the inverse relationship is that poorer corporate governance due to more anti-takeover provisions or less shareholder rights protection may create an agency conflict where managers are too conservative and avoid taking some beneficial risk, thus the firm operates at a suboptimal risk level. As corporate governance improves, the risk increases up to the optimal level. This explanation coincides with what Litov *et al.* (2006) document. They suggest that better investor protection reduces private benefits and may therefore induce riskier but value-enhancing investment. However, even though the inverse relationship between corporate risk and the *g_index* is significant and robust, different factors in corporate governance are not mutually independent and the further associations among corporate risk and various factors influencing corporate governance must be examined.

As in the case of leverage and percentage of outsiders on the board, each is found to be significantly related to implied volatility in univariate models, but the relationships do not hold in the multivariate model. This evidence suggests that there may exist interactions among various components within corporate governance, and one should not examine each component in isolation. Agca and Mansi (2008) find that firms with large managerial ownership operate at high debt levels unless they have a large number of takeover defenses, which implies that an interaction between anti-takeover defenses and managerial ownership determines the level of debt. Consistent with this, it is likely that the mutual effect between leverage and the *g_index* in the current analysis drives leverage to be insignificant in the full model. Therefore, the relationship between corporate risk and corporate governance, as an integrated concept, should be interpreted very carefully. That being said, we test for multicollinearity in Appendix 1 and find it to be insignificant.

Another potential concern is that the dataset includes firms from all industries. Because firms in the utilities and financial sectors are unique due to government regulation and distinct characteristics of their balance sheets, to test the robustness of including these firms, firms from the utility (SIC code in the range between 4900 and 4999) and financial (SIC code in the range between 6000 and 6999) sectors are removed from the analysis. The results using non-utility and non-finance firms, presented in Appendix 2, are qualitatively the same as the models using the whole dataset. In particular, the *g_index* and its three derived variables, *g_h*, *g_l*, and *g_m*, are all statistically significant and of the same sign in both sets of regression models. In addition, percentiles of firm size (*ta_ln*) for both whole sample model and model only covering non-utility and non-financial firms are provided as an evidence that firms of different sizes are fully used in building the models for different years. Therefore, the result that the Gompers *et al.*'s *gindex* is informative in explaining the variability in implied volatility is robust to the inclusion or exclusion of utilities and financial firms.

In summary, the analysis suggests a consistent and statistically significant inverse relationship between implied volatility and the *g_index*. While counter to initial expectations, these results suggest, at the very least, a firm with good governance may not necessarily have low implied volatility in its stock price.

Conclusion and suggestions for future research

It is safe to conclude that Gompers *et al.*'s (2003) governance index is a significant factor in explaining the implied volatility of firms. Gompers *et al.*'s governance index is robust to various measures including the *g_index* itself, as well as the dummy variables *g_m*, *g_h*, and *g_l*, and with and without the inclusion of control variables. In addition, dictatorship firms are less risky than non-dictatorship firms by 0.0664 percent annually and democracy firms are riskier than non-democracy firms by 0.0541 percent annually during the sample years. More strictly speaking, anti-takeover provisions employed by the firm are associated with a reduction in risk, particularly short-term risk measured by implied volatility. However, anti-takeover provisions can only partly measure the soundness of corporate governance.

Moreover, firm size is a vital component in the riskiness of a firm, and both the univariate model and multivariate model find that firm size is inversely related to firm risk. Larger firms may be better able to diversify themselves and thus decrease certain elements of their risk. Certainly more information about larger firms is available due to greater press coverage and more analysts following them, resulting in decreased uncertainty. Hence, keeping firm size in a model to explain volatility is meaningful. Firm leverage is also a significant factor determining the firm risk, though the sign of the coefficient for this factor is contrary to conventional wisdom that leverage brings more volatility to the entity. One plausible explanation is that high insulation from takeover leads to lower expectation of implied volatility or the result of suboptimal riskiness, and this type of less risky firms have more chance to carry more leverage.

As for board percentage of voting power, it turns out to be insignificant when controlling for the *g_index*, total assets, debt ratio and percentage of outsiders on the board. This suggests that the board percentage of voting power is not truly important in influencing the firm risk when controlling for other measures of corporate governance. The percentage of outsiders sitting on the board is related to corporate risk as expected. The more outsiders on the board, which captures board independence, the better governance a firm has and the less risk a firm is expected to incur.

Future research needs to examine specifically why higher takeover defenses lead to lower implied volatility. This includes exploring whether the lower level of expected volatility is due to lower levels of takeover activity or whether firms with poor governance assume a suboptimal amount of risk. Moreover, the causality between takeover defenses and the riskiness of corporations needs to be explored.

Note

1. Data of implied volatility for firms from OptionMetrics are provided with assistance of Peter J. DaDalt and Bing-Xuan Lin, both of whom are from The University of Rhode Island, College of Business Administration.

