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Value of strategic alliances: Evidence from the bond market

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ABSTRACT

The objective of this study is to examine the relationship between strategic alliances and the cost of debt, proxied by the at-issue yield spread of bond offerings. We hypothesize that the participation of strategic alliances lowers a firm's cost of debt because it improves the level and stability of future profit streams and reduces information asymmetry among investors. Based on 2150 bond-issuing firms during the period 1985–2009, we find evidence consistent with this argument. Furthermore, we find that the mitigating effect of strategic alliances on the debt cost is much more pronounced for firms with higher product market competition, more severe financial constraints, and greater R&D investments. Taken together, this is the first paper to examine the importance of strategic alliances in the bond market and our results highlight that corporate alliance activity is valued outside the equity market and creates additional benefits that result in lower cost of debt financing.

"In the decades to come, businesses will either be part of an alliance or competing with one."—Paul Lawrence, Harvard Business School

1. Introduction

Recently, inter-organizational strategic alliance activities have drawn increased interest from business and finance practitioners, as well as from academicians. Strategic alliances refer to collaborative partnerships between allying firms that pool together subsets of their own resources to achieve a common set of mutually beneficial objectives (Gulati and Singh, 1998; Baker et al., 2002). Thus, firms can access, exchange, or internalize valuable resources, both technological and financial, through strategic alliances. A recent review paper by Wassmer (2010) indicates that most of the research on alliances has focused on the emergence, management, and survival of alliances. There is little research on the effect of alliances on the cost of external capital. This paper aims to fill this gap in the literature by analyzing whether strategic alliances can reduce the cost of debt financing. Furthermore, we examine the differential effect of alliances conditional on product market competition, financial constraints, and the technological intensity of allying firms.

With global competition and increasing uncertainty and complexity in the business environment, single firms seldom possess all the strategically critical resources required to sustain and grow their businesses. Building alliance portfolios has been seen as an effective means of dealing with these problems and achieving competitive advantages for the parties involved. In the most recent decades, strategic alliances have grown dramatically (Powell et al., 1996; Larsson et al., 1998; Ireland et al., 2002). Dyer et al. (2004), for example, reports that U.S. companies entered into 57,000 alliances from 1996 through 2001 and more than 5000 alliances were formed each year in 2002 and 2003. Indeed, anecdotal evidence suggests that nearly 6% of Fortune 1000 companies' revenues are generated from inter-organizational alliances (*The Daily Deal*, October 8, 2001).[1] A 1997 survey by Coopers & Lybrand also reveals that firms engaging in strategic alliances have 11% higher revenue and a 20% higher growth rate than ones without alliances.

The prevalence of corporate alliance activity, with the objective of building cooperative advantages, has motivated researchers to investigate the valuation implications of strategic alliances. Specifically, some studies have examined the impact of alliance

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announcement on the stock market valuation of allying firms. The empirical evidence on equity market value is, however, mixed. For example, Chan et al. (1997) and Anand and Khanna (2000) report that firms enjoy significant positive abnormal returns following alliance announcements, suggesting that stockholders perceive strategic alliances to be beneficial to firm value. In contrast, Das et al. (1998) find an insignificant market reaction to such announcements and imply that the benefits of strategic alliances may be offset by their costs.[2] In sum, whether strategic alliances really bring about (net) benefits might not be as obvious as originally thought and needs to be further investigated.

This paper takes a different view and assesses the merits of strategic alliances from the perspective of bondholders. If bondholders value corporate alliance activity, they will be willing to sacrifice a portion of their required return on firms participating in strategic alliances. The theoretical underpinnings predicting a negative association between strategic alliances and the cost of debt financing follow two related thrusts. Grounded in transaction cost theory and resource-based theory, the first is that strategic alliances enhance the level and stability of firms' future profit streams and thus lower the cost of debt. This stream of research includes work by Zahra and Bogner (1999), Vickery et al. (2003), and Lerner and Rajan (2006). Predicated on signaling theory, the second stream of research, which includes Stuart et al. (1999), Nicholson et al. (2005), and Ivanov and Lewis (2008), suggests that strategic alliances can alleviate the information asymmetry problem among investors through external alliance partners serving to signal firm value and quality.

We focus on the bond setting for several reasons. First, bondholders represent the single largest set of capital providers for most firms and bond securities make up a significant portion of a typical firm's market capitalization. In doing so, we gain new insights into how strategic alliances could indirectly affect firm value through debt financing. Second, the bond market allows for cleaner inferences when compared to the equity market. Klock et al. (2005) argue that because bonds have precise payouts and shorter durations, their prices are more accurate and less subject to the criticism that the results are driven by misspecification of the equilibrium asset pricing model than are equity prices. Third, bondholders differ from stockholders in many aspects; in particular, they are more concerned with risk, or the lower tail of the probability distribution of outcomes. As a result, our study on the importance of corporate alliance activity in the bond market adds complementary knowledge to prior research based on equity markets.

Using a sample of 2150 bond-issuing firms during the period from 1985 to 2009, we find evidence that participation in strategic alliances is associated with a lower cost of debt financing. Multiple regression analysis reveals that this negative association is robust to controlling for firm- and issue-specific characteristics, as well as macroeconomic conditions. We also find that the effect of strategic alliances on the debt cost is much more pronounced for firms with higher product market competition, tighter financial constraints, and more R&D investments because the volatility of future profit streams and value uncertainty is higher for such firms and thus the marginal benefit of strategic alliances is greater. That is, our results suggest that strategic alliances appear to mitigate the adverse effects of inferior business environment on the cost of debt financing.

To gain further insight into the reducing effect of strategic alliances on the cost of debt, we conduct several additional analyses. First, some firms issue multiple bonds and we find that for consecutive bond issues from the same firm, our measure of the debt cost decreases across time as firms change status from not participating to participating in strategic alliances. Second, the reduction in the cost of debt is related not only to the alliance participation activity, but also to allying firms' past alliance experience. Third, the observed effect of strategic alliances appears to be due to a larger extent to technology alliances relative to marketing alliances. Fourth, we find that participation in equity-based joint ventures and participation in contractual alliances are both associated with a lower cost of debt. Fifth, the mitigating effect of strategic alliances on the cost of debt is more dramatic for small firms than for large firms. Sixth, we verify that our results are robust to various techniques used to deal with potential endogeneity concerns about corporate alliance decisions. Lastly, we find similar results when we use alternative definitions of alliance participation and when we use non-overlapping sample and mean annual regressions to prevent our results from being driven by cross-sectional dependence problems.

The closest research to ours is a recent working paper by Fang et al. (2012) that analyzes the impact of strategic alliances on private debt placements as opposed to publicly offered debt. Our work differs significantly from theirs in at least three important ways. First, the public bond investors we are interested in typically exercise limited control over the decisions of borrowers since they have limited exposure to borrowers and face free-rider problems. As a result, bondholders tend to rely more on price protection (i.e., bond yield adjustment), which, in turn, would allow us to better evaluate how debt providers value strategic alliances. Second, our analysis relies on the at-issue yield spread of bond offerings and not all-in-drawn data in the secondary market. The issuing market for corporate bonds is reportedly more liquid than the secondary market, which facilitates efficient price discovery; thus, we believe the at-issue yield spread to be a more accurate measure of a firm's cost of debt. Third, we additionally examine if debt providers' valuation of alliance activity varies with the business environment that firms face, whereas Fang et al. highlight the incremental impact of a firm's relative position in an alliance network on borrowing costs.

This study contributes to the literature in several aspects. First, our analysis suggests that bondholders exhibit interest in inter-organizational alliance activities. Second, our analysis supports the notion that strategic alliances provide a measurable and significant benefit to the firms involved, namely, through lower costs of debt financing. Thus, the consequences of firm strategic decisions are broader than a focus on equity issues alone could reveal. Our investigation of firm contextual factors as potential moderating variables is also a first step in this direction. Third, we add to the literature on alliance motives by identifying a new important incentive for engaging in strategic alliances. Fourth, our findings provide additional new evidence to suggest that participation in strategic alliances is an important way to ensure the stability of future profits and to reduce information asymmetry among market participants. To our knowledge, such evidence has not been demonstrated in prior work.

The remainder of the paper is organized as follows. Section 2 briefly reviews the theoretical motives and benefits of alliance formation and develops empirical hypotheses. Section 3 presents the data, variable measurements, and methodologies. Section 4 reports the empirical results. Section 5 provides additional analyses for robustness and Section 6 concludes the paper.

[2] A few studies have pointed to the non-trivial costs of strategic alliances, suggesting that alliance benefits may be offset by their costs, such as those due to the erosion of proprietary interests (Oxley and Sampson, 2004). For example, U.S. partners in cross-border alliances tend to suffer serious losses due to the involuntary loss of potential revenue and the uncompensated transfer of rent-generating resources, such as technology (Hamel et al., 1989). Moreover, contractual inefficiencies can make one firm in a strategic alliance able to opportunistically exploit its partner by exerting insufficient effort, underinvesting, or capturing a disproportionately large share of the joint payoffs created by the strategic relationship (Lerner and Malmendier, 2010). This is why some scholars argue that the net benefits of alliances have been overemphasized and find weak relations between partnerships and shareholder value (Das et al., 1998; Reuer and Koza, 2000).

2. Related literature and hypothesis development

2.1. Theoretical background

The economics, management, and finance literature has advanced several organizational motives and benefits of strategic alliances. To keep our inferences clear and comprehensible, we focus on three important theories and evidence on these motives and review them briefly as follows.

(1) *The transaction cost motive.* As argued by Williamson (1985) and Kogut (1988), contractual collaborations may be the least costly governance form in inter-organizational relationships than other kinds of resource integration when the hazards of knowledge leakage in conjunction with partners' opportunism exist. The use of external resources from partners provides organizational flexibility and allows rapid repositioning to changing demands and industry structure. As such, entering into a strategic alliance allows a firm to decrease transaction costs in its resource exchange relationships (Oxley, 1997).

(2) *The resource motive.* A firm is a collection of heterogeneous resources, specifically, tangible and intangible assets that are semi-permanently tied to it (Wernerfelt, 1984; Barney, 1991). Resource-based theory posits that a firm can achieve competitive advantages through seeking partners with complementary resource endowments via strategic alliances (Das and Teng, 2000). Often, resources of particular interest in alliances include financial capital, technical capabilities, managerial capabilities, and other relevant assets (Hitt et al., 2000). The literature suggests that firms benefit from collaborations through positive spillover effects; that is, know-how that is gained from alliance activities can be applied profitably to non-alliance operations as well (Branstetter and Sakakibara, 2002; Sampson, 2005). Furthermore, the internalized resources obtained through exchange relationships contribute to a firm's capability of gaining relational rents for competitive advantage (Gulati, 1995; Lavie, 2006).

