

Does Board Independence Reduce the Cost of Debt?

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Using the passage of the Sarbanes-Oxley Act and the associated changes in listing standards as a natural experiment, we find that while board independence decreases the cost of debt when credit conditions are strong or leverage is low, it increases the cost of debt when credit conditions are poor or leverage is high. We also document that independent directors set corporate policies that increase firm risk. These results suggest that independent directors act in the interests of shareholders and are increasingly costly to bondholders with the intensification of the agency conflict between these two stakeholder groups.

Prior literature suggests that independent directors generally perform a better monitoring role than affiliated or inside directors in increasing shareholder welfare (Fields and Keys, 2003; Hermalin and Weisbach, 2003). This is consistent with the reputational concerns of these directors as professional referees (Fama, 1980). Some monitoring functions, such as the reduction of managerial shirking or perquisite consumption and the improvement of financial disclosure and transparency, may also benefit creditors (Goh, Ng, and Yong, 2012; Armstrong, Core, and Guay, 2013). Other potential actions that an independent board may take, however, may harm bondholders when the interests of shareholders and bondholders diverge, leading to agency costs of debt (Jensen and Meckling, 1976; Myers, 1977). Most studies find that board independence is negatively related to the cost of debt (Bhojraj and Sengupta, 2003; Anderson, Mansi, and Reeb, 2004; Ertugrul and Hegde, 2008) suggesting that, on average, the benefits of independence outweigh its costs.

The focus of extant studies examining the overall effect of board independence on the cost of debt does not preclude the possibility of a differential impact of independence under different circumstances. If the difference between the benefits and costs of board independence on bondholders is not the same in all states of the world, such a differential impact is expected. It is plausible that the costs of board independence will increase with the severity of the shareholder-bondholder (S/B) conflict (commonly characterized by the closeness to default or the level of financial leverage) (Bodie and Taggart, 1978; John and John, 1993). The benefits of board independence, such as improved financial disclosure, may also be more important under financial distress as there is generally greater uncertainty about the future profitability of a distressed firm than a financially sound firm (Sengupta, 1998). Because the rates of changes in the costs and benefits of board independence may differ as the S/B conflict intensifies, the net effect of independence on the cost of debt may differ with respect to the degree of the S/B conflict. For example, suppose the costs of board independence are less than the benefits at mild degrees of

This is a substantially revised version of the paper circulated earlier under the title "Corporate Governance, Credit Condition, and the Cost of Debt." We thank an anonymous referee, Raghavendra Rau (Editor), and Yanyan Liu for very helpful comments. We also appreciate comments by Kiyoung Chang, Ivana Vitanova, Gregory Nagel, and the participants of the Midwest Finance Association and the Eastern Finance Association 2014 Annual Meetings.

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the S/B conflict, but increase at a faster rate than the benefits, eventually exceeding those benefits after a certain level of the conflict. Then the impact of independence on the cost of debt should be negative if the S/B conflict is mild, but positive if it is severe. These potentially differential and particularly divergent impacts of board independence on the cost of debt have not received much attention in the existing literature. This study attempts to fill this gap.

Using a sample of S&P 1,500 firms from 2001 to 2005 with senior unsecured bonds outstanding, we examine the differential impact of board independence on the cost of debt, conditional on the expected severity of the S/B conflict. We utilize the passage of the Sarbanes-Oxley Act of 2002 and the associated changes in the listing standards instituted by the major exchanges (abbreviated collectively as SOX subsequently) as a natural experiment. Employing propensity score-weighted difference-in-differences (DID) regressions (Hirano, Imbens, and Ridder, 2003; Imbens and Wooldridge, 2009), we examine the effect of a plausibly exogenous increase in board independence on the change in the cost of debt. This methodology distinguishes our study from the rest of the literature, which relies on cross-sectional identification strategies and, as such, is susceptible to the concerns of endogeneity.

To identify the noncompliant (treatment) firms, we focus on the SOX requirements that the board of listed companies be comprised of a majority of independent directors and that all of the members of a firm's audit committee be independent. In contrast to most prior studies (Bhojraj and Sengupta, 2003; Anderson et al., 2004; Ertugrul and Hegde, 2008), we do not find a significant overall effect of board independence on the cost of debt, suggesting that on average the benefits approximately equal the costs of independence. However, consistent with a differential impact of board independence on the cost of debt, we find that greater independence results in a significantly lower cost of debt when the expected S/B conflict is mild, but a significantly higher cost of debt when the expected conflict is severe.

To provide some evidence that some actions that independent directors take may benefit shareholders, but not necessarily bondholders, we examine the effects of increased board independence on the firm's subsequent risk profile and payout policies; two actions that may benefit one stakeholder group, but hurt the other. Consistent with this view, we find that an exogenous increase in board independence leads to an increase in risk-taking behavior, which presumably benefits shareholders at the expense of bondholders. However, we do not find a significant effect of independence on payout policies (dividends and repurchases).

We contribute to the literature across several dimensions. The divergent effect of board independence on the cost of debt, depending upon contingencies, adds to the literature that argues that "one-size-fits-all" regulations may have unintended consequences (Chhaochharia and Grinstein, 2007; Wintoki, 2007; Linck, Netter, and Yang, 2009; DeFond et al., 2011; Chen, 2014). While both this paper and Chen (2014) analyze the differential effect of board independence on credit risk, Chen (2014) focuses on credit ratings and confirms a non-monotonic impact. In contrast, we examine bond spreads and study the cross-sectional variation of the impact conditional on the expected S/B conflict.

Our finding of an opposite effect of board independence on the cost of debt depending on the credit condition of the firm also provides new insight into the literature. While a few studies have also examined the differential effect of corporate governance on the cost of debt with the deterioration of credit quality (Bhojraj and Sengupta, 2003; Klock, Mansi, and Maxwell, 2005), they focus on the stronger impact of governance for more distressed firms, with the implication that the direction of the impact should be the same regardless of the circumstances. In contrast, our results demonstrate that not only the magnitude, but also the sign of the effect of corporate governance on the cost of debt may change with a firm's credit condition.

The risk-increasing effect of board independence also adds to the related literature. In contrast to our findings, most studies find either a negative (Bargeron, Lehn, and Zutter, 2010; Ni and Purda, 2012) or an insignificant correlation between independence and risk-taking (Cheng, 2008). However, with the exception of Bargeron et al. (2010), most studies rely on cross-sectional variations that are susceptible to the concerns of endogeneity.¹ Although a few studies employ an instrumental variable (IV) approach, there is still concern about the validity of their IVs. For example, Ni and Purda (2012) use chief executive officer (CEO) tenure as an IV for board independence. However, Chen and Zheng (2014) argue and find evidence that CEO tenure matters for risk-taking behavior. It is notable that in analyzing the 2007–2008 financial crisis, Beltratti and Stulz (2012) find that banks with more shareholder-friendly boards (including more independent boards) are riskier. Consistent with our view, Beltratti and Stulz (2012) argue that these firms took excessive risks *ex ante* in the interests of their shareholders, but, *ex post* their stocks performed worse due to the unexpected financial crisis. The positive effect of board independence on managerial risk-taking also provides a different perspective when evaluating the effect of SOX as compared with the existing research. Most studies find that SOX discourages risk-taking (Cohen, Dey, and Lys, 2009; Bargeron et al., 2010). Consistent with these studies, we find that, overall, risk-taking decreased post-SOX. However, firms that were not in compliance with the independence requirement before SOX experienced a smaller decrease. Therefore, our results suggest that while many provisions in SOX, such as increased executive and director personal liabilities and the rules related to internal controls, may discourage managerial risk-taking (Bargeron et al., 2010), the requirement of higher board independence nevertheless promotes risk-taking.

The remainder of the paper is organized as follows. Section I describes the data, variables, and summary statistics. This section also describes the timelines and the provisions of SOX that are relevant for our study. Section II presents the empirical specifications and results. Section III conducts robustness checks based on propensity score matching, while Section IV concludes.

I. Data, SOX Provisions, Variables, and Summary Statistics

A. Data and Sample

The appendix provides detailed descriptions of the variables used in our empirical analysis, as well as their data sources. Consequently, we provide only a brief description of each variable here.

Following the literature, we use bond yield spreads as a measure of the cost of debt. Our bond data are taken from a proprietary database from S&P that contains the prices and issue characteristics of all publicly traded senior unsecured corporate bonds as of the end of March from 2002 to 2006. The year range and the inclusion of only senior unsecured bonds are a result of data limitations, but we note that these bonds are the most prevalent of corporate

¹ In unreported analysis, we find some potential explanations for the difference in results between our study and Bargeron et al. (2010), although both employ SOX as a natural experiment. First, while 2002 is the treatment year in our study, Bargeron et al. (2010) define 2001 as the treatment year, but still set the post-SOX period to start from 2003. This mismatch may be problematic since some noncompliant (compliant) firms at 2001 would become compliant (noncompliant) by 2002 and, as such, should no longer be treated as noncompliant (compliant). In addition, Bargeron et al. (2010) include fewer control variables. Moreover, Bargeron et al. (2010) do not employ the propensity score method to address the issue of the dissimilarity between noncompliant and compliant firms. Also, in Bargeron et al. (2010), standard errors are not adjusted for heteroskedasticity and autocorrelation. Finally, while we use the requirements for both the majority independence of entire boards and the full independence of audit committees to identify noncompliant firms, Bargeron et al. (2010) focus on the majority independence standard.

debt securities. Chava, Kumar, and Warga (2010) find that 82.7% of newly issued corporate bonds are senior unsecured. In our sample, the number of issues per firm is 3.88, which closely matches the statistics in Cremers, Nair, and Wei (2007) based on different types of bonds, further suggesting that our bond coverage is not significantly different from the literature. To match the year convention in Compustat, we convert the time range for the bond data to 2001-2005.² We obtain the Treasury bond data used to calculate yield spreads from the Federal Reserve Bank Report.

Board composition data are from the RiskMetrics (formerly IRRC) Director Database. The RiskMetrics database covers primarily the S&P 1,500 firms. We obtain data from Center for Research in Security Prices (CRSP) to calculate equity volatility and stock returns. Financial data are from Compustat, including data for payout policies and indicators of the S/B conflict.

Our empirical analyses include both firm- and bond-level regressions. Because the firm-level data are available in earlier years, the samples for the risk-taking and payout policy regressions extend back to 1996, the starting year of the RiskMetrics database. This increases the sample size and provides more comparability with prior studies, which typically employ multiple years' data.³ Our sample for the cost of debt regressions is an unbalanced panel from 2001 to 2005, with 6,252 bond-year and 1,610 firm-year observations.⁴

Our samples include firms with dual class stocks, as well as finance and utility companies. In unreported analysis, we exclude these firms and our results are substantially similar.