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Appendix 1

| Variable | Model 2.1 | | | | |
|-------------|-----------|--------|-------------|--------|--------|
| | 1998 | 2000 | VIF 2002 | 2004 | 2006 |
| gindex | 1.1338 | 1.1384 | 1.1225 | 1.0874 | 1.0305 |
| ta_ln | 1.0875 | 1.0434 | 1.0948 | 1.0665 | 1.0546 |
| dr | 1.0074 | 1.0214 | 1.0586 | 1.047 | 1.0419 |
| pcnt_ctrl | 1.33 | 1.2191 | 1.2237 | 1.2566 | 1.0019 |
| pcnt_affili | 1.1792 | 1.2457 | 1.2501 | 1.2444 | 1.0221 |
| Mean VIF | 1.1476 | 1.1336 | 1.1499 | 1.1404 | 1.0302 |

Table AI.
Test for multicollinearity
using VIF

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|-----------------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| <i>Model 1.1</i> | | | | | |
| Intercept | 0.5328*** (32.11) | 0.7952*** (30.90) | 0.7269*** (30.86) | 0.5008*** (32.07) | 0.3891*** (30.23) |
| Governance index (g_index) | -0.0126*** (-7.00) | -0.0214*** (-7.77) | -0.0252*** (-9.97) | -0.0148*** (-8.92) | -0.0071*** (-5.26) |
| Number of observations | 972 | 883 | 1,022 | 1,101 | 1,159 |
| <i>Model 1.2</i> | | | | | |
| Intercept | 0.4169*** (72.84) | 0.6003*** (76.66) | 0.4977*** (68.95) | 0.3659*** (82.29) | 0.3228*** (90.41) |
| Governance index (g_h) | -0.0588*** (-2.27) | -0.1003*** (-2.51) | -0.0997*** (-2.99) | -0.0608*** (-2.74) | -0.0298* (-1.66) |
| Governance index (g_l) | 0.0558*** (3.72) | 0.0720*** (2.76) | 0.0944*** (3.83) | 0.0355*** (2.22) | 0.0328*** (2.35) |
| Number of observations | 972 | 883 | 1,022 | 1,101 | 1,159 |
| <i>Model 1.3</i> | | | | | |
| Intercept | 0.4548*** (61.52) | 0.6619*** (61.61) | 0.5558*** (56.19) | 0.4018*** (63.25) | 0.3397*** (65.34) |
| Governance index (g_m) | -0.0629*** (-6.13) | -0.1062*** (-7.36) | -0.0998*** (-7.47) | -0.0611*** (-7.33) | -0.0277*** (-4.05) |
| Number of observations | 972 | 883 | 1,022 | 1,101 | 1,159 |
| <i>Model 1.4</i> | | | | | |
| Intercept | 1.0329*** (58.27) | 1.3332*** (49.08) | 1.0580*** (49.18) | 0.8963*** (61.82) | 0.8141*** (62.50) |
| Logarithm of total assets (ta_ln) | -0.0792*** (-30.59) | -0.0888*** (-23.30) | -0.0744*** (-24.40) | -0.0676*** (-33.92) | -0.0605*** (-33.87) |
| Number of observations | 1,386 | 1,321 | 1,367 | 1,401 | 1,626 |
| <i>Model 1.5</i> | | | | | |
| Intercept | 0.5322*** (70.06) | 0.7395*** (74.03) | 0.5778*** (71.39) | 0.4265*** (71.86) | 0.3890*** (74.76) |
| Debt ratio (dtr) | -0.1237*** (-4.95) | -0.0109*** (-3.27) | -0.1717*** (-5.66) | -0.0505*** (-2.26) | -0.0262 (-1.37) |

Table AII.
OLS estimation: analysis
of implied volatility for
stock price of non-utility
and non-financial firms

(continued)

Table AII.

| | 1998 | 2000 | 2002 | 2004 | 2006 |
|--|------------------------|------------------------|------------------------|------------------------|------------------------|
| Number of observations | 1,378 | 1,315 | 1,361 | 1,397 | 1,615 |
| <i>Model 1.6</i> | | | | | |
| Intercept | 0.4253*** (73.45) | 0.6211*** (74.21) | 0.4639*** (65.70) | 0.3612*** (68.82) | 0.3234*** (92.32) |
| Percentage control of voting power (pctn_ctrl) | 0.0002 (0.69) | 0.0007** (2.50) | 0.0004 (0.15) | -0.0001 (-0.25) | 0.0000 (0.53) |
| Number of observations | 924 | 915 | 841 | 678 | 701 |
| <i>Model 1.7</i> | | | | | |
| Intercept | 0.4726*** (28.07) | 0.7374*** (32.00) | 0.5472*** (22.01) | 0.4022*** (20.55) | 0.3523*** (21.88) |
| Percentage of outsiders (pctn_affili) | -0.0778*** (-2.86) | -0.1785*** (-4.91) | -0.1275*** (-3.48) | -0.0818*** (-3.01) | -0.0525*** (-2.40) |
| Number of observations | 924 | 915 | 841 | 873 | 922 |
| <i>Model 2.1</i> | | | | | |
| Intercept | 0.8817*** (29.86) | 1.2224*** (25.91) | 0.9727*** (24.84) | 0.7556*** (24.13) | 0.5721*** (23.45) |
| Governance index (g_index) | -0.0065*** (-3.49) | -0.0143*** (-4.92) | -0.0140*** (-5.94) | -0.0090*** (-5.49) | -0.0034*** (-2.65) |
| Logarithm of total assets (ta_ln) | -0.0540*** (-14.93) | -0.0569*** (-11.18) | -0.0434*** (-10.76) | -0.0416*** (-14.25) | -0.0316*** (-12.91) |
| Debt ratio (dir) | -0.0345 (-1.28) | 0.0193 (0.49) | -0.0313 (-0.87) | 0.0682*** (2.84) | -0.0081*** (0.37) |
| Percentage control of voting power (pctn_ctrl) | -0.0002 (-0.79) | -0.0003 (-1.02) | -0.0011** (-3.19) | -0.0005** (-2.03) | 0.0000 (0.99) |
| Percentage of outsider (pctn_affili) | 0.0075 (0.27) | -0.0919** (-2.33) | -0.0609 (-1.64) | -0.0172 (-0.59) | 0.0232 (1.03) |
| Number of observations | 840 | 748 | 775 | 638 | 636 |

Notes: Significant at: *10, **5, and ***1 percent levels; *t*-statistics are in parentheses below the estimated coefficients

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