(3) *The signal motive.* Collaborative agreements can enable firms to signal their value and thereby mitigate information asymmetry problems. Stuart et al. (1999), for example, show that alliances with prominent exchange partners provide endorsements and the legitimacy of startup firms, allowing them to go public sooner and obtain greater proceeds compared to firms without such connections. Baum et al. (2000) and Gulati and Higgins (2003) suggest that enhanced legitimacy through partnerships also improves the strategic position of firms. Relations with high-status firms can generate firm visibility, increase the likelihood that customers will accept the firm as a supplier, and help distinguish firms from competitors (Eisenhardt and Schoonhoven, 1996; Stuart, 2000). Legitimacy is important for drawing organizations closer to other resources and reducing the search and monitoring costs associated with seeking external constituents (e.g., customers, suppliers, collaborators, and investors).

Consistent with these motives, firm strategic alliances are broadly recognized as creating value, as reflected in the rents that partners gain which exceed rents generated through alternative organizational configurations (Ireland et al., 2002). Specifically, allying firms can reap the benefits of a larger customer base, economies of scale, resource complementarity, improved manufacturing capacity, reduced costs, the redeployment of assets to more profitable uses, and so on (Gulati, 1995; Gomes-Casseres et al., 2006). Alliances also assist in strengthening a firm's competitive position against rivals by increasing market power, introducing new products more rapidly, building entry barriers, and gaining access to new markets (Clayton and Jorgensen, 2005; Mathews, 2006). In addition, effective alliances can enable firms to reduce their downside risk while positioning themselves to gain and sustain long-term competitive advantage. As such, inter-firm collaborations may help reduce the risk premium demanded by investors and, therefore, reduce the cost of capital. The effect of strategic alliances on the cost of capital may be equally important as that on rent generation because the former is a direct measure of a firm's financing cost, which affects financing and investment decisions. Our work contributes to the literature by separating the cost of capital from firm value and then investigating the effect of corporate alliance activity on the cost of debt financing.

2.2. Strategic alliances and the cost of debt

Theoretical prediction for a negative association between strategic alliances and the cost of debt is provided by two streams of research. Grounded in transaction cost theory and resource-based theory, the first is represented by the literature examining the effect of strategic alliances on the distribution of a firm's future profit streams. As *Moody's Global Credit Research* (Moody's Investor Service, 2006) states in its guide to the methodology used to rate bonds, "[A] review of the issuer's strategy includes the firm's long-term vision, risk-return appetite ... strategic alliances can also impact its risk profile." This suggests that rating agencies examine a firm's alliance activity in evaluating its default risk. It should be noted that as a firm's (a) mean expected profit increases or (b) the variance of expected profits declines, the likelihood of default of debt holders decreases, leading to lower costs of debt to the firm.

Previous studies have documented that corporate alliance activity positively affects firm performance. On the one hand, Chan et al. (1997) find that partnering firms exhibit better operating performance than their industry peers over a five-year period following alliance formation. Allen and Phillips (2000) demonstrate that strategic alliances in conjunction with corporate equity ownership lead to significant improvements in profitability. Vickery et al. (2003) show that collaborative relationships between supply chain partners improve customer service and lead to better financial performance. In a case study of Japanese manufacturing firms, Cooper and Slagmulder (2004) find that inter-firm alliances lead to cost savings and long-term profitability. On the other hand, alliances can clearly be attractive in reducing risk due to firms' lower initial capital outlays, profit sharing, faster market entry, as well as access to supporting skills, and, therefore, eliminating seasonal variations in profit streams (Contractor and Lorange, 1988; Inkpen, 2001). Tyler and Steensma (1995) and Zahra and Bogner (1999) indicate that corporate alliance strategy increases the regularity of product hits and ensures the stability of future operating profits. Given that strategic alliances ensure the level and stability of future profit streams, firms participating in alliances are viewed as less risky borrowers and are expected to enjoy lower costs of debt financing.

Predicated on signaling theory, the second stream of theoretical research suggests that strategic alliances can reduce the cost of debt by reducing information asymmetry among market participants. If the financial community, such as debt capital providers, has not dealt with the firm before and its quality cannot be observed directly, the firm's portfolio of external alliances can be taken into account in assessing its quality (Stuart et al., 1999). Nicholson et al. (2005) develop a signaling model of strategic alliances and demonstrate that, in an imperfect information environment, inter-firm partnerships can serve to both signal firm quality and enable the exchange of resources. Ivanov and Lewis (2008) also indicate that when firms go public, the presence of

strategic alliances prior to the initial public offering helps issuing firms reduce value uncertainty, as well as information asymmetry in the markets. Signaling firm quality and value is important because information asymmetry increases the default risk an investor is exposed to when providing capital to a company (Easley and O'Hara, 2004; Mansi et al., 2011). We expect that participation in strategic alliances reduces information asymmetry through endorsements by external alliance partners, thereby lowering the cost of debt financing.

The research discussed above motivates our first hypothesis.

H1. Strategic alliance activities are negatively associated with the cost of debt.

2.3. Strategic alliances, firm contextual factors, and the cost of debt

Creditors are sensitive to variations in risk across issuers. Risk to future profit streams can be due to firm contextual factors such as product market competition, financial constraints, and technological change. It has been argued that strategic alliances can assist firms access the necessary resources to deal with rapid product cycles, offset capital constraints, and keep up with advances in technology (Alvarez and Barney, 2001; PriceWaterhouseCoopers, 2004). As a result, we hypothesize there are variations across firms within different contexts in the association between strategic alliances and the cost of debt.

Eisenhardt and Schoonhoven (1996) indicate that firms operating in highly competitive markets tend to engage in inter-organizational alliance activities because they are strategically vulnerable. Strategic alliances not only allow such firms to pool complementary resources and to share risks but also act as a means of "rapid competitive repositioning" by reducing product development costs and times (Porter and Fuller, 1986). Furthermore, through strategic alliances, firms can strengthen their competitive advantages against rivals by increasing market power, introducing new product design and development, improving production methods, and building innovative marketing and distribution systems (Chan et al., 1997; Frels et al., 2003). Increased competitiveness works as a hedge that smoothes out future profit fluctuations driven by market competition. Thus, the benefits of strategic alliances may be greater for firms facing greater product market competition. This motivates our second hypothesis, stated as follows.

H2. The negative association between strategic alliances and the cost of debt is stronger for firms that face greater product market competition.

In the context of financial constraints, it is difficult for such firms to acquire the resources necessary to foster profitability and investment. Indeed, financially constrained firms can actively engage in strategic alliances for access to financial capital (Stuart, 1998) and product markets (Hill and Rothaermel, 2003). Pablo and Subramaniam (2005) suggest that the smaller partner often sells equity to the larger partner to overcome their external financing constraints. The authors also find that the inter-firm alliance announcements of smaller high-growth firms are associated with positive market reactions because the partnerships alleviate the financial constraints of these firms. It appears that strategic alliances are especially valuable for financially constrained firms because they give such firms the opportunity to embody innovation projects and improve prospects when other capital resources are costly, limited, or unavailable. We therefore hypothesize that as financial constraints tighten, bondholders will place more value on the inter-organizational alliance activities of these firms. The third hypothesis is stated as follows.

H3. The negative association between strategic alliances and the cost of debt is stronger for firms that are subject to tighter financial constraints.

Driven by rapid technological changes, firms need to invest in R&D activities that are vital to the future economic benefits and survival of organizations. Note that not all instances of R&D investments generate positive outcomes and they can change the risk structure of future profit streams.[3] In this context, inter-firm alliance relationship benefits from cost reductions in R&D by sharing costs among the partners and deterring wasteful duplication. Allying firms can jointly manage the uncertainties associated with the innovation process, tap a partner's technologies and core competencies to exploit synergies, and generate economies of scale and scope in R&D. On the other hand, through R&D, strategic alliances can internalize the technological know-how offered by the partnering firms and develop new capabilities that can then be exploited to achieve competitive advantages and respond to market uncertainty. Therefore, R&D investments can increase allying firms' strategic alignment with the environment and produce better performance (Allen and Phillips, 2000; Luo and Park, 2001). Based on this line of reasoning, we expect that participation in strategic alliances is more beneficial for firms seeking to compete in more rapidly changing technological environments. The fourth hypothesis is stated as follows.

H4. The negative association between strategic alliances and the cost of debt is stronger for firms that invest more in R&D.

3. Research design

3.1. Data and sample selection

The initial sample starts with 7611 straight (nonconvertible) fixed-rate bond issues by U.S. firms over 1985–2009 taken from Securities Data Company (SDC) New Issue database. We impose the following sample selection criteria: (1) the company is not a financial institution or regulated utility (SIC codes 6000–6999 and 4900–4999, respectively), (2) we require that data be available for each firm in the Compustat and CRSP databases, (3) the issue has non-missing bond data from SDC, and (4) for firms with multiple bond issues in a given year, we convert all the multiple same-year issues into one observation weighted by issue proceeds, as in Anderson et al. (2004) and Klock et al. (2005).[4] These criteria leave us with a final sample of 2150 bond-issuing firms. Then, we match our issuing firms with SDC Joint Venture/Alliances database to obtain strategic alliances data. Of these 2150 issuers, 1159 issuers had one or more alliance activities announced in the three years before the issue and 991 issuers had no without alliance participation.

Panel A of Table 1 provides the frequency of bond issuers across years. There is mild clustering of bond issuers in time periods corresponding to hot issue periods in 1991–1993, 1995–1996, and 2009. Panel B shows the industry groupings of our sample firms. It seems that our sample exhibits industry concentration, with firms in the commodity production (SIC codes 20–29) and manufacturing (SIC codes 30–39) industries accounting for approximately 54% of our sample. In later regressions, we therefore include year and industry fixed effects to capture time variations in bond market conditions between hot and cold periods and industry clustering.

[3] For example, Kothari et al. (2002) find that R&D investments generate future benefits that are far more uncertain than benefits from investments in capital expenditures.

[4] Therefore, the unit of observation in our analyses is an issuing firm, not a bond issue.

Table 1
Sample distribution.