B. Relevant SOX Provisions and Timelines

The Sarbanes-Oxley Act was signed into law on July 30, 2002. In February 2002, the Securities and Exchange Commission (SEC) requested the exchanges to improve their governance listing standards. In August and October 2002, respectively, the NYSE and NASDAQ submitted proposed changes to the SEC. These proposals were approved with minor changes in November 2003. Given the corporate climate at the time, the ex ante probability of disapproval was minimal. Therefore, it is appropriate to set 2002 as the treatment year in our DID methodology. The compliance statistics reported later are consistent with this assumption.

The Sarbanes-Oxley Act requires audit committees to be fully independent. The three major exchanges (NYSE, NASDAQ, and AMEX) further require their listed firms to have a majority of independent directors. Since we study the effect of board independence on the cost of debt, it seems appropriate to use only the majority independence requirement to identify noncompliant firms.

² Compustat sets a year to t if the fiscal year end-of-month for the firm is between June, year t and May, year $t + 1$. Since our bond data are at the end of March, the year t in the bond data corresponds to year $t - 1$ in Compustat. This may also alleviate the endogeneity concern as most of the financial and governance variables are in place before we calculate spreads.

³ As pointed out by Bertrand, Duflo, and Mullainathan (2004), a concern for the DID specification with multiple years' data is that the standard errors may be severely underestimated. In unreported analysis, we follow their correction method to create an alternative sample with one year's observation prior to SOX and one year after, by averaging a firm's pre-SOX and post-SOX observations into a single observation, respectively. We find that our results are qualitatively similar. We also do the same for the cost of debt samples and find similar results as well.

⁴ Sample sizes may vary depending on the proxies for the S/B conflict. This sample size refers to using the S&P credit rating as a proxy for the credit condition of a firm. Our results are qualitatively similar for a sample created by randomly selecting one issue from each firm in a given year. The results are also similar if the sample consists of bonds that appear in both 2002 and 2005. This ensures that we calculate the post-SOX change of yield spread for the same bond. Our results are also similar for two of the four models with respect to the four S/B conflict proxies if we average the issue-level variables (yield spread, modified duration, convexity, and bond age) into firm-level variables by taking the weighted averages of the issue variables of a firm in a given year, with the weight being the size of the issue as a fraction of the total issue sizes.

However, for the two reasons discussed below, we choose to use both the majority independence requirement and the full independence requirement for audit committees to classify noncompliant firms. First, the fact that a significant number of the firms do not issue public bonds reduces the sample sizes and, as such, the number of noncompliant firms significantly. This issue is exacerbated by the fact that a supermajority of our sample firms were already in compliance with the majority independence requirement before the enactment of SOX. If we focus exclusively on the majority requirement to identify noncompliant firms, we are left with only 20 firms and 65 bonds for the cost of debt regressions. This may raise the concern that our results are driven by a small number of “outliers.” In addition, the increased workload and liabilities of independent directors around the time when SOX was enacted (Linck et al., 2009) suggest that the independent vacancies on audit committees were more likely to be filled by externally recruited new directors, rather than existing ones. Moreover, the SOX requirement of at least one financial expert on audit committees should also increase the demand for new independent directors.⁵ These arguments suggest that a firm without a fully independent audit committee may choose to hire new independent directors making the nonindependence of audit committees a valid criterion when identifying noncompliance. Indeed, using the RiskMetrics database, we find that 83% of the firms without an independent audit committee at 2002 increased their board independence after SOX, despite the fact that these firms already had a majority of independent directors prior to SOX. Specifically, we define a firm as noncompliant if it did not have a majority of independent directors *or* a fully independent audit committee at 2002, and became majority independent or, in the case of audit committee nonindependence, increased its board independence post-SOX. To determine whether a firm increased board independence post-SOX, we compare its independence at 2002 with the maximum value of independence from 2003 to 2005. The above definition of noncompliance ensures that each of the noncompliant firms increased its independence after SOX. Our results are even stronger if we compare board independence at 2002 with that of 2005 to determine whether a firm increased independence post-SOX. We use the maximum value of board independence from 2003 to 2005 in our primary analysis to increase the number of noncompliant firms. Note that this definition of noncompliance means that firms that did not have a majority of independent directors or a fully independent audit committee at 2002 and did not increase their board independence post-SOX were classified as compliant. Our results are similar if we drop these firms from the sample. Our definition of noncompliance results in 71 noncompliant firms with 260 bonds at 2002 for the cost of debt sample with credit rating as the measure of the S/B conflict. Since Z-scores are comprised of a number of financial measures, many of which are unavailable, the number of noncompliant firms (bonds) based on Z-scores as a proxy for the S/B conflict is only 32 (104). Because the samples on risk-taking and payout policy are not confined to public bonds, they have much larger numbers of noncompliant firms. For example, the number of noncompliant firms for the risk-taking sample is 191. In unreported analysis, we find that our major results are robust to the definition of noncompliance based on majority independence only.

The exchanges required firms to adopt the new governance standards during their first annual meeting after January 15, 2004, but no later than October 31, 2004. Firms with classified boards were given until the second annual meeting to comply, but no later than December 31,

⁵ This may raise the concern that our results regarding the effect of board independence on the cost of debt could be attributed to the effect of independent financial experts. This possibility is not inconsistent with our argument. While we focus on the motivation of independent directors to monitor management in the interests of shareholders, effective monitoring may require different areas of expertise including financial expertise. However, sorting out the motivation and the ability is beyond the scope of this paper.

2005. Therefore, it is appropriate to end our sample at 2005 for the implementation of the DID methodology. Consequently, we have two years on or before 2002, the treatment year, and three years thereafter.

C. Variables

1. Board Independence

RiskMetrics defines a director to be independent if she is not a current employee of the firm or affiliated with the firm. This definition closely follows that of the exchanges, but is somewhat stricter (Chhaochharia and Grinstein, 2009). NYSE and NASDAQ classify a director as independent even if she was a former employee of the firm, as long as her employment terminated at least three years prior to the directorship. In addition, the two exchanges classify an affiliated director as independent if her business transactions with the firm are inconsequential. In contrast, regardless of the termination date or transaction size, a director is regarded as not being independent by RiskMetrics if she had ever worked for the firm or if she has any business transactions with the firm. Since RiskMetrics does not provide the size of the transactions, we follow Chhaochharia and Grinstein (2009) and partially adjust the independence status by reclassifying an affiliated director as independent if her former employment with the firm ended at least three years before she was seated, the director does not currently provide professional services to the firm, and she is not an interlocking director. In unreported analysis, we further redefine all affiliated directors as independent regardless of the size of their business transactions. This methodology is likely to reclassify too many affiliated directors as independent directors. Consequently, the number of noncompliant firms at 2002 shrinks dramatically to only four (with 24 bonds) for the cost of debt sample. Thus, the results should be interpreted with caution. Nonetheless, our major results based on this reclassification scheme are similar to the reported results. As pointed out by Chhaochharia and Grinstein (2009), the stricter definition of independence by RiskMetrics should make it harder to detect a significant relation between board independence and the dependent variables as some noncompliant firms, according to RiskMetrics, may be actually compliant.

2. Bond Spread

We calculate the yield spread of a bond as the difference between the bond's yield-to-maturity (YTM) and the YTM of the Treasury bond matched by the closest maturity. As a robustness check, we also calculate spreads by the difference between the YTM of a bond and the linearly interpolated YTM of the Treasury bond. The results are similar.

3. Indicators of the Expected Agency Conflict between Shareholders and Bondholders

Since a firm with a greater default risk or more debt is expected to have a greater S/B conflict, we use credit condition and leverage as indicators of the degree of this conflict (Bodie and Taggart, 1978; John and John, 1993). Our first proxy of credit condition is the S&P long-term issuer credit rating. It is notable that this rating is a measure of the creditworthiness of the firm as a whole rather than any of its bonds. We also use Altman's Z-score (Altman, 1968) and interest coverage ratio (Asquith, Gertner, and Scharfstein, 1994) as two alternative measures of credit condition. A lower Z-score or interest coverage ratio indicates that the firm is closer to financial default.

4. Managerial Risk-Taking

We follow the previous literature and use equity volatility as a measure of managerial risk-taking (Brick, Palmon, and Wald, 2012). Since the distribution of volatility is highly skewed, we take the

log of this variable. In unreported analysis, we also examine the effects of board independence on corporate policies that may indicate managerial risk-taking including research and development (R&D) expenses, financial leverage, and cash balance. Consistent with the volatility results, we find that an exogenous increase of independence results in a decrease in cash balance and, under some model specifications, an increase in leverage, with both policies presumably indicating a higher level of risk-taking.

5. Payout Policy

We calculate the dividend payouts and stock repurchases in our primary analysis following Grinstein and Michaely (2005), where repurchases include both common and preferred stocks. The results are similar if we exclude preferred stocks (Grullon and Michaely, 2002) or use treasury common stock in the calculation of repurchases (Fama and French, 2001). Since it may take some time for new independent directors to influence corporate decision making, we calculate the risk-taking and payout variables in the following year.

6. Control Variables

We follow prior studies and control for a number of variables in our regressions. The cost of debt regressions include both issue- and firm-level control variables. The issue-level variables include modified duration and convexity to proxy for the systematic risk of bond returns, and bond age to measure liquidity. Older bonds are generally less liquid and, as such, may have higher spreads, *ceteris paribus* (Klock et al., 2005). In unreported analysis, we also control for four indicators of bond covenants including investment restrictions, financing restrictions, dividend restrictions, and event risk restrictions (Chava et al., 2010). The firm-level controls include financial variables and rating dummies. The financial controls include leverage, firm size, return on assets (ROA), market-to-book ratio, and the sales growth rate (Bhojraj and Sengupta, 2003; Anderson et al., 2004). We also control for firm age to account for the possibility that more established firms may have lower credit risk. We control for rating dummies based on the seven categories of S&P ratings in Ashbaugh-Skaife, Collins, and LaFond (2006). We also control for the current year's equity volatility, dividend payouts, and stock repurchases in the cost of debt regressions to examine whether these variables are indeed associated with a higher cost of debt. However, we do not expect that these variables fully account for the adverse effect of board independence on bondholders as the S/B conflict also resides in other aspects of corporate actions, some of which may be unobservable. We do not control for governance variables in our primary analysis to preserve the sample sizes. In unreported robustness checks, we control for a number of governance variables following the literature including compensation vega and delta (Shaw, 2012), board size (Anderson et al., 2004), institutional and block holdings (Bhojraj and Sengupta, 2003; Cremers et al., 2007), the G-index (Klock et al., 2005), the L-index (Bradley and Chen, 2011), and the classified board dummy (Chen, 2012). The results are similar except for those with respect to the interest coverage ratio. In the risk-taking regressions, we control for CEO compensation vega and delta, CEO tenure and age, firm size, ROA, market-to-book ratio, sales growth rate, firm age, R&D expense, capital expenditure, leverage, cash balance, and the number of business segments (Coles, Daniel, and Naveen, 2006; Cheng, 2008). We also control for the lagged equity volatility to alleviate the omitted variable bias (Brick et al., 2012), but note that our results are qualitatively similar if we omit this variable. The control variables in the payout regressions include CEO tenure, firm size, ROA, market-to-book ratio, sales growth rate, firm age, leverage, cash balance, CEO shareholdings, CEO unexercisable and exercisable options, and

stock returns (Hu and Kumar, 2004; Skinner, 2008; Sharma, 2011). To account for outliers, we either take the log of or winsorize a variable at the 1st and 99th percentiles.

D. Summary Statistics

Table I reports the summary statistics of the major variables, the compliance trend, and comparisons of the key variables of interest between the noncompliant and compliant firms. Panel A lists the summary statistics. Except for the variables that are unique to the cost of debt regressions reported at the bond level, the summary statistics for the other variables are reported at the firm level for those firms with nonmissing common variables in the volatility and payout regressions. For the cost of debt regressions, we report both the statistics for the full sample and, pursuant to our purpose in this paper, the statistics conditional upon the expected severity of the S/B conflict. To save space, we only report the subsample statistics of yield spread, board independence, and the four indicators of the S/B conflict stratified by the median rating in the sample (BBB+). The summary statistics indicate that the mean (median) spread for the full sample is 2.46% (1.53%). The bond spreads in our sample are slightly larger than those in the literature (Bhojraj and Sengupta, 2003; Anderson et al., 2004; Klock et al., 2005), presumably reflecting our more recent sample period. Our sample also reports a mean (median) board independence of 0.68 (0.71). The high proportion of independent directors in our sample is consistent with the statistics reported in related studies over a comparable time period (Chhaochharia and Grinstein, 2009; Armstrong et al., 2013) and the upward trend in board independence over time (Linck et al., 2009).

As expected, the subsample statistics indicate that lower rated firms have higher spreads and leverage and lower Z-scores and interest coverage ratios. Higher rated firms have slightly higher board independence than lower rated firms (0.75 vs. 0.73). An unreported *t*-test indicates that the difference is statistically significant.

Panel B presents the compliance trend from 2000-2005. Since these statistics are at the firm level, they are based on the firms with nonmissing common variables in the volatility and payout regressions. We report the annual statistics of board independence, as well as the fractions of firms without a majority of independent boards or fully independent audit committees. Because the definition of noncompliance requires a comparison between board independence before and after SOX, it is not appropriate to list the annual fraction of the noncompliant firms. For example, if the year is after 2002 (post-SOX), in order to calculate the fraction of firms that are noncompliant based on our definition, we must compare the board independence at that year with the post-SOX maximum value of independence, which is not meaningful. The statistics in Panel B suggest a general upward trend for board independence even before the enactment of SOX. We find a similar pattern for an even earlier time period. The positive trend toward independence presumably reflects the effects of shareholder activism (Gillan and Starks, 2007) and the 1999 NYSE rule for independent audit committees. However, despite the uptrend of independence over time, Panel B reports a significant increase of independence right after SOX took effect between 2002 and 2003 relative to the earlier years. Therefore, it is appropriate to use 2002 as the treatment year in our DID methodology.

It is notable that a portion of the firms were still not compliant by 2005. This puzzle is shared by other studies using the RiskMetrics data (Chhaochharia and Grinstein, 2009; Kim and Lu, 2012). Our manual search of a random sample of these firms suggests that a vast majority of them actually declared they were compliant. Therefore, this puzzle seems to be driven by the stricter definition of independence based on RiskMetrics than the exchanges.

Table I. Summary Statistics and Compliance Trend

This table reports the summary statistics of the variables used in the empirical analysis, the compliance trend, and the comparison between the changes of some key variables of interest of the noncompliant and compliant firms from 2002 to 2005. Panel A presents the summary statistics for the full samples, as well as the subsamples stratified by the median rating in the cost of debt sample (BBB+). The full samples include both the bond-level cost of debt sample from 2001 to 2005, and the firm-level risk-taking and payout samples from 1996 to 2005. Panel B reports the time trend of noncompliance. Panel C compares the changes of some of the key variables of interest from 2002 to 2005 between the noncompliant and compliant firms. Next X is the value of X in the following year. %*Percent ind* < 0.5 is the fraction of firms in a given year with less than majority independent boards. %*Ind audit* = 0 is the fraction of firms in a given year without fully independent audit committees. %*Percent ind* < 0.5 or *Ind audit* = 0 is the fraction of firms in a given year with less than majority independent boards or fully independent audit committees. Δ is the change in a variable between 2002 and 2005. *Ind audit* = 0 and *Percent ind* \geq 0.5 at 2002 indicates those firms that did not have fully independent audit committees, but had majority independent boards at 2002, and increased their board independence after 2002. *Number ind* (Number inside, Number linked) is the number of independent (executive, affiliated) directors on a board. The numbers within the parentheses in Panel C represent the numbers of firms/bonds that the statistics are based on. See the Appendix for the definitions of the other variables. The statistics for *Bond age*, *CEO tenure*, *CEO age*, *Firm age*, and *Segment* are reported in their raw format without taking logs. *Spread*, *Leverage*, *Next dividend*, *Dividend*, *Next repurchase*, *Repurchase*, *ROA*, *Mb*, *R&D*, *Capexp*, *CEO shares*, *Unexercisable options*, *Exercisable options*, and *Stock return* have been winsorized at the 1st and 99th percentiles.

Panel A. Summary Statistics

Full Sample

Variable	Observations	P25	Mean	Median	P75	Std
<i>Spread</i> (%)	6,252	1.02	2.46	1.53	2.59	3.64
<i>Percent ind</i>	8,283	0.57	0.68	0.71	0.82	0.18
<i>Ind audit</i>	7,038	1	0.76	1	1	0.43
<i>Rating</i>	6,252	13	15.1	15	17	2.76
<i>Z-score</i>	3,406	1.97	4.59	3.53	5.63	4.83
<i>Interest coverage</i>	6,203	3.81	9.6	6.47	11.79	11.01
<i>Leverage</i> (spread sample)	6,252	0.12	0.23	0.2	0.31	0.15
<i>Volat</i>	8,328	-4.04	-3.74	-3.76	-3.44	0.44
<i>Next volat</i>	8,329	-4.06	-3.77	-3.79	-3.48	0.44
<i>Dividend</i>	8,329	0	0.01	0.01	0.02	0.02
<i>Next dividend</i>	7,965	0	0.01	0.01	0.02	0.02
<i>Repurchase</i>	7,735	0	0.03	0	0.03	0.05
<i>Next repurchase</i>	7,428	0	0.03	0	0.04	0.05
<i>Duration</i> (log years)	6,252	0.97	1.39	1.57	2	0.93
<i>Convexity</i> (log years)	6,252	2.15	3.09	3.36	4.23	1.74
<i>Bond age</i> (years)	6,252	1.84	4.9	3.94	7.27	3.87
<i>Size</i> (log \$millions)	8,329	6.57	7.68	7.53	8.67	1.56
<i>ROA</i>	8,329	0.09	0.14	0.14	0.19	0.08
<i>Mb</i>	8,329	1.21	2.01	1.56	2.29	1.28
<i>Salesgrow</i>	8,329	0	0.09	0.08	0.17	0.23
<i>Firm age</i> (years)	8,329	11.6	27.06	23.43	35.03	19.46
<i>Vega</i> (log \$10 ³)	6,980	3.2	3.58	4.23	5.24	3.15
<i>Delta</i> (log \$10 ³)	6,796	4.65	5.66	5.67	6.7	1.71
<i>CEO tenure</i> (years)	8,329	2.63	7.84	5.34	10.59	7.54
<i>CEO age</i> (years)	7,936	51	55.71	56	60	7.23

(Continued)

Table I. Summary Statistics and Compliance Trend (Continued)

<i>Panel A. Summary Statistics</i>						
Full Sample						
Variable	Observations	P25	Mean	Median	P75	Std
<i>R&D</i>	8,329	0	0.03	0	0.03	0.05
<i>Capexp</i>	8,329	0	0.04	0.02	0.05	0.05
<i>Leverage (volatility and dividend sample)</i>	8,329	0.04	0.16	0.13	0.25	0.14
<i>Cash balance</i>	8,327	-4.04	-2.99	-2.91	-1.77	1.52
<i>Segment</i>	8,213	3	5.63	5	7	3.27
<i>CEO shares</i>	8,098	0	0.02	0	0.01	0.05
<i>Unexercisable options</i>	8,327	0	0	0	0.01	0.01
<i>Exercisable options</i>	8,327	0	0.01	0	0.01	0.01
<i>Stock return</i>	8,321	-0.12	0.16	0.1	0.35	0.44
Low Rating Sample						
<i>Spread (%)</i>	3,459	1.32	3.07	2	3.47	4.08
<i>Percent ind</i>	3,459	0.67	0.73	0.78	0.86	0.18
<i>Rating</i>	3,459	12	13.08	14	14	1.83
<i>Z-score</i>	2,134	1.48	3.12	2.41	4.03	2.71
<i>Interest coverage</i>	3,439	3.36	6.46	5.04	7.61	5.93
<i>Leverage</i>	3,459	0.17	0.27	0.25	0.33	0.13
High Rating Sample						
<i>Spread (%)</i>	2,793	0.85	1.7	1.16	1.71	2.82
<i>Percent ind</i>	2,793	0.65	0.75	0.79	0.89	0.15
<i>Rating</i>	2,793	17	17.59	17	18	1.3
<i>Z-score</i>	1,272	3.77	7.07	5.55	8.56	6.35
<i>Interest coverage</i>	2,764	5.2	13.5	10.22	15.95	14.18
<i>Leverage</i>	2,793	0.09	0.19	0.14	0.23	0.16
<i>Panel B. Compliance Trend</i>						
	2000	2001	2002	2003	2004	2005
<i>Percent ind</i>	0.66	0.67	0.68	0.71	0.73	0.75
<i>%Percent ind < 0.5</i>	15.81	14.57	13.32	7.79	4.56	3.84
<i>%Ind audit = 0</i>	30.16	25.53	24.81	18.02	10.63	8.60
<i>%Percent ind < 0.5 or Ind audit = 0</i>	35.65	31.76	30.23	20.65	12.58	10.70

(Continued)

Table I. Summary Statistics and Compliance Trend (Continued)

<i>Panel C. Comparison Between Changes of Noncompliant and Compliant Firms</i>				
Sample	Variable	Compliant Firms	Noncompliant Firms	Difference
Full (volatility and dividend sample)	Δ Percent ind	0.02*** (617)	0.19*** (224)	0.17***
	Δ Number ind	0.27*** (617)	1.53*** (224)	1.26***
	Δ Percent ind for Ind audit = 0 and Percent ind \geq 0.5 at 2002	0.02*** (617)	0.12*** (127)	0.10***
	Δ Number ind for Ind audit = 0 and Percent ind \geq 0.5 at 2002	0.27*** (617)	1.19*** (127)	0.92***
	Δ Number inside	-0.25*** (617)	-0.61*** (224)	-0.36***
	Δ Number linked	0.02 (617)	-0.85*** (224)	-0.87***
	Δ Board size	0.06 (617)	0.14 (224)	0.08
	Δ Next volat	-0.23*** (617)	-0.22*** (224)	0.01
	Δ Next dividend	0.003*** (516)	0.002*** (187)	-0.001
	Δ Next repurchase	0.03*** (475)	0.02*** (160)	-0.01
Full (spread sample)	Δ Percent ind (issue-level)	0.02*** (514)	0.13*** (134)	0.11***
	Δ Percent ind (firm-level)	0.01* (182)	0.16*** (50)	0.15***
	Δ Spread	-0.28* (514)	0.28 (134)	0.56
Low Rating (spread sample)	Δ Percent ind (issue-level)	0.01** (262)	0.14*** (92)	0.13***
	Δ Percent ind (firm-level)	0.01 (106)	0.18*** (32)	0.17***
	Δ Spread	-1.13*** (262)	0.34 (92)	1.47***
High Rating (spread sample)	Δ Percent ind (issue-level)	0.02*** (252)	0.10*** (42)	0.08***
	Δ Percent ind (firm-level)	0.02 (76)	0.11*** (18)	0.09***
	Δ Spread	0.62** (252)	0.15 (42)	-0.47

***Significant at the 0.01 level.

**Significant at the 0.05 level.

*Significant at the 0.10 level.