Year	Entire sample		Subsample: firms with SA		Subsample: firms without SA	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Panel A: Sample distribution by year						
1985	20	0.93	1	0.09	19	1.92
1986	100	4.65	17	1.47	83	8.38
1987	63	2.93	11	0.95	52	5.25
1988	47	2.19	11	0.95	36	3.63
1989	56	2.60	19	1.64	37	3.73
1990	51	2.37	25	2.16	26	2.62
1991	112	5.21	70	6.04	42	4.24
1992	150	6.97	92	7.94	58	5.85
1993	177	8.23	111	9.58	66	6.66
1994	78	3.63	50	4.31	28	2.83
1995	112	5.21	75	6.47	37	3.73
1996	124	5.77	79	6.82	45	4.54
1997	74	3.44	49	4.23	25	2.52
1998	60	2.79	38	3.28	22	2.22
1999	95	4.42	64	5.52	31	3.13
2000	22	1.02	13	1.12	9	0.91
2001	69	3.21	52	4.49	17	1.72
2002	69	3.21	42	3.62	27	2.72
2003	95	4.42	47	4.06	48	4.84
2004	51	2.37	32	2.76	19	1.92
2005	56	2.60	26	2.24	30	3.03
2006	93	4.33	49	4.23	44	4.44
2007	107	4.98	53	4.57	54	5.45
2008	94	4.37	48	4.14	46	4.64
2009	175	8.14	85	7.33	90	9.08
Total	2150	100.00	1159	100.00	991	100.00
2-digit SIC	Entire sample		Subsample: firms with SA		Subsample: firms without SA	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Panel B: Sample distribution by industry						
10–19	242	11.26	90	7.77	152	15.34
20–29	651	30.28	393	33.91	258	26.03
30–39	506	23.53	308	26.57	198	19.98
40–48	283	13.16	170	14.67	113	11.40
50–59	282	13.12	110	9.49	172	17.36
70–79	135	6.28	66	5.69	69	6.96
80–89	41	1.91	19	1.64	22	2.22
90–99	10	0.47	3	0.26	7	0.71

The sample consists of 2150 issuing firm–year observations of all nonconvertible bond issues by U.S. firms from 1985 to 2009. Firms with SA represent firms participating in one or more strategic alliances during the three years prior to their bond issues. Panel A reports the sample distribution by calendar year. Panel B reports the sample distribution by industry. These two-digit SIC codes correspond to the following industries: 10–19, mining and construction; 20–29, commodity production; 30–39, manufacturing; 40–48, transportation; 50–59, wholesale and retail; 70–79, person and business services; 80–89, health and other services; and 90–99, public administration and others.

3.2. Methodology and variable description

To empirically test H1, we employ Regression (1) as our primary model:

$$\begin{aligned} SPREAD_i = {} & \beta_0 + \beta_1 SA_i + \beta_2 \ln TA_i + \beta_3 LEV_i + \beta_4 ROA_i \\ & + \beta_5 INTCOV_i + \beta_6 CAPINTEN_i + \beta_7 STDRET_i \\ & + \beta_8 SUBORD_i + \beta_9 \ln PROC_i + \beta_{10} \ln MATUR_i \\ & + \beta_{11} RATING_i + \beta_{12} BCYCLE_i \\ & + Industry\ fixed\ effects_i + Year\ fixed\ effects_i + \varepsilon_i \end{aligned} \quad (1)$$

The time subscript is dropped from all variables for ease of notation. The dependent variable is the at-issue yield spread, *SPREAD*, defined as the difference between the bond offering yield and the comparable Treasury bond yield with equivalent duration as the bond issue, measured in basis points. If a firm has more than one bond issue in a given year, we use the proceeds-weighted spread, where the weight is the proceeds of each bond issue relative to the total proceeds of all bond issues in the same year, as the dependent variable. The at-issue bond yield spread represents the risk premium that firms must pay to borrow money in the bond market and is a direct measure of a firm's cost of debt (Shi, 2003; Jiang, 2008).

The variable of primary interest in this study, *SA*, is an indicator that equals one if the firm has ever participated in at least one alliance activity during the three years preceding the bond issue and zero otherwise.[5] Based on H1, we anticipate *SA* to be negatively associated with *SPREAD*, which means that β_1 is expected to be negative.

Next, we test the hypotheses that the impact of strategic alliance on the debt cost is moderated by three firm contextual factors: product market competition (H2), financial constraints (H3), and R&D intensity (H4). We measure a firm's product market competition using its excess profit–cost margin, defined as the difference between the firm's operating profit margin (operating profits over sales) and the average industry profit margin. Firms that are (not) able to exceed their industry in terms of profit margin

[5] The three-year window approaches the average time it takes partnering firms to develop a new collaborative model and enables us to account for the majority of previous alliances, which may have effects on ensuing activities subsequent to bond issues.

have a greater (weaker) ability to extract profit and are viewed as facing a lower (higher) intensity of product market competition (Gaspar and Massa, 2006). We therefore construct a competition dummy *COMP* that takes the value of one if the firm's excess price–cost margin is negative and zero otherwise.[6] To capture the moderating effect of firm's financial constraints, we define a dummy variable *FC* that identifies the top 50% of firms ranked on the Kaplan–Zingales (KZ, 1997) index as financially constrained, in analogy with Lamont et al. (2001).[7] R&D intensity is measured by the firm's R&D expenditure divided by sales, adjusted for the industry. We compute the industry-adjusted R&D intensity (denoted *AdjRD*) to remove any industry-specific effects from the firm's R&D investments by subtracting the median R&D intensity from the firm's R&D intensity.

To test H2 to H4, we add firm contextual factors, referred to as *FACTOR* in Regression (2), to the primary model one at a time. The hypotheses are tested through the interaction $SA * FACTOR$. The variable *FACTOR* is included because omitting it would make the interpretation of the coefficient of $SA * FACTOR$ problematic if *FACTOR* directly affects yield spread. The model specification is outlined as follows:

$$\begin{aligned} SPREAD_i = {} & \beta_0 + \beta_1 SA_i + \beta_2 SA_i * FACTOR_i + \beta_3 FACTOR_i + \beta_4 \\ & \times \ln TA_i + \beta_5 LEV_i + \beta_6 ROA_i + \beta_7 INTCOV_i \\ & + \beta_8 CAPINTEN_i + \beta_9 STDRET_i + \beta_{10} SUBORD_i + \beta_{11} \\ & \times \ln PROC_i + \beta_{12} \ln MATUR_i + \beta_{13} RATING_i \\ & + \beta_{14} BCYCLE_i + Industry\ fixed\ effects_i \\ & + Year\ fixed\ effects_i + \varepsilon_i \end{aligned} \quad (2)$$

where *FACTOR* represents *COMP*, *FC*, or *AdjRD* and the time subscript is dropped.

The coefficient of the interaction term $SA * COMP$, $SA * FC$, or $SA * AdjRD$ indicates how market competition, financial constraints, or R&D intensity, respectively, influences the relation between firm alliance activity and the cost of debt. Based on H2 to H4, the coefficient of the interaction term (β_2) is expected to be negative.

In addition, we construct several control variables related to firm characteristics, issuing characteristics, and macroeconomic conditions. All firm characteristic variables are measured at the end of the fiscal year preceding the bond issues, assuming a three-month reporting lag. These variables are identified in previous studies as significant in explaining various aspects of bond yield spread (e.g., Bhojraj and Sengupta, 2003; Khurana and Raman, 2003; Klock et al., 2005). The measurement of all the empirical variables follows prior research and is summarized in the Appendix A.

Firm size (*TA*), financial leverage (*LEV*), return on assets (*ROA*), interest coverage ratio (*INTCOV*), capital intensity (*CAPINTEN*), and firm idiosyncratic risk (*STDRET*) are included to control for differences in firm-specific characteristics across bond issuers. *TA* is measured by book value of total assets. Since larger firms tend to less risky and can enjoy a lower cost of debt, we expect a negative relation between *TA* and yield spread. *LEV* is the firm's ratio of long-term debt to total assets. Highly levered firms face a higher probability of default and, consequently, a higher yield spread. Accordingly, we expect the coefficients of *LEV* will be positive. *ROA* is used as a proxy for firm profitability. Because profitable firms generally have low default risk and thus can raise external capital at a lower cost, we expect *ROA* to be negatively related to the cost of debt. *INTCOV* is an alternative measure of default risk and is expected to be negatively associated with the yield spread. *CAPINTEN* is the ratio of tangible assets to total assets. The intensity of a firm's tangible assets is viewed as potential collateral and bond investors are expected to demand lower yields on firms with more tangible assets. *STDRET* is measured by the standard deviation of the residuals of the market model over the year prior to the bond issue and is expected to be positively related to bond yield.

The subordinated nature of bonds (*SUBORD*), issue size (*PROC*), maturity (*MATUR*), and credit rating (*RATING*) are included to control for differences across bond issues. Because subordinated bonds increase default risk, they are, thus, expected to be positively associated with the bond yield spread. *PROC* is the total proceeds from the firm's bond issues and is expected to be negatively related to the debt cost because, according to liquidity theory, bonds of larger issue size have higher liquidity and thus a lower yield spread. *MATUR* is the length of the maturity of the issue in years. Since Flannery (1986) suggests that a longer bond maturity is expected to be associated with a higher default risk, we expect the coefficient of *MATUR* will be positive. Bond credit rating is based on the S&P credit rating and is computed using a conversion process in which AAA-rated bonds are assigned a value of 22 and D-rated bonds receive a value of one. Thus, the higher the value, the better the credit quality and the lower the yield spread is expected to be.

Finally, bond yield is also likely to depend on time series changes in risk premiums over the business cycle. To capture the effect of market conditions, we include *BCYCLE*, defined as the average yield on Moody's Aaa bonds for the month of issue less the average yield on the 30-year U.S. Treasury bill for the month of issue. This variable is expected to have a positive association with the bond yield spread. Because an issuer can carry out multiple bond issues, we cluster the standard errors by firm, following Petersen (2009), in all subsequent tests.

4. Empirical results

4.1. Descriptive statistics

Table 2 provides descriptive statistics of variables associated with firm alliance activity, as well as firm and issuing characteristics. About 54% of bond issuers in the sample had participated in strategic alliances during the three years preceding the bond issues. The average total asset size is $13.833 billion, the average long-term debt-to-assets ratio is 0.307, the average return on assets is 0.053, the average interest coverage ratio is 11.333 times, the average capital intensity is 0.429, and the average annualized standard deviation of returns is 33.934%. The average at issue yield spread for the newly-issued bonds is 187.784 basis points over its duration equivalent Treasury Security, with a median of 133.532 basis points and a standard deviation of 150.605 basis points. The average proceeds raised at the bond issue is $335.013 million, with the average maturity of 14.052 years. The average credit rating of 14.617 corresponds to S&P's rating quality between BBB and BBB$^+$. Less than 10% of firms issue subordinated debt. The summary statistics related to issuing characteristics are comparable to the findings of Liu and Jiraporn (2010) and Francis et al. (2010), which also use the SDC database.