Panel C compares the changes in some key variables of interest from 2002 to 2005 for the noncompliant and compliant firms. We also compare the changes conditional on credit ratings. The results based on other measures of the S/B conflict are qualitatively similar. We report the statistics for independence at both the issue and firm levels. We also report the number of firms/bonds that the statistics are based on. Note that since the calculation of the statistics essentially requires the bonds to be available at both 2002 and 2005, the number of noncompliant firms/bonds reported in the panel is smaller than the number of noncompliant firms/bonds mentioned earlier (71/260).

As expected, the independence of the noncompliant firms increased significantly more than that of the compliant firms regardless of the sample. On average, the noncompliant firms added 1.26 more independent directors in the post-SOX period. At the same time, the noncompliant firms removed more inside and linked (affiliated) directors, leaving board sizes unchanged. Therefore, the statistics suggest that noncompliant firms replaced some of their nonindependent directors with the independent directors. To ensure that the noncompliant firms identified through the audit

committee independence requirement increased their board independence post-SOX relative to the compliant firms, we also compare the change in board independence of firms without fully independent audit committees, but with majority independent boards, with that of the compliant firms. The statistics are consistent with our expectations. The noncompliant firms identified through the audit committee independence requirement added 0.92 more independent directors than the compliant firms. However, the statistics in Panel C do not detect a significant difference in the changes of volatility and payout policy variables between the noncompliant and compliant firms.

The results reported in Panel C also indicate that the changes in bond spreads are similar between the noncompliant and compliant firms, despite a significantly greater increase in board independence by the former. However, the subsample statistics suggest that while the changes in spreads of the noncompliant firms are lower than those of the compliant firms for the high-rated sample, the reverse is true for the low-rated sample, though the difference between the spread changes is statistically significant only for the latter.⁶ Therefore, these results not only provide preliminary evidence consistent with a differential impact, but also some weak evidence of a divergent effect of board independence on the cost of debt conditional on the S/B conflict.

II. Methodology and Empirical Results

In this section, we first discuss our empirical specifications. Next, we examine the determinants of the propensity score; that is, the probability of being noncompliant at 2002, to be used in weighting the observations in the DID regressions. We then present our primary analysis, which is the examination of the differential impact of board independence on the cost of debt conditional on the expected S/B conflict. Finally, to illustrate some potential costs of independence for bondholders, we examine the effects of board independence on managerial risk-taking and payout policies.

A. Empirical Specification

Our DID models for the cost of debt regressions are as follows:

$$\begin{aligned} \text{Bond Spread}_{i,j,t} = & \beta_0 + \beta_1 \times \text{Noncompliant}_i \times \text{Post} - \text{SOX} + \beta_2 \times \text{Post} - \text{SOX} \\ & + \overline{\text{Control Variables}_{i,j,t}} \beta_3 + \alpha_i + \varepsilon_{i,j,t}. \end{aligned} \quad (1)$$

In the above equation, $\text{Bond Spread}_{i,j,t}$ is the yield spread of bond j of firm i at year t . Noncompliant_i is a dummy variable that is equal to one if firm i is not compliant at 2002, and zero otherwise. Post-SOX is a dummy variable that is equal to one if the observation is on or after 2003, and zero otherwise. The control variables are as described in Section I.C.6. α_i is the fixed firm effect. Our major results are similar if we control for firm, as well as CEO fixed

⁶ Interestingly, the statistics show that it is the bond spreads of the compliant rather than the noncompliant firms that experienced a significant change. This evidence suggests that in addition to board independence, other factors are at work during our sample period to drive the changes in yield spreads. Some potential candidates for these factors may include decreased corporate opacity and earnings management, and increased market liquidity as a result of SOX. Sorting out these factors is beyond the scope of this paper. We note that the increasingly beneficial effects of these factors on bond spreads with the intensification of the S/B conflict as suggested by the statistics in Panel C are consistent with our argument that some benefits to bondholders may also increase with the S/B conflict.

effects. The CEO fixed effect considers the possibility that innate attributes of a CEO may affect corporate actions and the cost of debt. Our primary coefficient of interest is β_1 , which represents the difference between the post-SOX changes of the dependent variables of the noncompliant and compliant firms. Standard errors are adjusted for heteroskedasticity and, in light of the issue-level regressions, clustered at both the bond level (recognizing the autocorrelation) and firm-year level (recognizing the cross-sectional correlations of different bonds of the same firm in a given year).

Our focus in this study is to analyze the potentially differential effects of board independence on the cost of debt conditional on the severity of the S/B conflict. Two methods could serve this purpose. First, we could conduct subsample analyses according to Specification (1), but contingent on different levels of the S/B conflict. However, as noted earlier, the number of noncompliant firms/bonds in our sample is generally small, which may raise the concern that our results are driven by the undue influence of outliers. Since the small number issue is more acute for subsample analyses, we focus on the second method to study differential effects (while still using the subsample analyses as a robustness check), which utilizes the full sample and interacts the treatment indicator, $Noncompliant_i \times Post-SOX$, with the proxy for the S/B conflict. A significant interaction term is consistent with a differential effect. This method is not subject to another concern for subsample analyses that the division of the sample into subsamples is essentially arbitrary. However, subsample analyses have the advantage of not forcing the equality of the coefficients for the control variables across the subsamples. In light of this issue, we also interact each of the control variables, except for the firm fixed effects, with the S/B conflict proxies. The above discussion suggests the following specification to study differential impacts of board independence, where we have abbreviated the S/B conflict proxy as “SBCP” to save space:

$$\begin{aligned}
 Bond\ Spread_{i,j,t} = & \beta_0 + \beta_1 \times Noncompliant_i \times Post - SOX \times SBCP_{i,t} + \beta_2 \times Noncompliant_i \\
 & \times Post - SOX + \beta_3 \times Noncompliant_i \times SBCP_{i,t} + \beta_4 \times Post - SOX \\
 & \times SBCP_{i,t} + \beta_5 \times Post - SOX + \beta_6 \times SBCP_{i,t} + \overline{Control\ Variables}_{i,j,t}' \\
 & \times SBCP_{i,t} + \overline{\beta_7} + \overline{Control\ Variables}_{i,j,t}' \times \overline{\beta_8} + \alpha_i + \varepsilon_{i,j,t}.
 \end{aligned} \tag{2}$$

For ease of interpretation, we either median-adjust (credit rating) or mean-adjust (Z-score, interest coverage ratio, and leverage) *SBCP* in the above equation.

Our DID models for the regressions on equity volatility and payout policies are similarly specified, except that the regressions are at the firm level (as such, standard errors are clustered at the firm level):

$$\begin{aligned}
 Volatility\ (Payout)_{i,t+1} = & \beta_0 + \beta_1 \times Noncompliant_i \times Post - SOX + \beta_2 \times Post - SOX \\
 & + \overline{Control\ Variables}_{i,t}' \beta_3 + \alpha_i + \varepsilon_{i,t}.
 \end{aligned} \tag{3}$$

In Equation (3), $Volatility\ (Payout)_{i,t+1}$ is the equity volatility (payout) of firm i at year $t + 1$.

B. Propensity Score Analysis

An important assumption of the DID method is that the treatment and control firms are similar to each other, so that the underlying time effect would have followed parallel paths for both in the absence of the treatment. However, given that board independence is endogenously determined (Hermalin and Weisbach, 2003), the assumption of the similarity between the non-compliant and compliant firms is unlikely to be satisfied. A common solution to this problem is to match treatment firms with control firms based on the propensity score (Rosenbaum and Rubin, 1983). Imbens and Wooldridge (2009) further recommend the combination of regressions with propensity score matching or weighting. Hirano et al. (2003) show that weighting based on the following algorithm leads to an efficient estimate of the average treatment effect on the treated⁷:

$$w = \begin{cases} 1 & \text{for the noncompliant firms} \\ p/(1 - p) & \text{for the compliant firms,} \end{cases} \quad (4)$$

where p is an estimate of the propensity score.⁸ The above weighting scheme is intuitive as it gives greater weight to compliant firms with higher propensity scores, which are presumably more similar to the noncompliant firms. We use the propensity score-weighted DID regressions in our primary analysis, and propensity score matching in the robustness checks.

We rely on previous studies regarding the determinants of board composition and audit committee independence for the covariates of the propensity score (Klein, 2002; Boone et al., 2007; Linck, Netter, and Yang, 2008; Lehn, Patro, and Zhao, 2009). The covariates in our primary regression include firm size, number of business segments, free cash flow, market-to-book ratio, sales growth rate, R&D expense, CEO shareholdings, a dummy variable indicating whether the CEO sits on the nomination (compensation) committee, the shareholdings of independent directors, and ROA. With the exception of ROA, the covariates are based on the three hypotheses concerning board composition in Boone et al. (2007): 1) scope of operation, 2) monitoring, and 3) negotiation. Since we use these variables to predict noncompliance at 2002, we lag them by one year in the regressions. In Panel A of Table II, we compare these variables for the noncompliant and compliant firms. The statistics indicate several significant differences, primarily for the governance variables. Specifically, when compared with the compliant firms, the CEOs of the noncompliant firms hold more equity shares and are more likely to sit on these two committees. In addition, independent directors of the noncompliant firms also have more shareholdings.

In Panel B, we run logit regressions on the noncompliant dummy at 2002. In addition to the control variables described, we also include the Fama-French 48-industry dummies. Consistent with the statistics in Panel A, Model 1 suggests that firms with more CEO shareholdings, firms whose CEOs sit on nomination or compensation committees, as well as firms with independent directors holding more shares are more likely to be noncompliant. The first three results are

⁷ This is the case in our study as the post-SOX change of the compliant firms essentially serves as an estimate of the change in the noncompliant firms in the absence of the treatment.

⁸ The exact implementation of the method in Hirano et al. (2003) requires a nonparametric estimate of the propensity score, which could be obtained through logit estimation with flexible functions of the covariates. However, the literature regarding the determinants of board composition focuses on the linear function of the covariates. Since we rely on the existing studies to identify the covariates of the propensity score, we also focus on the linear form. In this regard, our method is an approximation of the method proposed in Hirano et al. (2003). We note that many other studies also have this feature (Malmendier and Tate, 2009; Stuart and Yim, 2010; Yim, 2013).

Table II. Propensity Score Analysis

This table reports the results on the determinants of the probability of being a noncompliant firm at 2002 (propensity score). Panel A compares the characteristics of the noncompliant and compliant firms that may determine noncompliance. Panel B presents the logit regression results predicting noncompliant status. The sample covers 1,500 S&P firms at 2002. Lagged X refers to the lagged value of X. Lagged size² is the square of the lagged firm size. See the Appendix for the definitions of the other variables. All models in Panel B also include Fama-French 48-industry dummies and a constant term. Standard errors are adjusted for heteroskedasticity. *t*-statistics are in parentheses.

<i>Panel A. Comparison between Noncompliant and Compliant Firms at 2002</i>			
Variable	Compliant Firms	Noncompliant Firms	Difference
<i>Lagged size</i>	7.52	7.64	0.12
<i>Lagged segment</i>	1.61	1.48	-0.13***
<i>Lagged cash flow</i>	0.61	0.52	-0.09
<i>Lagged mb</i>	2.05	2.05	0.00
<i>Lagged salesgrow</i>	0.02	0.04	0.02
<i>Lagged R&D</i>	0.03	0.02	-0.01**
<i>Lagged CEO shares</i>	0.02	0.04	0.02***
<i>Lagged CEO nom</i>	0.43	0.58	0.15***
<i>Lagged CEO comp</i>	0.02	0.11	0.09***
<i>Lagged ind director shares</i>	0.016	0.024	0.008**
<i>Lagged ROA</i>	0.13	0.14	0.01

<i>Panel B. Regression Analysis on the Propensity for Noncompliant Status</i>				
Dependent Variable	(1) Noncompliant	(2) Noncompliant	(3) Noncompliant	(4) Noncompliant
<i>Lagged size</i>	0.194*** (2.879)	1.024** (2.260)	0.211** (2.468)	0.181*** (3.057)
<i>Lagged size</i> ²		-0.052* (-1.839)		
<i>Lagged segment</i>	-0.209 (-1.407)	-0.197 (-1.322)	-0.343* (-1.889)	
<i>Lagged cash flow</i>	-0.159* (-1.805)	-0.161* (-1.843)	-0.233* (-1.871)	
<i>Lagged mb</i>	-0.166* (-1.711)	-0.165* (-1.694)	-0.220* (-1.737)	-0.157** (-2.101)
<i>Lagged salesgrow</i>	0.119 (0.459)	0.091 (0.349)	0.121 (0.414)	
<i>Lagged R&D</i>	-2.778 (-0.913)	-2.471 (-0.813)	-5.174 (-1.316)	
<i>Lagged CEO shares</i>	2.853** (1.969)	2.939** (2.029)	1.951 (1.123)	3.042** (2.136)
<i>Lagged CEO nom</i>	0.518*** (2.747)	0.497*** (2.645)	0.392* (1.798)	0.484*** (2.744)
<i>Lagged CEO comp</i>	1.349*** (3.329)	1.357*** (3.376)	1.847*** (3.632)	1.524*** (3.845)

(Continued)

Table II. Propensity Score Analysis (Continued)

<i>Panel B. Regression Analysis on the Propensity for Noncompliant Status</i>				
Dependent Variable	(1) Noncompliant	(2) Noncompliant	(3) Noncompliant	(4) Noncompliant
<i>Lagged ind director shares</i>	5.126*** (2.814)	5.169*** (2.799)	5.681*** (2.674)	4.458** (2.530)
<i>Lagged ROA</i>	1.171 (0.879)	1.014 (0.764)	2.973 (1.574)	
<i>Firm age</i>			-0.145 (-0.743)	
<i>Lagged leverage</i>			0.046 (0.049)	
<i>Lagged Herfindahl sales</i>			-1.375 (-0.245)	
<i>Lagged G-index</i>			-0.029 (-0.777)	
<i>Lagged PPE</i>			-0.395 (-0.551)	
<i>Lagged volat</i>			-0.267 (-0.791)	
<i>CEO tenure</i>			0.062 (0.585)	
<i>Lagged loss</i>			0.264 (0.496)	
Observations	1,010	1,010	850	1,096
Pseudo R ²	0.11	0.12	0.13	0.10

***Significant at the 0.01 level.

**Significant at the 0.05 level.

*Significant at the 0.10 level.

consistent with the negotiation hypothesis that a powerful CEO tends to select nonindependent directors. The last result is consistent with the substitution effect of board independence and the shareholdings of independent directors in monitoring management. Interestingly, some variables that are not significantly different based on the *t*-tests in Panel A (firm size, free cash flow, and market-to-book ratio) are significant in the regressions. The reverse is true for the number of business segments and R&D expense, perhaps reflecting industry effects. The signs on firm size and market-to-book ratio are inconsistent with prior studies, presumably due to both the difference in samples and our inclusion of audit committee independence in defining noncompliance. Indeed, if we run logit regressions on the noncompliance dummy based solely on the majority independence requirement, these two variables are no longer significant. Conditioning the regressions on firm sizes, Linck et al. (2008) find that a monitoring cost factor extracted from three variables, including the market-to-book ratio, is not significantly related to board independence for the largest firms in their sample (Table 5 in their study), which are comparable to the sample firms in our study. However, we note that another proxy for firms' growth opportunities, the sales growth rate, is not significant. Lehn et al. (2009) provide evidence of a nonlinear effect of firm size on board composition. Therefore, in Model 2, we include the squared term of firm size as an additional variable. The results are consistent with a nonmonotonic impact of firm size on noncompliance.

In Model 3, we include a more comprehensive set of control variables, which reduces the sample to 850 observations. Note that none of these additional variables are significant. Since Models 1 and 3 include a number of insignificant variables, we entertain a fourth model with only the significant determinants of the propensity score. The results are reported in Model 4. We use Model 1 to estimate the propensity score in our primary analysis.⁹ In unreported analysis, we find that our results are similar using the other three models.

An important requirement for the implementation of the propensity score method is the satisfaction of the balancing property, that the treatment and control firms are indeed similar in terms of the propensity score and its covariates. In unreported analysis, we find that among the four models in Panel B, only Model 1 satisfies the balancing property, which is another reason we employ this model in our primary analysis.

C. Board Independence and the Cost of Debt

Using the estimated propensity score p and the weighting scheme in Equation (3), we examine the overall effect of board independence on the cost of debt with Specification (1). The results are reported in Model 1 of Table III. The coefficient on *Noncompliant* \times *Post-SOX* is positive, but not significant, consistent with the similarity between the post-SOX changes of bond spreads of the noncompliant and compliant firms demonstrated in Table I. In light of the benefits and costs of independent directors on bondholders and given that we control for equity volatility and payout variables in the model, this result suggests that the costs of independent directors on bondholders other than their potential effects on managerial risk-taking and payout policy, largely equal their benefits. The insignificant effect of board independence on the cost of debt that we find is in contrast with most related studies, which find a beneficial effect of independence on bondholders (Bhojraj and Sengupta, 2003; Anderson et al., 2004; Ertugrul and Hegde, 2008).

As expected, equity volatility is associated with a higher cost of debt, consistent with the proposition that managerial risk-taking is detrimental to bondholders' wealth. However, the two payout variables are not significant, which may suggest that the detrimental effect of wealth transfers through corporate payouts and their beneficial effect to "signal" future profitability are both present for bondholders (Maxwell and Stephens, 2003; Jun, Jung, and Walkling, 2009). Other significant control variables generally have their expected signs except for bond age and firm age. Though predicted to be positive (negative), bond (firm) age is negatively (positively) related to spread.

In Models 2 to 5 of Table III, we follow Specification (2) to examine the differential impact of board independence on the cost of debt conditional, respectively, on the four indicators of the expected S/B conflict as discussed in Section I.C.3. Because a higher rating (*Z-score*, interest coverage ratio) suggests a less intensive S/B conflict, but higher leverage indicates just the opposite, a differential effect implies that *Noncompliant* \times *Post-SOX* \times *Rating (Z-score, Interest Coverage)* and *Noncompliant* \times *Post-SOX* \times *Leverage* should be significant, but with opposite signs. Indeed, the results in Table III indicate that *Noncompliant* \times *Post-SOX* \times *Rating (Z-score, Interest Coverage)* is negative and significant, whereas *Noncompliant* \times *Post-SOX* \times *Leverage* is positive and significant. These results imply that with the intensification of the S/B conflict, board independence is increasingly costly to bondholders. Since we median- or mean-adjusted *SBCP*, and since the coefficients on *Noncompliant* \times *Post-SOX* are not significant, these results further suggest that exogenously increasing board independence has a divergent effect on the

⁹ Our results are similar for a sample with propensity score on the "common support" (between the minimum score for the treated and the maximum score for the control firms). The results are also similar for a "trimmed" sample with propensity scores between 0.1 and 0.9, the efficiency bound suggested by Crump et al. (2009).

Table III. The Differential Effect of Board Independence on Bond Spreads Conditional on Expected Agency Conflict between Shareholders and Bondholders (Interaction Results)

This table reports the results using the propensity score-weighted DID regressions to examine the differential effects of board independence on the cost of debt conditional on four shareholder-bondholder conflict proxies (SBCP): 1) credit rating, 2) Z-score, 3) interest coverage ratio, and 4) leverage. The four SBCPs have been either median-adjusted (credit rating) or mean-adjusted (Z-score, interest coverage ratio, and leverage). The samples cover senior unsecured bonds of 1,500 S&P firms from 2001 to 2005. The dependent variable is the yield spread of an outstanding bond in a given year. The weight is one for noncompliant firms and $p/(1-p)$ for compliant firms, where p is the estimated propensity score based on Model 1 of Panel B in Table II. *Post-SOX* is a dummy variable that is equal to one if the year is on or after 2003, and zero otherwise. See the Appendix for the definitions of the other variables. All models also include rating dummies and their interactions with the respective SBCP, firm fixed effects, and a constant term. Standard errors are adjusted for heteroskedasticity, and clustered at both the bond (same bond across different years) and firm-year (different bonds of the same firm in a given year) levels. *t*-statistics are in parentheses.