4.2. Correlation analysis

Table 3 displays the Pearson (above the diagonal) and Spearman (below the diagonal) correlations between the variables and coefficients significant at the 5% level are in boldface. As expected,

[6] We construct a dummy variable to proxy for market competition because we consider the possibility that the moderating effect of market competition on the relationship between strategic alliances and the cost of debt may not be continuous. In fact, using a raw excess profit–cost margin variable does not qualitatively change our findings.

[7] The KZ index is based on the KZ (1997) ordered logit regression and is calculated according to the equation KZ = −1.002 ∗ (Cash Flow/Net PPE) + 0.283 ∗ MB + 3.139 ∗ (Debt/Total Capital) − 39.368 ∗ (Total Dividend/Net PPE) − 1.315 ∗ (Cash/Net PPE).

Table 2
Descriptive statistics.

Variables	Mean	Standard deviation	25th Percentile	Median	75th Percentile
Strategic alliance variable					
SA	0.539	0.499	0.000	1.000	1.000
Firm characteristics					
TA (in $billion)	13.833	30.456	1.874	4.948	13.135
LEV	0.307	0.152	0.202	0.285	0.340
ROA	0.053	0.056	0.028	0.053	0.081
INTCOV	11.333	23.875	4.051	6.818	11.290
CAPINTEN	0.429	0.245	0.235	0.391	0.620
Issuing characteristics					
SPREAD	187.784	150.605	85.000	133.532	238.000
STDRET	33.934	15.006	23.736	30.437	40.370
SUBORD	0.092	0.289	0.000	0.000	0.000
PROC (in $mil.)	335.013	349.894	140.000	239.150	399.300
MATUR	14.052	9.668	8.556	10.161	17.769
RATING	14.617	3.386	13.000	15.000	17.000
Macroeconomic conditions					
BCYCLE	0.850	0.387	0.610	0.750	1.040

The table reports summary statistics for the variables used in subsequent analyses. The sample consists of 2150 issuing firm–year observations of all nonconvertible bond issues by U.S. firms from 1985 to 2009. See the Appendix A for variable measurements.

Table 3
Correlations between selected variables.

	SPREAD	*SA*	ln*TA*	*LEV*	*ROA*	*INTCOV*	*CAPINT*	*STDRET*	*SUBORD*	ln*PROC*	ln*MATUR*	*RATING*	*BCYCLE*
SPREAD		**−0.222**	**−0.296**	**0.282**	**−0.260**	**−0.075**	−0.003	**0.614**	**0.411**	**0.044**	**−0.208**	**−0.701**	**0.284**
SA	**−0.245**		**0.349**	**−0.105**	−0.001	**0.044**	**−0.064**	**−0.086**	**−0.160**	**0.235**	0.004	**0.246**	−0.020
ln*TA*	**−0.240**	**0.344**		**−0.191**	**0.099**	**0.051**	**−0.066**	**−0.181**	**−0.417**	**0.719**	**0.095**	**0.531**	**0.188**
LEV	**0.273**	**−0.101**	**−0.146**		**−0.311**	**−0.332**	**0.081**	**0.162**	**0.264**	**−0.114**	**−0.101**	**−0.446**	**−0.086**
ROA	**−0.247**	0.013	**0.096**	**−0.380**		**0.307**	**−0.051**	**−0.161**	**−0.143**	**0.136**	0.040	**0.379**	**0.109**
INTCOV	**−0.293**	**0.107**	**0.214**	**−0.699**	**0.695**		**−0.084**	−0.022	**−0.092**	**0.140**	−0.032	**0.165**	**0.073**
CAPINT	−0.015	**−0.059**	**−0.061**	**0.096**	**−0.051**	−0.041		0.014	0.026	**−0.120**	**0.150**	**−0.058**	−0.041
STDRET	**0.505**	**−0.079**	**−0.207**	**0.156**	**−0.165**	**−0.146**	−0.008		**0.176**	**0.048**	**−0.240**	**−0.445**	**0.203**
SUBORD	**0.380**	**−0.160**	**−0.373**	**0.237**	**−0.165**	**−0.271**	0.016	**0.201**		**−0.218**	**−0.073**	**−0.526**	**−0.065**
ln*PROC*	**0.108**	**0.224**	**0.703**	**−0.091**	**0.140**	**0.280**	**−0.129**	0.024	**−0.203**		**−0.059**	**0.171**	**0.281**
ln*MATUR*	**−0.124**	0.002	**0.104**	**−0.101**	0.027	0.022	**0.164**	**−0.231**	**−0.058**	**−0.074**		**0.237**	**−0.082**
RATING	**−0.700**	**0.240**	**0.468**	**−0.394**	**0.404**	**0.456**	−0.038	**−0.429**	**−0.443**	**0.111**	**0.232**		**0.090**
BCYCLE	**0.315**	**−0.054**	**0.176**	**−0.074**	**0.142**	**0.186**	**−0.058**	**0.161**	**−0.087**	**0.262**	**−0.054**	**0.085**	

Above the diagonal contains the Pearson correlation coefficients; below the diagonal contains the Spearman correlation coefficients. The sample consists of 2150 issuing firm–year observations of all nonconvertible bond issues by U.S. firms from 1985 to 2009. See the Appendix A for variable measurements. To be consistent with later regression analyses, we use the log transformation of *TA*, *PROC*, and *MATUR* in estimating correlations. Numbers in bold are significant at the 5% level (two tailed). To evaluate the concern of multicollinearity, VIFs are checked for all independent variables. The VIFs are all less than three, far below 10.

there is a significant negative relation between *SA* and *SPREAD* (Pearson = −0.222 and Spearman = −0.245), providing preliminary evidence supporting our first hypothesis. Consistent with prior studies, *SPREAD* is positively correlated with *LEV*, *STDRET*, *SUBORD*, and *lnPROC* and is negatively correlated with ln*TA*, *ROA*, *INTCOV*, *lnMATUR*, as well as *RATING*. Interestingly, the result reveals that *RATING* is positively correlated with *SA* (Pearson = 0.246 and Spearman = 0.240) and the correlation coefficients are significant. This suggests that rating agencies such as S&P examine a firm's alliance strategy in evaluating its bond rating and that our *SA* measure is a reasonable proxy for the corporate alliance activity implicit in credit rating. Although the correlations between some independent variables are high, multicollinearity is not a serious concern since the variance inflation factor (VIF) is under 10 for all our regression specifications (Belsley et al., 1980).

4.3. Effect of strategic alliances on the cost of debt

In this section, we use ordinary least squares regression analysis to test H1. In Model 1 of Table 4, the only explanatory variable, besides year and industry dummies, is *SA*. The coefficient of *SA* is negative and statistically significant at the 1% level. This finding suggests that firms joining in strategic cooperative relationships with other firms have a lower bond yield spread. The impact of firm participation in strategic alliances on the cost of debt is also economically significant: Because the mean yield spread for firms without alliance activity is 223.961 basis points (untabulated), the regression result shows that firms participating in alliance activity have a 64.791 basis point lower cost of debt after controlling for the trend in yield spread, equivalent to 28.93% less than the mean of firms without strategic alliances.

Model 2 of Table 4 reports results from the regression of the yield spread on strategic alliances and control variables. The coefficient of *SA* remains negative and highly significant. Although smaller than the estimate in the Model 1, the magnitude of the effect is still economically large. Compared with firms not involved in inter-firm alliances, allying firms have a 19.969 basis point lower cost of debt financing, representing a relative decrease of 9%. As for control variables, we find that the coefficient of stock return volatility is significantly positive and that the impact of firm size is insignificant, potentially due to the high correlation between firm size and other control variables, such as issuing proceeds and credit rating. In addition, the coefficients of firm profitability, capital intensity, and credit rating are significantly negative and the coefficients of subordination status dummy, issuing proceeds, maturity, and macroeconomic conditions are positive and

Table 4
Multiple regressions of the at-issue yield spread on strategic alliances: Tests of H1.

Variables	Predicted sign	Dependent variable: SPREAD			
		Model 1		Model 2	
		Coef.	*p*-Value	Coef.	*p*-Value
Intercept	?	415.839***	0.000	293.834***	0.000
SA – H1	–	−64.791***	0.000	−19.969***	0.000
ln*TA*	–			−2.524	0.276
LEV	+			−11.137	0.432
ROA	–			−126.978***	0.001
INTCOV	–			0.045	0.591
CAPINTEN	–			−17.593**	0.020
STDRET	+			2.987***	0.000
SUBORD	+			52.516***	0.000
ln*PROC*	+			19.746***	0.000
ln*MATUR*	+			7.879***	0.000
RATING	–			−23.293***	0.000
BCYCLE	+			99.889***	0.000
Industry dummies		Inclusive		Inclusive	
Year dummies		Inclusive		Inclusive	
Adjusted R^2		0.245		0.692	
Number of obs.		2150		2150	

This table reports the results of regressing the at-issue yield spread (in basis points) on the strategic alliances measure and a vector of firm and bond issue control variables. The sample consists of 2150 issuing firm–year observations of all nonconvertible bond issues by U.S. firms from 1985 to 2009. See the Appendix A for variable definitions. We include dummies for each calendar year and each two-digit SIC code industry in all the regressions; the coefficients are not tabulated to save space. All *p*-values are based on two-tailed tests using firm-clustered standard errors.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

significant. The coefficients of leverage and interest coverage are not significant, implying their impact on the bond yield spread may be captured in the credit ratings.

In sum, the multiple regression analyses strongly support H1, that the bond yield spread decreases with corporate alliance activity. Compared with firms without alliances, firms joining in alliance relationships have a lower at-issue corporate bond yield spread, from 9% to 28.93%, depending on the model specification.[8]

4.4. Firm contextual factors and the expected benefit of strategic alliances

In this section, we first test H2, that the effect of strategic alliances on the cost of debt is strengthened by the degree of market competition, as proxied by *COMP*. Model 1 of Table 5 reports regression results. We find that the coefficient of *SA* is significantly negative, as before. Of interest here is that the coefficient of the interaction term $SA * COMP$ is negative and significant, indicating that corporate alliance activity exerts greater impact in reducing the cost of debt for firms facing higher product market competition. That is, bondholders value strategic alliances more when greater intensification of market competition can decrease profit margins and thus increase firms' risk of default. In an economic sense, strategic alliances engaged by firms facing less product market competition lead to a 15.617 basis point decrease in yield spread, while alliances engaged by firms facing higher competition generate a much larger cost of debt-reducing benefit: a 43.931 (15.617 + 28.314) basis point decrease in the yield spread.[9] In addition, the coefficient of *COMP* is significantly positive, suggesting that bondholders charge higher yields for bond lending to firms facing a more competitive environment.

Next, we test H3, which posits that the effect of strategic alliances on the reduction of the debt cost is stronger for financially constrained firms relative to liquid firms. We now focus on the interaction term between strategic alliances and a dummy variable for financial constraints, *FC*. The interaction term captures the difference in the effect of alliances on the cost of debt of financially constrained and liquid firms. As shown in Model 2 of Table 5, the coefficient of *SA* is significantly negative. In addition, the coefficient of $SA * FC$ is negative and significant, indicating that the alliance activity of financially constrained firms has a greater impact on the cost of debt than that of liquid firms. We interpret this finding as evidence that, from the bondholders' perspective, it is more beneficial for firms to engage in strategic alliances when the firm is confronted with more severe financial constraints. Importantly, the moderating effect of firm financial constraints is economically significant. Specifically, with all else held constant, liquid firms participating in strategic alliances have a 14.985 basis point lower yield spread than firms that do not participate in alliances, while financially constrained allying firms have a much larger, 30.708 (14.985 + 15.723) basis point decrease in yield spread.[10]

[8] In addition to conducting our tests of the association between firm alliance participation and the cost of debt, we examine whether strategic alliances affect firm information environment and the level and volatility of profit streams, two key arguments underlying H1. We find that bond-issuing firms with alliance involvement have a significantly lower pre-issue standard deviation of residual returns, better post-issue long-run operating performance, and lower volatility of future profits. The results suggest that firm alliance activity reduces information asymmetry problems and improves the distribution of operating performance following public bond offerings. A direct test confirming these arguments helps strengthen our findings.

[9] In untabulated results, we use the Herfindahl index as an alternative measure of market competition and find our main results remain unchanged. In this paper, we prefer using a competition measure based on the excess profit–cost margin (EPCM), for two reasons: (i) The EPCM is a firm-specific measure, as opposed to the Herfindahl index and (ii) the EPCM is intuitively appealing in its construction. This is because the measure suggests that a firm's positioning within its industry (as measured by its market power relative to that of its industry peers) affects bondholder beliefs and perceptions, rather than the average market power of all firms in the industry (which is what the Herfindahl index measures).

[10] In addition, we perform our analysis using an alternative proxy for financial constraints. Denis and Sibilkov (2010) argue that financially constrained firms are unlikely to distribute cash in the form of dividends. Therefore, we classify firms that (do not) pay dividends as financially unconstrained (constrained). The untabulated results remain qualitatively the same.

Table 5
Multiple regressions of the yield spread on strategic alliances, with interaction terms with firm contextual factors: Tests of H2 to H4.

Variables	Predicted sign	Dependent variable: SPREAD					
		Model 1		Model 2		Model 3	
		Coef.	*p*-Value	Coef.	*p*-Value	Coef.	*p*-Value
Intercept	?	296.429***	0.000	289.496***	0.000	297.188***	0.000
SA	–	−15.617***	0.000	−14.985***	0.002	−20.239***	0.000
SA ∗ *COMP* – H2	–	−28.314***	0.006				
COMP	+	14.866**	0.038				
SA ∗ *FC* – H3	–			−15.723**	0.042		
FC	+			−9.109	0.146		
SA ∗ *AdjRD* – H4	–					−90.747**	0.034
AdjRD	+					61.960	0.124
ln *TA*	–	−2.701	0.244	−1.975	0.394	−2.801	0.227
LEV	+	−10.190	0.468	2.136	0.883	−11.209	0.425
ROA	–	−125.677***	0.001	−141.457***	0.000	−127.278***	0.001
INTCOV	–	0.041	0.623	0.055	0.510	0.007	0.936
CAPINTEN	–	−18.624**	0.014	−4.754	0.576	−16.777**	0.027
STDRET	+	2.982***	0.000	3.025***	0.000	2.988***	0.000
SUBORD	+	51.893***	0.000	51.527***	0.000	52.722***	0.000
ln *PROC*	+	19.471***	0.000	19.292***	0.000	20.122***	0.000
ln *MATUR*	+	7.856**	0.021	7.808**	0.022	7.425**	0.030
RATING	–	−23.213***	0.000	−24.111***	0.000	−23.183***	0.000
BCYCLE	+	99.396***	0.000	99.183***	0.000	100.254***	0.000
Industry dummies		Inclusive		Inclusive		Inclusive	
Year dummies		Inclusive		Inclusive		Inclusive	
Adjusted R^2		0.693		0.694		0.693	
Number of obs.		2150		2150		2150	

This table reports the results of regressing the at-issue yield spread (in basis points) on the strategic alliance measure and other control variables, with the inclusion of the interaction terms of strategic alliances with production market competition (Model 1), financial constraints (Model 2), and R&D intensity (Model 3). See the Appendix A for definitions of the variables. The sample consists of 2,150 issuing firm–year observations of all nonconvertible bond issues by U.S. firms from 1985 to 2009. We include dummies for each year and each two-digit SIC code industry in all the regressions; the coefficients are not tabulated to save space. All *p*-values are based on two-tailed tests using firm-clustered standard errors.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

To test H4, which predicts the mitigating effect of strategic alliances on the cost of debt is more pronounced for firms with greater R&D intensity, we examine the interaction between strategic alliances and R&D intensity. Model 3 of Table 5 provides evidence consistent with our argument. As reported earlier, we again find that firm participation in strategic alliances significantly reduce the yield spread. The coefficient of *SA* ∗ *RD* is negative and significant, indicating that the negative association between strategic alliances and the yield spread increases as the firm's R&D intensity grows. This implies that bondholders apparently place a distinct value on corporate alliance activity when the pace of technological change that firms face is more rapid. As mentioned earlier, the coefficient in this regression can be interpreted to provide a better sense of the economic significance of the effect. An increase in R&D intensity of one standard deviation (0.137) is associated with a further decrease in the at-issue yield spread by 12.432 basis points (90.747 × 0.137), holding the alliance effect constant. Consistent with Shi (2003), we find a positive association between R&D investment and bond spread, but this association is not significant.[11]

In summary, our H2 to H4 suggest that the effect of strategic alliances on the cost of debt is conditional on firm contextual factors such as the degree of product market competition, the severity of financial constraints, and the intensity of R&D expenditures. Overall, these results confirm that, as firms experience higher market competition, tighter financial constraints, or heavier R&D investments, their participation in inter-organizational alliances is associated with further decreases in the cost of debt financing.

5. Additional analyses

5.1. Firms with multiple bond issues

Several firms conduct multiple bond issues. Although we combine multiple same-year issues into one (firm-level) observation using issuing proceeds as the weight if a firm has multiple bond issues in a given year, there are potentially multiple bond issues conducted by a given firm across years. Specifically, our full sample consists of 336 firms conducting only one issue, 149 firms conducting two issues, 87 firms conducting three issues, and 191 firms conducting four or more issues during the sample period. To assess the sensitivity of our results to the inclusion of multiple issuers, we re-estimate all regression models for the subsample with only the first bond issue by each firm, or with an indicator variable, to denote firms that have issued bonds more than once during the sample period included as an additional control variable using the full sample. Neither approach changes our main findings.[12]

Because 427 firms have multiple bond issues, we conduct an additional test in which we examine the relationship between changes in alliance participation status and the cost of debt over time. Specifically, we identify a sample of firms that change their status from a non-participant in strategic alliances in a given year to a participant the subsequent year. If strategic alliances are negatively related to the cost of debt, we hypothesize that a change in status from non-participant to participant will be associated with a decrease in the yield spread for consecutive bond issues of the same firm. We then estimate the yield spread regression, where

[11] The untabulated results for the replacement of industry-adjusted R&D intensity with raw R&D intensity are also similar.

[12] These results are not reported here for the sake of brevity but are available from the authors upon request.

Table 6
Tests of the effect of a change in alliance participation status on the change in the at-issue yield spread.

Variables	Predicted sign	Dependent variable: SPREAD			
		Model 1		Model 2	
		Coef.	*p*-Value	Coef.	*p*-Value
Intercept	?	400.503***	0.000	151.633**	0.011
AFTER_SA	–	−30.645***	0.000	−12.151**	0.034
ln*TA*	–			1.661	0.647
LEV	+			0.999	0.966
ROA	–			50.922	0.514
INTCOV	–			−0.244	0.533
CAPINTEN	–			−17.922*	0.097
STDRET	+			2.736***	0.000
SUBORD	+			54.662***	0.000
ln*PROC*	+			22.577***	0.000
ln*MATUR*	+			11.087**	0.023
RATING	–			−22.779***	0.000
BCYCLE	+			109.704***	0.000
Industry dummies		Inclusive		Inclusive	
Year dummies		Inclusive		Inclusive	
Adjusted R^2		0.334		0.653	
Number of obs.		0.768		0.768	

This table reports the regression results of change in the at-yield spread resulting from firms changing their alliance participation status from non-participant to participant. The sample is made up of firm–years that changed status from one year to the next. Firms must have at least one year of available data both before and after the alliance participation to be included in the analysis. The variable of interest is *AFTER_SA*, a dummy capturing whether the bond issue is conducted after the alliance participation. See the Appendix A for the definitions of the other regression variables. We include dummies for each year and each two-digit SIC code industry in all the regressions; the coefficients are not tabulated to save space. All *p*-values are based on two-tailed tests using firm-clustered standard errors.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

we replace *SA* with an indicator variable *AFTER_SA*, which is set equal to one in the firm–years after the firm participates in strategic alliances and zero otherwise (i.e., the firm–years prior to the firm participating in an alliance). Table 6 presents the results of two regression specifications. Model 1 includes *AFTER_SA* only and Model 2 adds other control variables. In both specifications, the coefficient of *AFTER_SA* is negative and significant, consistent with the at-issue yield spread being lower after firms participate in strategic alliances relative to the firm–years prior to alliance participation. We interpret this finding as providing additional support for our main cross-sectional results.

5.2. Effect of the number of alliance activities on the cost of debt

Until now, we have focused on the relation between the cost of debt and firm participation in strategic alliances. We now address a related issue: whether, conditional on alliance participation, the number of alliance activities has a further marginal impact on the bond-issuing firm's debt cost. In recent theoretical work, scholars have posited that firms accumulate experience from multiple alliances that enable them to develop, refine, and leverage intra- and inter-organizational routines to effectively solve problems and manage alliances. Moreover, more experienced firms can better assess and select appropriate alliance partners for their specific knowledge contribution (Ireland et al., 2002; Hoang and Rothaermel, 2005). Empirical evidence indicates that alliance experience results in higher stock market value creation (Anand and Khanna, 2000), enhanced new product development (Rothaermel, 2001), and the establishment of a dedicated alliance function, which, in turn, improves alliance performance (Kale et al., 2002). Given that experience can play a beneficial role in improving alliance outcomes, we expect broader strategic alliances to lead to a greater reduction in the level of the firm's bond at-issue yield spread.