SBCP	(1)	(2) Rating	(3) Z-score	(4) Interest Coverage	(5) Leverage
<i>Noncompliant</i> × <i>Post-SOX</i> × SBCP		-0.170***	-0.210***	-0.051**	6.996***
<i>Noncompliant</i> × <i>Post-SOX</i>	0.131	(-2.819) 0.147	(-3.744) 0.006	(-2.242) 0.108	(3.676) 0.165
	(0.678)	(1.000)	(0.032)	(0.577)	(0.977)
<i>Noncompliant</i> × SBCP		-0.211	0.240***	0.047	-4.822**
		(-1.030)	(3.064)	(1.642)	(-2.095)
<i>Post-SOX</i> × SBCP		0.213***	0.002	0.029*	-3.045**
		(3.864)	(0.067)	(1.921)	(-2.236)
<i>Post-SOX</i>	-0.280	-0.666***	-0.190	-0.324*	-0.461***
	(-1.610)	(-4.039)	(-1.179)	(-1.904)	(-2.824)
SBCP		0.375	-0.779*	-0.720***	
		(0.383)	(-1.919)	(-5.337)	
<i>Volat</i> × SBCP		-0.165***	-0.087**	-0.032*	2.814
		(-2.810)	(-2.024)	(-1.927)	(1.611)
<i>Volat</i>	0.687***	0.322	0.810***	0.598***	0.469**
	(3.097)	(1.556)	(4.013)	(2.891)	(2.291)
<i>Dividend</i> × SBCP		-10.039***	-1.609	-0.292	156.554**
		(-3.562)	(-1.012)	(-0.805)	(2.004)
<i>Dividend</i>	-2.086	-7.726	5.659	-1.365	5.417
	(-0.206)	(-0.832)	(0.642)	(-0.135)	(0.543)
<i>Repurchase</i> × SBCP		-0.382	-0.365*	-0.001	32.801**
		(-0.854)	(-1.718)	(-0.009)	(2.269)
<i>Repurchase</i>	-0.161	-1.160	-1.312	-0.535	2.205
	(-0.145)	(-1.052)	(-0.962)	(-0.425)	(1.341)
<i>Duration</i> × SBCP		0.257	-0.256	0.051	-8.412*
		(0.715)	(-1.441)	(0.873)	(-1.764)
<i>Duration</i>	-16.968***	-16.950***	-16.242***	-17.056***	-16.368***
	(-18.169)	(-17.379)	(-14.340)	(-17.985)	(-18.588)
<i>Convexity</i> × SBCP		-0.065	0.138	-0.019	3.624
		(-0.384)	(1.520)	(-0.645)	(1.596)

(Continued)

Table III. The Differential Effect of Board Independence on Bond Spreads Conditional on Expected Agency Conflict between Shareholders and Bondholders (Interaction Results) (Continued)

SBCP	(1)	(2) Rating	(3) Z-score	(4) Interest Coverage	(5) Leverage
<i>Convexity</i>	8.209*** (17.945)	8.173*** (17.232)	7.932*** (13.869)	8.256*** (17.757)	7.907*** (18.142)
<i>Bond age × SBCP</i>		0.011 (0.436)	-0.016 (-1.577)	0.002 (0.499)	-0.223 (-0.396)
<i>Bond age</i>	-0.090* (-1.748)	-0.107** (-2.013)	-0.022 (-0.539)	-0.090* (-1.842)	-0.078* (-1.910)
<i>Leverage × SBCP</i>		-0.543 (-0.994)	-0.211 (-0.267)	-0.150 (-1.118)	-1.407 (-0.218)
<i>Leverage</i>	-1.836 (-1.036)	-3.170** (-2.215)	2.897 (0.819)	-3.096* (-1.655)	19.644** (2.034)
<i>Size × SBCP</i>		0.075 (0.853)	0.095*** (3.157)	0.022*** (2.971)	-2.992*** (-3.017)
<i>Size</i>	-2.313*** (-5.733)	-1.763*** (-5.860)	-1.148*** (-3.722)	-2.178*** (-5.554)	-1.799*** (-5.474)
<i>ROA × SBCP</i>		2.406*** (3.129)	0.637** (2.015)	0.060 (0.714)	-13.837 (-0.666)
<i>ROA</i>	1.044 (0.519)	2.745 (1.582)	0.887 (0.449)	3.647 (1.584)	0.457 (0.181)
<i>Mb × SBCP</i>		-0.051 (-1.043)	-0.017 (-0.825)	-0.010 (-1.515)	1.026 (0.406)
<i>Mb</i>	0.711*** (3.955)	0.722*** (3.437)	0.507** (2.411)	0.758*** (3.250)	0.598 (1.227)
<i>Salesgrow × SBCP</i>		-0.053 (-0.552)	-0.065* (-1.669)	-0.024 (-1.471)	8.373*** (4.016)
<i>Salesgrow</i>	0.396* (1.792)	0.452* (1.765)	-0.457** (-2.184)	0.544** (2.550)	0.308 (1.469)
<i>Firm age × SBCP</i>		-0.567*** (-2.683)	0.004 (0.069)	0.000 (0.005)	6.222*** (3.017)
<i>Firm age</i>	1.972** (2.450)	1.390** (1.990)	1.475* (1.895)	2.084** (2.554)	1.719** (2.177)
Observations	6,252	6,252	3,406	6,203	6,252
Adjusted R ²	0.47	0.51	0.53	0.48	0.50

***Significant at the 0.01 level.

**Significant at the 0.05 level.

*Significant at the 0.10 level.

cost of debt depending on whether the credit ratings (Z-scores, interest coverage ratios, leverage) are above or below their median (mean) value. For example, as the median credit rating in our sample is 15 (BBB+), the negative coefficient on *Noncompliant × Post-SOX × Rating* suggests that while board independence is beneficial to bondholders if the rating is above BBB+, it is detrimental to bondholders if the rating is below BBB+. This evidence implies that while the costs of board independence are smaller than its benefits when the S/B conflict is small, the costs increase at a faster rate and eventually exceed the benefits when the conflict intensifies. This result also implies a potentially stronger effect of board independence on the cost of debt given

a certain degree of the S/B conflict as compared with the overall effect. We find that this is the case in our subsample analyses as well.

The results in Table III also suggest a differential effect of several control variables on the cost of debt. In particular, in three of the four models, we find equity volatility is increasingly positive with the amplification of the S/B conflict. As we show subsequently, independent boards increase firm risk. Therefore, these results are consistent with the argument that some corporate actions that independent directors take are costly to bondholders and these costs are increasing with the severity of the S/B conflict. In two of the four models, we also confirm a similar effect for cash dividends and stock repurchases.

In Table IV, we employ subsample analyses to examine the robustness of our results. As previously discussed, a disadvantage of these analyses is that the division of the full sample into subsamples is arbitrary. The finer the division, the more homogeneous the firms within each subsample in terms of their S/B conflict, making it easier to identify the differential effects of board independence on the cost of debt conditional on the S/B conflict. However, the small number of noncompliant firms/bonds in our study does not permit a very fine division. Therefore, we divide the full sample into two subsamples based on the issue-level median value of credit ratings (*Z*-scores, interest coverage ratios, leverage). Our results are similar if we divide the full sample based on the firm-level median values. Note that these division methods imply that the same firm may be in different subsamples at different points in time if the degree of the S/B conflict has changed. In unreported analysis, we find that our results are qualitatively similar if we delete these firms from the samples.

The results in Table IV demonstrate an opposite effect of board independence on the cost of debt depending on the level of the S/B conflict and, with the exception of the results with respect to the interest coverage ratio, all of the results are significant.¹⁰ Unreported Chow tests also show that the coefficients are statistically different across the subsamples. Consistent with the interaction results in Table III, the subsample results in Table IV indicate that while exogenously increasing board independence results in an increase in bond spreads for firms with severe S/B conflict, it leads to a decrease in spreads when the conflict is mild.¹¹

Turning to the economic significance of the results, we note that the average board size of the low-rated sample is 10.45. As seen in Table I, the mean spread and the difference between the increase in board independence of low-rated noncompliant and compliant firms are 3.07(%) and 0.13, respectively. Therefore, the coefficient on *Noncompliant* × *Post-SOX*, 0.803, suggests that adding one more independent director to the average firm of the low-rated sample (to replace a nonindependent director) results in a substantial 19.3% ($=0.803/0.13 \times (1/10.45) / 3.07$) increase in its cost of debt. A similar calculation suggests that adding one more independent director to the average high-rated firm results in a significant 17.3% decrease in the cost of debt.¹² Compared with related studies, the impact of board independence in our study is much

¹⁰ If we run regressions on subsamples with interest coverage ratios greater than their 75th percentile and less than the 25th percentile, respectively, which presumably include firms with more homogenous S/B conflicts, we find that the negative effect is significant at the 5% level and the positive effect is close to significance with a *p*-value at 0.104. The magnitudes of the coefficients are also larger than those in Models 5 and 6, consistent with our expectations.

¹¹ In unreported analysis, we interact each control variable in Table IV with a pre-SOX dummy and the post-SOX dummy, respectively. This considers the possibility that SOX may have changed the impact of a variable on the cost of debt. We find the results are qualitatively similar. We also do the same for the risk-taking and payout regressions and document similar results.

¹² This large effect of board independence in reducing the cost of debt coupled with the beneficial effect of independence on shareholders raises an interesting question: why firms with mild S/B conflict did not increase their independence sufficiently before SOX, since they still benefited from an externally-imposed higher independence standard? One

Table IV. The Differential Effect of Board Independence on Bond Spreads Conditional on Expected Agency Conflict between Shareholders and Bondholders (Subsample Results)

This table reports the results using the propensity score-weighted DID regressions to examine the differential effects of board independence on the cost of debt conditional on subsamples characterized by different expected agency conflict between shareholders and bondholders, as indicated by the credit rating, Z-score, interest coverage ratio, and leverage, respectively. The samples cover senior unsecured bonds of 1,500 S&P firms from 2001 to 2005. Low (High) Rating (Z-score, Interest Coverage, Leverage) is the subsample with ratings (Z-scores, interest coverage ratios, leverage) at or below (above) the median value in the sample. The dependent variable is the yield spread of an outstanding bond in a given year. The weight is one for noncompliant firms and $p/(1-p)$ for compliant firms, where p is the estimated propensity score based on Model I of Panel B in Table II. *Post-SOX* is a dummy variable that is equal to one if the year is on or after 2003, and zero otherwise. See the Appendix for the definitions of the other variables. All models also include rating dummies, firm fixed effects, and a constant term. Standard errors are adjusted for heteroskedasticity, and clustered at both the bond and firm-year levels. *t*-statistics are in parentheses.

Sample	(1) Low Rating	(2) High Rating	(3) Low Z- score	(4) High Z- score	(5) Low Interest Coverage	(6) High Interest Coverage	(7) Low Leverage	(8) High Leverage
<i>Noncompliant</i> × <i>Post-SOX</i>	0.803*** (2.668)	-0.281* (-1.830)	0.639* (1.754)	-0.309* (-1.647)	0.509 (1.561)	-0.226 (-1.507)	-0.404** (-2.262)	0.732** (2.140)
<i>Post-SOX</i>	-0.887*** (-3.237)	-0.097 (-0.699)	-0.588** (-1.996)	-0.309* (-1.760)	-0.596** (-2.059)	-0.273* (-1.874)	-0.007 (-0.046)	-0.814*** (-2.580)
<i>Volat</i>	1.107*** (3.444)	0.211 (1.107)	0.831** (2.281)	0.081 (0.324)	0.884** (2.399)	0.100 (0.637)	0.458** (2.373)	1.022*** (2.750)
<i>Dividend</i>	15.174 (1.157)	-16.812** (-2.162)	16.013 (1.242)	-16.007 (-1.200)	35.812** (2.050)	-26.496** (-2.314)	-17.932* (-1.693)	25.238 (1.448)
<i>Repurchase</i>	-2.313 (-1.295)	-0.318 (-0.318)	-8.029* (-1.920)	-2.012 (-1.558)	-2.526 (-0.629)	-0.572 (-0.743)	-0.626 (-0.667)	-3.673 (-1.157)
<i>Duration</i>	-17.492*** (-11.508)	-16.487*** (-16.164)	-15.943*** (-8.617)	-16.867*** (-14.764)	-17.995*** (-12.219)	-15.753*** (-15.750)	-15.505*** (-15.366)	-18.072*** (-12.551)

(Continued)

Table IV. The Differential Effect of Board Independence on Bond Spreads Conditional on Expected Agency Conflict between Shareholders and Bondholders (Subsample Results) (Continued)

Sample	(1) Low Rating	(2) High Rating	(3) Low Z- score	(4) High Z- score	(5) Low Interest Coverage	(6) High Interest Coverage	(7) Low Leverage	(8) High Leverage
<i>Convexity</i>	8.350*** (11.334)	8.118*** (15.596)	7.775*** (8.318)	8.253*** (14.299)	8.697*** (12.205)	7.623*** (15.202)	7.492*** (14.811)	8.757*** (12.527)
<i>Bond age</i>	-0.089 (-1.040)	-0.092** (-2.474)	-0.024 (-0.359)	-0.025 (-0.614)	-0.154* (-1.835)	-0.044 (-1.116)	-0.018 (-0.489)	-0.160* (-1.953)
<i>Leverage</i>	-5.532** (-2.528)	4.128*** (2.611)	2.667 (0.976)	3.286* (1.774)	-5.568** (-2.245)	1.637 (1.051)	-1.922 (-0.868)	-3.096 (-1.227)
<i>Size</i>	-3.273*** (-6.225)	-0.000 (-0.002)	-2.233*** (-3.971)	-0.197 (-0.752)	-3.690*** (-6.325)	-0.275 (-1.348)	-0.814** (-2.353)	-3.479*** (-5.494)
<i>ROA</i>	1.027 (0.383)	1.822 (1.111)	-3.837 (-0.837)	2.118 (1.282)	-2.820 (-0.580)	0.565 (0.430)	-1.149 (-0.725)	0.432 (0.098)
<i>Mb</i>	1.764*** (2.930)	0.204** (1.985)	0.892 (1.035)	0.141 (1.207)	0.568 (0.640)	0.139 (1.599)	0.325*** (2.661)	0.852 (0.728)
<i>Salesgrow</i>	0.386 (1.357)	0.071 (0.272)	0.289 (1.118)	-0.725*** (-2.469)	1.141*** (3.420)	-0.419* (-1.659)	-0.640* (-1.896)	0.883*** (2.844)
<i>Firm age</i>	3.182** (2.452)	-0.432 (-0.673)	4.167*** (2.620)	-1.141 (-1.219)	3.599* (1.769)	-0.932* (-1.862)	-0.586 (-0.812)	6.003*** (2.657)
Observations	3,459	2,793	1,705	1,701	3,114	3,089	3,127	3,125
Adjusted R ²	0.45	0.56	0.44	0.66	0.43	0.58	0.56	0.43

***Significant at the 0.01 level.

**Significant at the 0.05 level.

*Significant at the 0.10 level.

larger. Different samples and time periods, as well as different empirical methodologies, may provide some explanations for the difference in results. However, we believe that the most important reason for the difference is whether the regressions are conditioned on the expected S/B conflict. Subsamples presumably include firms with much more homogenous S/B conflicts as compared with full samples in other studies. As a result, the effects of board independence on the cost of debt that is contingent on subsamples may also be substantially larger. Consistent with this explanation, we note that the overall effect of independence based on the full sample is insignificant in our study.

Similar to the interaction results in Table III, Table IV also suggests a differential impact of some of the control variables. Notably, while dividend payout benefits bondholders under mild S/B conflict, it hurts bondholders if the conflict becomes severe. In contrast, the effect of stock repurchases is consistently negative, suggesting that repurchases may not harm bondholders. As noted, these results provide some evidence that is consistent with the two opposite, but nonmutually exclusive roles of corporate payouts as suggested in the literature: 1) wealth transfer and 2) signaling (Maxwell and Stephens, 2003; Jun et al., 2009). These results also suggest the different effects of dividends and repurchases on bondholders.

D. Board Independence and Managerial Risk-Taking and Payout Policy

In the cost of debt regressions, we control for equity volatility and payout variables to examine whether the two examples of corporate actions, managerial risk-taking and corporate payout, are indeed detrimental to bondholders and whether their adverse effects increase with the S/B conflict. To provide some direct evidence of the role independent directors may play in these actions, we examine the effects of board independence on equity volatility, cash dividends, and stock repurchases. Using Specification (3), the results are reported in Table V.

Model 1 confirms that when compared with compliant firms, the equity volatility of noncompliant firms increased significantly post-SOX. To gauge the economic significance of this result, we note that in Panel C of Table I, the noncompliant firms increased their board independence by 0.17 more than the compliant firms. In our sample, the average board size is 9.51 and the average log of equity volatility is -3.77 . Thus, adding one more independent director results in a 0.64% increase in volatility for the average firm in the sample. When compared with some financial variables, the effect of board independence on firm risk is small, but not negligible.

Model 1 also suggests that firms on average decreased risk-taking after SOX, as indicated by the negative *Post-SOX* dummy. This evidence is consistent with the extant studies (Cohen et al., 2009; Barger et al., 2010), which argue that SOX discourages firms from taking risks. However, given the positive effect of board independence on risk-taking, we provide a refined version of this argument, that although many provisions of SOX may discourage risk-taking, a higher independence requirement nevertheless encourages risk-taking.

Model 1 also indicates that several risk-taking policy variables, including R&D expense, leverage, and cash balance, are significantly associated with equity volatility and the signs on these variables are consistent with expectations.

The other two models in Table V examine the effect of board independence on payout policy. We do not find a significant effect of independence on either cash dividends or stock repurchases.

plausible explanation is the role management plays. As we argue and most empirical evidence suggests, independent directors generally perform a more effective monitoring role, which may reduce managerial opportunism. Therefore, in the absence of external regulations, management may attempt to prevent the board from reaching its optimal composition. As a support to this argument, we note that our propensity score analysis in Table II suggests that a more powerful CEO is associated with lower board independence.

Table V. The Effect of Board Independence on Firm Risk and Payout Policy

This table reports the results using the propensity score-weighted DID regressions to examine the effects of board independence on firm risk and payout policy. The sample covers 1,500 S&P firms from 1996 to 2005. The weight is one for noncompliant firms and $p/(1-p)$ for compliant firms, where p is the estimated probability of being a noncompliant firm at 2002 (propensity score) based on Model 1 of Panel B in Table II. *Post-SOX* is a dummy variable that is equal to one if the year is on or after 2003, and zero otherwise. Next X stands for the value of X in the following year. See the Appendix for the definitions of the other variables. All models also include firm fixed effects and a constant term. Standard errors are adjusted for heteroskedasticity and clustered at the firm level. t -statistics are in parentheses.

Dependent Variable	(1) Next Volat	(2) Next Dividend	(3) Next Repurchase
<i>Noncompliant</i> × <i>Post-SOX</i>	0.039** (2.117)	-0.000 (-0.226)	0.002 (0.587)
<i>Post-SOX</i>	-0.244*** (-14.639)	0.001** (2.087)	0.003 (1.451)
<i>Vega</i>	-0.002 (-0.773)		
<i>Delta</i>	0.008 (1.591)		
<i>CEO tenure</i>	0.001 (0.135)	0.000 (1.611)	0.001 (0.646)
<i>CEO age</i>	0.048 (0.714)		
<i>Size</i>	-0.009 (-0.549)	-0.000 (-0.223)	0.006** (2.296)
<i>ROA</i>	-0.308*** (-2.708)	0.013** (2.568)	0.102*** (4.274)
<i>Mb</i>	0.068*** (7.873)	0.000 (0.178)	-0.001 (-0.403)
<i>Salesgrow</i>	0.112*** (4.806)	-0.002*** (-2.895)	-0.012*** (-3.019)
<i>Firm age</i>	-0.170*** (-5.203)	0.002 (1.031)	0.006 (0.975)
<i>R&D</i>	0.683** (2.138)		
<i>Capexp</i>	0.016 (0.119)		
<i>Leverage</i>	0.149* (1.782)	-0.018*** (-4.520)	-0.062*** (-4.294)
Cash balance	-0.018*** (-3.065)	0.000 (1.014)	0.004*** (3.683)
<i>Segment</i>	0.019 (1.266)		
<i>Volat</i>	0.346*** (16.368)		

(Continued)

**Table V. The Effect of Board Independence on Firm Risk and Payout Policy
(Continued)**

Dependent Variable	(1) Next Volat	(2) Next Dividend	(3) Next Repurchase
<i>CEO shares</i>		−0.017** (−2.131)	−0.033 (−0.975)
<i>Unexercisable options</i>		−0.114* (−1.748)	−0.278 (−1.261)
<i>Exercisable options</i>		−0.037 (−0.927)	−0.472*** (−2.604)
<i>Stock return</i>		−0.000 (−1.365)	−0.001 (−0.593)
Observations	6,455	7,733	7,223
Adjusted R^2	0.74	0.81	0.46

*** Significant at the 0.01 level.

** Significant at the 0.05 level.

* Significant at the 0.10 level.

These results are consistent with some studies (White, 1996; Farinha, 2003), but inconsistent with others (Hu and Kumar, 2004; Sharma, 2011). We note that among the related studies, ours is the only one that employs a natural experiment to mitigate the endogeneity problem.

In summary, our empirical analysis suggests that board independence is increasingly costly to bondholders with the intensification of the S/B conflict. Our evidence is consistent with the notion that while the benefits of independent directors outweigh their costs when the S/B conflict is mild, the costs appear to increase at a faster rate than the benefits as the conflict intensifies, eventually catching up to and exceeding the benefits at a certain degree of the conflict. In examining the effects of board independence on two corporate actions that may be detrimental to bondholders, we find a risk-increasing effect of independence. However, we do not detect a significant effect of independence on corporate payout policies.