To capture the number of a firm's alliance activities, we introduce one additional continuous variable, *NUMSA*, which is defined as the cumulative number of strategic alliances that a firm has participated in during the three years prior to bond issue. In Panel A of Table 7, we report the mean yield spread grouped by the number of strategic alliances. Overall, the results suggest that the yield spread for firms with large numbers of alliance participation is significantly lower than for firms with small numbers of alliances. The mean yield spread for group 2 (180.370 basis points) is higher than that for group 3 (156.287 basis points), which is, in turn, higher than that for group 4 (139.795 basis points). All of these differences are significant at the 5% level or better. Firms without alliances (group 1) have a significantly higher yield spread than groups 2 to 4. The regression results using *NUMSA* to explain the bond yield spread are reported in Panel B of Table 7. The results are qualitatively similar to those earlier in Tables 5 and 6, with the exception that *SA* is replaced with its continuous number counterpart *NUMSA*.[13] There is a strong and statistically significant negative relationship between the number of strategic alliances and yield spread. The interaction terms of ln*NUMSA* with *COMP*, *FC*, and *AdjRD* are all negative and statistically significant. Thus, a firm's cost of debt is affected not only by its participation in strategic alliances, but also by the number of alliances involved. The result implies that bondholders view a firm's multiple-alliance building favorably since accumulated experience helps to alleviate investor uncertainty regarding partners and subsequent alliance performance.

5.3. Differential effects of marketing and technology alliances

Alliance activities can be conventionally separated into two main areas, namely, technology and marketing alliances. The former involves upstream activities (e.g., R&D, engineering, technology transfer) that can lead to innovative technologies and applications. Entering a technology alliance requires a desire for exploration by the firm to discover new opportunities through the acquisition of knowledge, skills, and capabilities that are novel

[13] We use the log transformation ln*NUMSA* in regressions.

Table 7
Results relating yield spread to the number of strategic alliances.

		Group 1	Group 2	Group 3	Group 4
Panel A: Univariate tests					
Number of strategic alliances		0	1–2	3–11	12 and above
Number of sample firms		991	323	404	432
Mean at-issue yield spread		223.961	180.370	156.287	139.795
t-stat. for differences in mean yield spread compared with:					
Group 2		4.21***			
Group 3		8.22***	2.45**		
Group 4		11.08***	4.31***	2.00**	
Variables	Predicted sign	Dependent variable: SPREAD			
		Model 1	Model 2	Model 3	Model 4
Panel B: Multiple regressions of yield spread on the number of strategic alliances					
Intercept	?	281.535***	279.879***	274.282***	282.483***
		(0.000)	(0.000)	(0.000)	(0.000)
ln*NUMSA*	–	−5.378***	−4.076***	−4.403***	−5.711***
		(0.000)	(0.009)	(0.006)	(0.000)
ln*NUMSA* ∗ *COMP*	–		−14.020***		
			(0.001)		
COMP	+		14.102**		
			(0.030)		
ln*NUMSA* ∗ *FC*	–			−8.239**	
				(0.019)	
FC	+			−9.720	
				(0.100)	
ln*NUMSA* ∗ *AdjRD*	–				−26.564**
					(0.019)
AdjRD	+				57.625
					(0.103)
Control variables		Inclusive	Inclusive	Inclusive	Inclusive
Industry dummies		Inclusive	Inclusive	Inclusive	Inclusive
Year dummies		Inclusive	Inclusive	Inclusive	Inclusive
Adjusted R^2		0.690	0.691	0.692	0.691
Number of obs.		2150	2150	2150	2150

The sample consists of 2150 issuing firm–year observations of all nonconvertible bond issues by U.S. firms from 1985 to 2009. The at-issue yield spread is defined as the yield to maturity of the corporate bond minus the yield to maturity of a Treasury security of similar duration, expressed in basis points. The number of strategic alliances is measured as the number of strategic alliances the firm participated in the three years prior to the bond issue. In Panel A, we split the sample into four groups based on the number of strategic alliances and report the mean at-issue yield spread for each group and *t*-statistics for the differences between groups. Panel B reports the results of regressing the yield spread on the number of strategic alliances and related interaction terms. The term ln*NUMSA* is the natural logarithm of one plus the number of strategic alliances. See the Appendix A for the definitions of the regression variables. The control variables include ln*TA*, *LEV*, *ROA*, *INTCOV*, *CAPINTEN*, *STDRET*, *SUBORD*, ln*PROC*, ln*MATUR*, *RATING*, and *BCYCLE*. See the Appendix A for variable definitions. We include dummies for each year and each two-digit SIC code industry in all the regressions; the coefficients are not tabulated to save space. All *p*-values are based on two-tailed tests using firm-clustered standard errors and are reported in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

to the firm (Koza and Lewin, 1998). The latter focuses on stimulating customer demand through downstream value chain activities such as sales, distribution, and customer service. Referring to such alliances as exploitation alliances, Grant and Baden-Fuller (2004) argues that these are built to leverage existing firm resources and capabilities in current or new markets. Because they involve an active search for new knowledge, technology alliances are more dynamic and generate more opportunities for future sustainability/expansion. In contrast, marketing alliances generally focus on short-term economic returns from existing knowledge and resources (Rothaermel and Deeds, 2004).

The choice between technology- and marketing-oriented alliances is a function of firms' strategic intent and expected returns (Koza and Lewin, 1998). Empirical evidence also indicates a significant difference in equity investors' valuation of technology versus marketing alliances. Chan et al. (1997) and Das et al. (1998) find that technology alliances enjoy greater abnormal returns than market alliance announcements. This differential effect is attributed to the market's perception that technological alliances have greater option value for generating new activities and future profit streams. In contrast, marketing alliances are typically formed during the mature or declining phase of their products' life cycles and are therefore perceived as a signal of weakness by investors (Das and Teng, 2000).[14] To examine the potential different effects of alliance areas on the cost of debt, we decompose *SA* into *TECH_SA*, *MKT_SA*, and *TECH&MKT_SA*. The term *TECH_SA* (*MKT_SA*) is a dummy variable identifying firms participating solely in technology (marketing) alliance activities during the three years prior to bond issue. The *TECH&MKT_SA* dummy represents firms that are involved in both marketing and technology alliances.

Table 8 reports the results of regressing the yield spread on these three dummies for alliance areas. Model 1 includes strategic alliance measures only and Model 2 adds other control variables. Irrespective of model specifications, the coefficients of *TECH_SA*, *MKT_SA*, and *TECH&MKT_SA* are all negative and significant,

[14] Lee et al. (2013) provide opposite evidence that, in the case of Korea, marketing alliances generate significantly greater value than technology alliances. The authors interpret the results in terms of the export-oriented structure of the Korean economy. Investors therefore prefer strategic alliances related to easy accessibility of marketing resources already established in oversea countries. The inconsistent results from the United States and developing countries studies imply that country-level economic structure, disclosure requirements, or legal factor is perhaps more important than firm-level intent to determine alliance areas. More research in this area is needed to understand the effects of country-level versus firm-level characteristics on alliance outcome. In the same vein, future research can extend this study to other countries to examine the generalizability of our findings.

Table 8
Multiple regressions of the yield spread on different areas of strategic alliances.

Variables	Predicted sign	Dependent variable: SPREAD			
		Model 1		Model 2	
		Coefficient	*p*-Value	Coefficient	*p*-Value
Intercept	?	414.507***	0.000	299.887***	0.000
TECH_SA	–	−59.249***	0.000	−25.535***	0.000
MKT_SA	–	−24.567***	0.004	−12.164**	0.028
TECH&MKT_SA	–	−90.051***	0.000	−19.519***	0.000
ln*TA*	–			−2.832	0.226
LEV	+			−10.797	0.443
ROA	–			−128.074***	0.001
INTCOV	–			0.053	0.529
CAPINTEN	–			−18.518**	0.015
STDRET	+			2.990***	0.000
SUBORD	+			51.997***	0.000
ln*PROC*	+			19.485***	0.000
ln*MATUR*	+			8.118**	0.018
RATING	–			−23.207***	0.000
BCYCLE	+			100.064***	0.000
Industry dummies		Inclusive		Inclusive	
Year dummies		Inclusive		Inclusive	
Adjusted R^2		0.245		0.692	
Number of obs.		2150		2150	
Tests of coefficient equality		Diff. in Coef.	*p*-Value	Diff. in Coef.	*p*-Value
H_0: *TECH_SA* = *MKT_SA*		−34.682***	0.001	−13.371**	0.041

This table reports the results of regressing the at-issue yield spread (in basis points) on the alliance measure and a vector of firm and bond issue control variables. We decompose strategic alliances into three areas—technology, marketing, and technology and marketing—and test the differential impact of firm participation in these alliance areas on the yield spread. The sample consists of 2150 issuing firm–year observations of all nonconvertible bond issues by U.S. firms from 1985 to 2009. The variable *TECH_SA* (*MKT_SA*) is a dummy variable identifying firms participating solely in technology (marketing) alliances in the three years prior to bond issue and the *TECH&MARKET_SA* dummy represents firms that are involved in both marketing and technology alliances. See the Appendix A for definitions of the other variables. We include dummies for each year and each two-digit SIC coded industry in all the regressions; the coefficients are not tabulated to save space. All *p*-values are based on two-tailed tests using firm-clustered standard errors.

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

indicating that both marketing and technology alliances matter in affecting the cost of debt financing. Furthermore, the magnitude of the coefficient of *TECH_SA* is much larger than that of *MKT_SA*, suggesting that the yield-reducing effect of technology alliances may be stronger than that of marketing alliances. As shown in Model 2, compared with firms without alliances, firms participating in marketing alliances have a −12.038 basis point lower at-issue yield spread, whereas firms participating in technology alliances have a two times greater reduction of −25.013 basis points in the yield spread. Since returns to marketing alliances are generally less risky but short term (Rothaermel, 2001; Rowley et al., 2000), technology alliances enable partner firms to reduce their downside risk while positioning themselves to capture long-term growth opportunities. As a result, bondholders value technology alliances more highly than marketing alliances. Our evidence also complements the results of Das et al. (1998) and Arend (2004), which document a decline in stock volatility subsequent to alliance formations, particularly technological alliances.