III. Propensity Score Matching

Our primary empirical analysis employs propensity score-weighted DID regressions. One advantage of this methodology is that it preserves the sample size as much as possible. In addition to this method, Imbens and Wooldridge (2009) also recommend combining regressions with propensity score matching. Therefore, we use the propensity score-matched DID regressions to examine the robustness of our primary findings of the differential impact of board independence on the cost of debt conditional on the expected S/B conflict. We entertain several matching algorithms: 1) one-to-one matching without replacement, 2) nearest neighbor matching with five compliant firms (if available) matched with each noncompliant firm, and 3) kernel matching. The results are reported in Table VI. To conserve space, we only report the results with respect to credit ratings, but note that the results based on the other proxies of the S/B conflict are similar. The results in Table VI are consistent with those in Table III, providing support for our primary findings.

Table VI. Robustness Check by Propensity Score Matching

This table reports the results using the propensity score-matched DID regressions to check the robustness of the results with respect to the differential effects of board independence on the cost of debt conditional on median-adjusted credit ratings. Results using three matching methods are presented: 1) one-to-one matching without replacement (One-to-One), 2) nearest neighbor matching with five compliant firms (if available) matched with each noncompliant firm (Nearest Five Neighbors), and 3) kernel matching (Kernel). The samples cover senior unsecured bonds of 1,500 S&P firms from 2001 to 2005. The dependent variable is the yield spread of an outstanding bond in a given year. The weight is one for noncompliant firms and $p/(1-p)$ for compliant firms, where p is the estimated propensity score based on Model 1 of Panel B in Table II. *Post-SOX* is a dummy variable that is equal to one if the year is on or after 2003, and zero otherwise. See the Appendix for the definitions of the other variables. All of the models also include the control variables as in Model 2 of Table III. Standard errors are adjusted for heteroskedasticity, and clustered at both the bond and firm-year levels. *t*-statistics are in parentheses.

Matching Method	(1) One- to-One	(2) Nearest Five Neighbors	(3) Kernel
<i>Noncompliant</i> × <i>Post-SOX</i> × <i>Rating</i>	-0.221* (-2.341)	-0.225*** (-2.899)	-0.205*** (-3.135)
<i>Noncompliant</i> × <i>Post-SOX</i>	0.122 (0.704)	0.149 (0.911)	0.188 (1.292)
<i>Volat</i> × <i>Rating</i>	-0.156* (-1.646)	-0.231*** (-2.760)	-0.173** (-2.536)
<i>Volat</i>	0.314 (1.247)	0.382 (1.545)	0.348 (1.621)
<i>Dividend</i> × <i>Rating</i>	-13.274*** (-2.700)	-9.564** (-2.060)	-10.580*** (-3.749)
<i>Dividend</i>	-7.745 (-0.600)	1.997 (0.144)	-2.041 (-0.207)
<i>Repurchase</i> × <i>Rating</i>	-0.191 (-0.311)	-0.475 (-0.878)	-0.401 (-0.877)
<i>Repurchase</i>	-0.678 (-0.517)	-2.439* (-1.896)	-1.425 (-1.241)
Observations	2,366	4,061	5,992
Adjusted R^2	0.52	0.54	0.51

***Significant at the 0.01 level.

**Significant at the 0.05 level.

*Significant at the 0.10 level.

IV. Conclusion

We examine the potentially differential impact of board independence on the cost of debt conditional on the expected agency conflict between shareholders and bondholders. We theorize that because independent directors generally act in the interests of shareholders, their monitoring functions may be both beneficial and costly to bondholders, depending on the alignment or misalignment of interests between these two stakeholders. Since both the benefits and costs of board independence may increase with the degree of the S/B conflict and it is likely that the speeds of their increases are different, divergent effects of independence on the cost of debt are possible.

Using SOX as a natural experiment and propensity score-weighted DID regressions, we document empirical evidence that is consistent with these arguments. While board independence significantly reduces the cost of debt when the S/B conflict is mild, it substantially increases the cost of debt when the conflict becomes severe. We also find a risk-increasing effect of board independence, providing some direct evidence on the costly corporate actions for bondholders associated with the presence of independent directors.

Our study offers several insights into the academic literature and policy debate. The divergent effect of board independence on the cost of debt provides clear evidence against the one-size-fits-all approach to regulations. It also offers another example in support of the argument that “good” governance from the perspective of one stakeholder group may not be good for other stakeholders. Unlike the common perception in the literature that corporate governance matters more for bondholders when the default risk is higher, we find that not only the magnitude, but also the direction of the effect of a governance structure on the cost of debt may change with the credit condition of a firm.

Appendix: Variable Definitions

Variable	Definition	Data Source
<i>Spread</i>	The difference between the yield-to-maturity (YTM) of a bond issue and the YTM of the Treasury bond with the closest maturity.	S&P Snapshot
<i>Percent ind</i>	Percentage of independent directors to total board size. Since the definition of independence in RiskMetrics is stricter than that of the exchanges, we reclassify affiliated directors according to RiskMetrics as independent if they were former employees of the firm, but had terminated their employment for at least three years, do not provide any professional services to the firm, and is not an interlocking director.	RiskMetrics
<i>Ind audit</i>	Dummy variable that is equal to one if the audit committee of a firm is composed entirely of independent directors, and zero otherwise.	RiskMetrics
<i>Noncompliant</i>	Dummy variable that is equal to one if independent directors were less than a majority in 2002, but became a majority between 2003 and 2005, or the audit committee was not composed entirely of independent directors in 2002 and the firm increased the independence of the whole board between 2003 and 2005, and zero otherwise.	RiskMetrics

(Continued)

Appendix: Variable Definitions

Variable	Definition	Data Source
<i>Rating</i>	Numerical coding of the S&P long-term domestic issuer credit ratings (data280). Ranges from 1 (debt in default) to 22 (AAA-rated). We then group the S&P credit ratings into seven categories to form the Grating variable. Specifically, Grating = 1 if $Rating \leq CCC+$; Grating = 2 if $CCC+ < Rating \leq B+$; Grating = 3 if $B+ < Rating \leq BB+$; Grating = 4 if $BB+ < Rating \leq BBB+$; Grating = 5 if $BBB+ < Rating \leq A+$; Grating = 6 if $A+ < Rating \leq AA+$; Grating = 7 if $Rating > AA+$. <i>Rating</i> dummies in the regressions are based on Grating.	Compustat
<i>Z-score</i>	Altman's Z-score, a composite score indicating the distance to financial default, defined as $[3.3 \times (data15 + data16 + data18 + data49)/data6 + 1.0 \times data12/data6 + 1.4 \times data36/data6 + 1.2 \times (data4 - data5)/data6 + 0.6 \times data199 \times data25/(data9 + data34)]$.	Compustat
<i>Interest coverage</i>	Interest coverage ratio $[data13/(data15 \text{ or } data339 \text{ if } data15 = 0 \text{ or } data15 \text{ is not available})]$.	Compustat
<i>Leverage</i>	Market leverage ratio $[(data9 + data34)/(data9 + data34 + data199 \times data25)]$.	Compustat
<i>Volat</i>	The log of the standard deviation of daily stock returns for at least 100 days over the year.	CRSP
<i>Dividend</i>	Annual cash dividends for common stock scaled by total assets $(data26 \times data25/data6)$.	Compustat
<i>Repurchase</i>	Annual repurchases of common and preferred stocks scaled by total assets $(data115/data6)$.	Compustat
<i>Duration</i>	The log of the modified duration of a bond.	S&P Snapshot
<i>Convexity</i>	The log of the convexity of a bond.	S&P Snapshot
<i>Bond age</i>	The log of the number of years since a bond was issued.	S&P Snapshot
<i>Size</i>	The log of market capitalization $[\log(data199 \times data25)]$.	Compustat
<i>ROA</i>	Return on assets $(data13/data6)$.	Compustat
<i>Mb</i>	Market-to-book ratio $[(data6 - data60 + data199 \times data25)/data6]$.	Compustat
<i>Salesgrow</i>	The log of sales growth rate $[\log(data12/lagged \ data12)]$.	Compustat
<i>Firm age</i>	The log of the number of years since a firm was publicly traded.	Compustat

(Continued)

Appendix: Variable Definitions

Variable	Definition	Data Source
<i>Vega</i>	The log of 0.001 plus the sensitivity of the CEO option portfolio value to a 0.01 change in the annualized standard deviation of stock returns, where the estimation of the sensitivity follows the “one-year approximation” (OA) method in Core and Guay (2002). Specifically, for the estimation inputs, we use the annualized standard deviation of monthly stock returns over the past 60 months, and the average dividend yield over the past three years. Risk-free rates are the YTM of the Treasury bonds matched by the closest maturities.	Execucomp
<i>Delta</i>	The log of 0.001 plus the sensitivity of the CEO option and the stock portfolio value to a 1% change in stock price, where the estimation of the sensitivity follows the OA method. Specifically, for the estimation inputs, we use the annualized standard deviation of monthly stock returns over the past 60 months, and the average dividend yield over the past three years. Risk-free rates are the YTM of the Treasury bonds matched by the closest maturities.	Execucomp
<i>CEO tenure</i>	The log of 0.001 plus CEO tenure in years.	Execucomp
<i>CEO age</i>	The log of CEO age in years.	Execucomp
<i>R&D</i>	R&D expenses scaled by total assets, with missing values coded as zeros (data46/data6).	Compustat
<i>Capexp</i>	Net capital expenditure scaled by total assets, with missing values coded as zeros [(data128-data107)/data6].	Compustat
<i>Cash balance</i>	The log of the cash balance scaled by total assets [log(data1/data6)].	Compustat
<i>Segment</i>	The log of the number of business segments.	Compustat
<i>CEO shares</i>	Percentage shareholding of a CEO.	Execucomp
<i>Unexercisable options</i>	Percentage of the unexercisable options held by a CEO to the total shares outstanding.	Execucomp
<i>Exercisable options</i>	Percentage of unexercised exercisable options held by a CEO to the total shares outstanding.	Execucomp
<i>Stock return</i>	Cumulative annual stock return over the year.	CRSP
<i>PPE</i>	Net PPE scaled by total assets (data8/data6).	Compustat
<i>Cash flow</i>	Free cash flow [(data18-data14)/lagged data8].	Compustat
<i>G-index</i>	The sum of 24 dummy variables indicating the presence or absence of firm-level antitakeover provisions and state-level antitakeover statutes.	RiskMetrics
<i>CEO nom</i>	Dummy variable that is equal to one if a CEO sits on the firm’s nomination or governance committee, or the firm does not have a nomination and governance committee, and zero otherwise.	RiskMetrics

(Continued)

Appendix: Variable Definitions

Variable	Definition	Data Source
<i>CEO comp</i>	Dummy variable that is equal to one if a CEO sits on the firm's compensation committee or the firm does not have a compensation committee, and zero otherwise.	RiskMetrics
<i>Ind director shares</i>	Aggregate percentage shareholdings of all independent directors.	RiskMetrics
<i>Herfindahl sales</i>	Herfindahl index of industry sales based on Compustat firms.	Compustat
<i>Loss</i>	Dummy variable that is equal to one if both current and previous earnings are negative.	Compustat

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