5.4. Expected benefits of strategic alliances across forms of collaborative relationship

In terms of organizational features, strategic alliances fall into two forms of inter-organizational collaboration: equity-based joint ventures and contractual alliances (Hagedoorn, 2002). Joint ventures involve two or more partners pooling a portion of their resources within a common legal entity, with each partner sharing benefits through equity holdings. With increased uncertainty about partner opportunism, joint ventures generate a hierarchical governance structure where the parties can monitor alliance activities since they own equity in the joint ventures (Oxley, 1997). The capital invested in a joint venture also signals partner commitment, thereby enhancing the probability of success. The latter collaboration takes a contractual form and demands less capital infusion from the allying firms. Such collaborations are more flexible and entail lower transaction costs and thus perform better in certain environments (Dussauge and Garrette, 1995). Supporting these arguments, prior studies (Chan et al., 1997; Johnson and Houston, 2000) find a significant and positive market reaction to the announcement of contractual alliances and joint ventures. In this section, we are interested in learning whether the impact of corporate alliance activity on the debt cost is similar for joint ventures and contractual alliances.

To test this, we analyze the alliance portfolio a firm participated in during the last three years prior to the bond issue. Firms that were involved in one or more joint ventures are classified as JV firms and firms that participated solely in contractual alliances are classified as CA firms. Of 1159 firms with strategic alliances (i.e., *SA* = 1), there are 787 JV firms and 372 CA firms. In Models 1 to 4 of Table 9, we re-estimate the models in Eqs. (1) and (2), the only modification being that the dataset is composed of a sub-sample that is restricted to firms without strategic alliances (*SA* = 0) and JV firms. In Models 5 to 8 of Table 9, the dataset is made up of non-alliance firms and CA firms. The results are qualitatively similar to those reported above. In seven of eight model specifications, we find that firm participation in alliance activity consistently reduces the bond yield spread, the only exception being the coefficient of *SA* in Model 7, which becomes insignificantly negative. It appears that for firms without financial constraints, participation in contractual alliances is unrelated to lower costs of debt. In addition, the moderating effects of firm contextual factors are also similar to those previously reported, except that the

Table 9
Effects of strategic alliance forms on the at-issue yield spread.

Variables		Dependent variable: *SPREAD*							
	Sample composition	JV firms versus non-alliance firms				CA firms versus non-alliance firms			
	Predicted sign	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Intercept	?	272.618***	277.216***	257.726***	273.245***	324.298***	326.501***	315.419***	329.549***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SA – H1	–	−21.236***	−16.328***	−15.354***	−21.288***	−17.825***	−15.873**	−6.709	−18.713***
		(0.000)	(0.000)	(0.002)	(0.000)	(0.003)	(0.012)	(0.344)	(0.002)
SA ∗ *COMP* – H2	–		−31.685***				−12.874		
			(0.004)				(0.475)		
COMP	+		13.446*				7.794*		
			(0.056)				(0.326)		
SA ∗ *FC* – H3	–			−17.103**				−36.648***	
				(0.018)				(0.003)	
FC	+			−10.559*				−17.759**	
				(0.092)				(0.015)	
SA ∗ *AdjRD* – H4	–				−90.395**				−96.391**
					(0.040)				(0.050)
AdjRD	+				60.054				68.048
					(0.126)				(0.122)
Control variables		Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive
Industry dummies		Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive
Year dummies		Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive
Adjusted R^2		0.707	0.708	0.709	0.708	0.691	0.708	0.709	0.692
Number of obs.		1778	1778	1778	1778	1363	1363	1363	1363

This table reports the results of regressing the at-issue yield spread (in basis points) on participation in strategic alliances, with the inclusion of the interaction terms of strategic alliances with production market competition (Models 2 and 6), financial constraints (Models 3 and 7), and R&D intensity (Models 4 and 8). See the Appendix A for the definitions of the regression variables. In Models 1 to 4, the sample consists of 787 JV firms that participated in one or more joint ventures in the three years prior to their bond issues and 991 firms that did not participate in any alliance activities. In Models 5 to 8, the sample comprises only 372 CA firms and 991 non-alliance firms. Firms that participated solely in contractual alliances are classified as CA firms. We include dummies for each year and each two-digit SIC code industry in all the regressions; the coefficients are not tabulated to save space. All *p*-values are based on two-tailed tests using firm-clustered standard errors.

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

coefficient of *SA* ∗ *COMP* loses its significance for firms engaging in contractual alliances. This finding suggests that with a higher degree of product market competition, only joint ventures are associated with a further decrease in the cost of raising debt capital. Taken as a whole, both joint ventures and contractual alliances are perceived by bond investors as leading to lower future default risk and/or uncertainty.

5.5. Exploring endogeneity

Thus far, the empirical evidence shows a negative association between corporate alliance activities and the cost of bond financing. We argue that strategic alliances improve the distribution of future profits and mitigate information problems among creditors and consequently reduce the cost of issuing new bonds. The reverse causality is less of a concern, given our research design. In our empirical tests, our measure of strategic alliances is based on the essence in the year preceding the bond issue. The alliance activities in the earlier period could not have resulted from the cost of bond financing in the subsequent period. However, it is still possible that the participation rate of alliance activities is higher for firms with a low cost of debt and that our results reflect the tendency of such firms to undertake inter-firm alliances, although we are unaware of existing theory supporting this possibility. To address this concern, we employ a multitude of different strategies.

First, we employ a specification in which the dependent variable is the change in yield spreads between two consecutive issues and all independent variables, including firm alliance status, represent changes during the corresponding period to maintain the lag between the right-hand- and left-hand-side variables. Change regressions have a unique value in this setting, since we can observe bond investors' reactions (increased or decreased at-issue yield spreads) to firm-specific changes in alliance activities. Level regressions, on the other hand, suffer from potential bias arising from the existence of unobserved time-invariant firm-specific variables (e.g., corporate culture or management style). We limit the sample to firms with multiple bond issues and this procedure reduces the sample size in the change regression considerably. The results are presented in Column 1 of Table 10. We find that changes in alliance participation have a significant negative impact on the change in yield spreads, as expected.

Next, we adopt an instrumental variable estimation. Wassmer (2010) states that a firm is more likely to participate in strategic alliances if a large fraction of firms in the same industry have alliance partners. For each firm, we employ the fraction of firms in the same industry that participate in strategic alliances as an instrument for the firm's alliance activities. We define industries using the Fama–French 48 industry groupings. The first-stage instrumental variable regression is a probit regression of whether the firm is involved in strategic alliances on this fraction and all the control variables in Model (1). The *F*-statistics for the first-stage regression indicate that the coefficient of the excluded instrument is significantly different from zero at the 1% level. We also calculate Shea's (1997) partial R^2 from the first-stage regression. The R^2 value exceeds the suggested hurdle of 10% by a large margin. These tests suggest that our instrument is relevant in explaining the variation in the potentially endogenous regressor (*SA* dummy). For brevity, we present only the second-stage regression results in Columns 2 to 5 of Table 10. We find that the coefficients of the instrumented alliance-participation and its interaction terms still have the expected signs and are still significant, suggesting that endogeneity is less of a concern than it would otherwise appear.

In a final effort to clarify the interpretation of the relation between strategic alliances and the cost of bond issuing, we

Table 10
Effects of strategic alliances on the at-issue yield spread after controlling for endogeneity.

Variables	Dependent variable	ΔSPREAD	SPREAD							
		Change model	Instrumental variable model				Firm fixed effects model			
	Pred. sign	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Intercept	?	8.082***	165.412***	168.134***	145.515***	129.417***				
		(0.006)	(0.000)	(0.000)	(0.002)	(0.007)				
ΔSA	–	−21.968***								
		(0.000)								
pred_SA	–		−89.764***	−84.510***	−82.032***	−102.076***				
			(0.000)	(0.000)	(0.000)	(0.000)				
pred_SA ∗ *COMP*	–			−37.782***						
				(0.000)						
pred_SA ∗ *FC*	–				−26.806***					
					(0.000)					
pred_SA ∗ *AdjRD*	–					−18.419***				
						(0.001)				
SA	–						−22.768***	−18.958***	−23.652***	−16.368***
							(0.000)	(0.001)	(0.000)	(0.006)
SA ∗ *COMP*	–							−30.099**		
								(0.013)		
SA ∗ *FC*	–								−3.401	
									(0.676)	
SA ∗ *AdjRD*	–									−20.228**
										(0.014)
Control variables		Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive
Industry dummies		Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Not Incl.	Not Incl.	Not Incl.	Not Incl.
Firm dummies		Not Incl.	Not Incl.	Not Incl.	Not Incl.	Not Incl.	Inclusive	Inclusive	Inclusive	Inclusive
Year dummies		Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive	Inclusive
Adjusted R^2		0.435	0.661	0.661	0.662	0.651	0.854	0.855	0.854	0.854
Number of obs.		1387	2150	2150	2150	2150	2150	2150	2150	2150

This table reports the results of regressing the at-issue yield spread (in basis points) on participation in strategic alliances. Model 1 presents the regression of changes in the at-issue yield spread against changes in strategic alliance participation and changes in control variables. The sample consists of 1387 firms that issued multiple corporate bonds. The difference variables are the current bond issue's value minus the previous issue's. Models 2 to 5 report the results of the instrumental variable model, where strategic alliance participation (*SA*) is instrumented with fitted values from a first-stage regression on the fraction of firms in the same industry that participate in strategic alliances and the control variables from Table 4. Models 6 to 9 show the regressions that add firm fixed effects (in place of industry fixed effects). See the Appendix A for the definitions of the regression variables. We include dummies for each year and each two-digit SIC code industry in Models 1 to 5; the coefficients are not tabulated to save space. All *p*-values are based on two-tailed tests using firm-clustered standard errors.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

estimate a firm fixed effects specification to control for unobserved firm heterogeneity instead of industry-level heterogeneity. We rerun the analyses in Tables 5 and 6 using firm and year fixed effects. The results reported in Columns 6 to 9 of Table 10 show that the *SA* dummy and its interaction terms continue to be significantly (and as expected) associated with at-issue yield spreads, even after the addition of firm fixed effects to the model, with the magnitude of the coefficients being comparable to those reported in prior tables.

5.6. Effect of strategic alliances on the cost of debt, conditional on firm size

If reducing profit volatility and information asymmetry lowers the cost of debt, the effect of strategic alliances should be asymmetric between larger and smaller firms. The quality and growth prospects of small firms are uncertain due to their relatively short track record. In general, firms contemplating alliances assess potential partners by reputation (Stuart et al., 1999). Partnering with larger, reputed firms provides several benefits to smaller firms. First, the fact that a larger firm has selected a smaller and lesser-known entity over alternative firms provides a valuable endorsement for the smaller firm. Such endorsement effects can draw the attention of key constituents (e.g., customers, collaborators, and investors) to the smaller firms (Baum et al., 2000). For example, Stuart et al. (1999) report that firms with prominent alliance partners proceed more quickly to initial public offering and raise more capital in that offering. Second, alliance with a larger firm provides access to valuable skills and resources (e.g., innovativeness and product market capital) that the smaller firm lacks (Stuart, 2000). Chan et al. (1997) find that a small firm that enters into a partnership with a large firm experiences a higher positive stock market reaction than the large firm.

To the extent that the performance (uncertainty) of smaller firms would be enhanced (reduced) in their alliances with reputable larger firms, we therefore expect that strategic alliances have the potential to reduce the cost of debt more for smaller firms than for larger firms. We test this prediction by including an interaction variable between strategic alliances and firm size (e.g., *SA* ∗ *SIZE*) in our regressions. Untabulated results show that the main effect of strategic alliances continues to be significantly negative (coefficient = −80.956, *p*-value = 0.000). The interaction variable has a significant positive coefficient (coefficient = 7.873, *p*-value = 0.001), which is consistent with our prediction that the mitigating impact of strategic alliances on the cost of debt is more pronounced for smaller firms. In addition, the estimation results regarding firm contextual factors remain unchanged after including this interaction term.

5.7. Other robustness checks

To further test for robustness, we explore several alternative specifications in the tests of the relation between the yield spread

and firm alliance activity. First, the SDC database reports nearly complete data for the announcement of new alliances from early 1980, but it does not show the termination date for each alliance. In earlier analyses, we choose a moving window approach in which a firm's alliance participation status is aggregated over the three years prior to a given year. One potential limitation of this window choice is that it overlooks the fact that the life spans of alliances can vary dramatically.[15] To address this concern, we use a shorter one-year and a two-year moving window to determine a firm's alliance participation. A shorter window should better capture the impact of alliance agreements of short duration. The estimation results based on the alternative measure are consistent with those reported above and are not reported here for brevity.

Our second robust check considers the impact of independent variables such as strategic alliances on credit rating determination. As stated by Moody's Investor Service (2006), rating agencies have access to inside information when assigning credit ratings to companies and bonds, which is likely to contain or subsume the effect of inter-organizational collaborations. Therefore, credit rating is potentially affected by corporate alliance activity, even before these two variables affect the yield spread. To reflect the a priori effect of other covariates on credit rating, we follow a procedure that is frequently used in earlier studies on the cost of debt, placing an orthogonality condition on credit rating with respect to firm alliance activity (e.g., Anderson et al., 2004; Klock et al., 2005). That is, we introduce a modified credit rating, *ORTHRATING*, as an additional control variable for the cost of debt analysis. The variable *ORTHRATING* is the residual from regressing the credit rating on strategic alliances and all other explanatory variables in Eq. (1). We re-run all the analyses, replacing *RATING* with *ORTHRATING*. Untabulated results show that this adjustment does not materially affect the reported findings.

As a final robustness check in this section, we consider whether the results hold for different sample periods. Our measure of strategic alliances is computed based on alliance announcements in the three years immediately preceding each bond issue. Since the entire sample consists of firms issuing bonds in consecutive years, one might suspect that the error terms of the regressions are subject to interdependence over time. To address this concern, we pool observations only in 1985, 1989, 1993, 1997, 2001, 2005, and 2009, seven years in which the alliance measure is computed based on seven non-overlapping windows, 1982–1985, 1986–1989, 1990–1993, 1994–1997, 1998–2001, 2002–2005, and 2006–2009, respectively. We test our specification models using the non-overlapping sample and find similar results. We also run yearly regressions over the sample period and base our results on the average of yearly coefficients and the associated *t*-statistics with Newey–West corrections (Fama and MacBeth, 1973). In untabulated results, we find that all conclusions regarding strategic alliances still hold.

6. Conclusions

Corporate alliance activities have attracted great attention from business practitioners and researchers. Most of the attention, however, is directed at the impact of strategic alliances on stockholder wealth. Relatively little is understood about the impact of strategic alliances on bondholder interests. In this study, we fill this void in the literature by examining the relationship between strategic alliances and the cost of debt. We choose a setting, the corporate bond-issuing yield spread, in which we can directly measure the cost of raising debt capital. This setting also provides a powerful research design because, compared with alterative settings, the at-issue yield spread is less subject to liquidity problems, misspecification errors, and confounding concurrent events.

Based on 2150 bond issuers in 1985–2009, we find that strategic alliances are negatively associated with the bond yield spread, after controlling for firm and issuing characteristics, as well as macroeconomic conditions. This suggests that bondholders charge lower costs of debt for firms participating in strategic alliances, since they perceive superior profitability and lower information asymmetry for these firms. We also find that the effect of strategic alliance is stronger for firms facing an inferior business environment, such as higher product market competition, tighter financial constraints, and more rapid technological changes. Further analyses indicate that the reduction in the cost of debt is also related to the firm's past alliance experience. When breaking down the areas of alliance, we find that the decrease in the cost of debt is due to a larger extent to technology alliances, relative to marketing alliances. In addition, our results indicate that both joint ventures and contractual alliances provide benefits to the allying firms through lower costs of debt financing.

Such evidence represents an extension of the management and finance literature that generally explores the association between strategic alliances and overall firm value. By separating two components of firm value, our results reveal that inter-firm alliance activities not only positively affect firm performance (i.e., the numerator of the valuation model) but also are negatively associated with financing cost (i.e., the denominator of the model). In particular, the effect on the cost of bond financing may be quite important because the bond market represents the single largest source of external capital for most firms. The findings in this study may also have implications for firms interested in reducing the cost of raising debt capital and for debt holders viewing participation in strategic alliances as a positive signal, given the lower valuation risk associated with these firms.

Our research is subject to several limitations, which also open up avenues for future research. First, our finding is based strictly on the U.S. capital market. Therefore, it is difficult to draw inferences concerning the debt–cost impact of strategic alliances for other countries. There are reasons to believe that a country's culture and economy would affect the value of forming alliances (e.g., Xin and Pearce, 1996; Lee et al., 2013). Similarly, distinct legal regimes (such as legal protection against technological leakage) should affect the degree to which firms can sustain advantages in inter-organizational connections. Therefore the introduction of a larger dataset that includes international companies outside the United States and a comparison of the results with links to legal and institutional environments across countries would be an interesting study. Second, firms pursuing different strategies might develop and benefit from certain alliance configurations but not from others. Thus, the economic consequences of alliances may depend on firm strategy (Koka and Prescott, 2008). Future research could examine, for instance, whether alliances between competitors or between firms with more complementary positions in the value chain have distinct effects on the cost of raising capital. Finally, while our study has made a conscious attempt to analyze the effects of marketing versus technology and equity versus contractual alliances, it would be worthwhile to examine the differences between domestic and international alliances. Since international alliances necessarily involve cooperation between partners with very different orientations, skill sets, and institutional environments, they are more fragile and likely to demonstrate greater variations in outcome (Oxley and Sampson, 2004). We conjecture the inclusion of partner nationality might give us incremental explanatory power in explaining the cost of debt. In the same vein, a firm's alliance management experience could also be examined

[15] For instance, Dussauge et al. (2004) indicate that some alliances only last less than three years and some have been effectual for more than 10 years.

in future research on account of its close relationship with alliance performance (Sampson, 2005).

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Appendix A

Variable	Measurement
Dependent variable	
SPREAD	The yield spread measured as the yield to maturity of the corporate bond minus the yield to maturity of a Treasury security of similar duration, expressed in basis points. If a firm issues multiple bonds in a year, this variable is calculated as a weighted average of all *SPREAD* values based on each bond's proceeds
Strategic alliances variable	
SA	A dummy variable that equals one if the firm ever participated in at least one alliance activity during the three years preceding its bond issue and zero otherwise
Firm contextual variables	
COMP	A dummy variable for product market competition which is equal to one for firms facing a high degree of market competition (i.e., firms with a negative EPCM) and zero for firms facing low market competition. The EPCM is the difference between the firm's operating profit margin and the average operating profit margin of its two-digit SIC code industry. The operating profit margin is defined as operating profit over sales, where operating profit is sales less the cost of goods sold and general and administrative expenses
FC	A dummy variable for financial constraints that is equal to one for financially constrained firms (i.e., the top 50% of sample firms ranked on the KZ index) and zero for liquid firms. The KZ index is based on the KZ (1997) ordered logit regression and is calculated as $-1.002 * (\text{Cash Flow/Net PPE}) + 0.283 * \text{MB} + 3.139 * (\text{Debt/Total Capital}) + 39.368 * (\text{Total Dividend/Net PPE}) + 1.315 * (\text{Cash/Net PPE})$
AdjRD	Industry-adjusted R&D intensity, measured as the difference between the firm's ratio of R&D expenditure to sales and the median R&D ratios of all the firms in its two-digit SIC industry at the end of the fiscal year immediately preceding the bond issuance, assuming a three-month reporting lag
Control variables	
TA	The book value of total assets (in millions), measured using the latest available fiscal year-end data (with the assumption of a three-month reporting lag). We use the log transformation, ln*TA*, in regressions
LEV	Financial leverage, defined as long-term debt over total assets, measured using the latest available fiscal year-end data (with the assumption of a three-month reporting lag)
ROA	Return on assets, defined as income before extraordinary items divided by total assets, measured using the latest available fiscal year-end data (with the assumption of a three-month reporting lag)
INTCOV	Times interest earned ratio, defined as net income plus interest expenses, divided by interest expenses. This variable is measured using the latest available fiscal year-end data (with the assumption of a three-month reporting lag)
CAPINTEN	Capital intensity, calculated as gross PPE divided by total assets. This variable is measured using the latest available fiscal year-end data (with the assumption of a three-month reporting lag)
STDRET	The annualized standard deviation of the residual daily stock return from the regression of daily stock returns on the value-weighted market return over the year prior to bond issuance
SUBORD	A dummy variable that equals one if the firm has subordinated debt and zero otherwise
PROC	The total amount of proceeds (in millions) received from the issue. If a firm issues multiple bonds in a year, this variable is calculated as the sum of all proceeds. We use the log transformation, ln*PROC*, in regressions
MATUR	The number of years to the maturity of the bond issuance. If a firm issues multiple bonds in a year, this variable is calculated as the weighted average of all *MATUR* values based on each bond's proceeds. We use the log transformation, ln*MATUR*, in regressions
RATING	The S&P credit rating of the bond issue, converted to a numerical scale ranging from 1 (D or SD) to 22 (AAA). If a firm issues multiple bonds in a year, this variable is calculated as the weighted average of all *RATING* values based on each bond's proceeds
BCYCLE	The average yield on Moody's Aaa bonds for the month of issue less the average yield on 30-year U.S. Treasury bonds for the month of issue

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