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Product market relationships and cost of bank loans: evidence from strategic alliances

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Product market relationships and cost of bank loans: evidence from strategic alliances

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Abstract

This paper examines the effects of strategic alliances on non-financial firms' bank loan financing. We construct several measures to capture firms' alliance activities using the frequency of alliance activities, the prominence of the alliance partner and the relative networking position in the overall alliance network. We find that firms with active alliance involvement experience a lower cost of debt from banks. We also document that allying with a prestigious partner (ie S&P 500 firms) can provide an endorsement effect and benefit the borrowers by reducing the price of bank loans. Moreover, a borrowing firm positioned at the centre of an alliance network enjoys a lower cost of bank loans. Finally, we find that borrowing firms with alliance experience are less likely to use collateral and covenants in their loan contracts.

Keywords: cost of bank loans, strategic alliances, product market relationships

JEL classification numbers: G21, G30, D82, D85

Onnistuvatko yritykset pienentämään pankkilainan kustannuksia strategisten liittoutumien avulla?

Suomen Pankin keskustelualoitteita 4/2011

Yiwei Fang – Bill Francis – Iftekhar Hasan – Haizhi Wang
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä empiirisessä työssä tarkastellaan, onnistuvatko rahoitussektorin ulkopuoliset yritykset pienentämään pankkilainoituksen kustannuksia strategisten liittoutumien avulla. Tutkimuksessa yritysten välistä strategista liittoutumista mitataan vaihtoehtoisesti liittoutumispyrkimysten yleisyydellä, yhteistyöosapuolen asemalla ja kunkin osapuolen suhteellisella sijainnilla yhteistyösuhteet kattavassa verkostossa. Tutkimustulosten mukaan yritykset, joilla on aktiivinen yhteistyöverkosto, onnistuvat pienentämään pankkilainan kustannuksia. Tuloksista ilmenee myös, että yhteistyö arvovaltaisen liittolaisen, esimerkiksi S&P 500 -yrityksen, kanssa antaa lainanottajalle myönteistä julkisuutta, mikä puolestaan laskee lainanottajan pankkilainastaan maksamaa korkoa. Lisäksi yhteistyöverkoston keskiössä sijaitsevat yritykset saavat tulosten mukaan lainaa pankista halvemmalla kuin muut. Toisaalta onnistuneiden liittoutumien tapauksessa lainaa hakevien yritysten lainasopimuksissa käytetään keskimäärin vähemmän vakuuksia ja kiinnityksiä.

Avainsanat: pankkilainan kustannukset, strategiset yritysliitot, hyödykemarkkinoiden yrityssuhteet

JEL-luokittelu: G21, G30, D82, D85

Contents

1 Introduction

As an inter-firm organizational form, the importance of strategic alliances in American industry has been increasing sharply (Lerner and Rajan, 2006). Commonly defined as voluntarily initiated organizational agreements between firms, corporate alliances bring together otherwise legally independent firms to share the costs and benefits of a mutually beneficial activity (Chan et al, 1997). Corporate alliances allow the participating firms to gain access to complementary resources and strengthen their competitive positions (Gulati, 1995; Baum et al, 2000). More importantly, strategic alliances provide another important option for firms to grow (Habib and Mella-Barral, 2006; Lindsey, 2008; Robinson, 2008). While a large amount of management literature has explored the patterns, motivations, and benefits for firms entering into alliance agreements (Gulati, 1995; Eisenhardt and Schoonhoven, 1996; Das et al, 1998; Stuart et al, 1999; Lavie and Rosenkope, 2006), knowledge is still scant regarding the financial consequences of corporate alliance activities (Lerner and Rajan, 2006).

The main point of this paper is to investigate whether and to what extent non-financial firms' alliance activities affect their bank financing. We examine several aspects of corporate alliance activities, and relate them to both price and non-price terms of bank loans. We collect a sample of US public firms that received bank loans during 1991 to 2007 from Loan Pricing Corporation's Dealscan database. Relying on the Thomson Financial SDC Platinum (SDC) Joint Ventures database, we identify whether our sample firms engaged in any alliance partnerships within three years prior to the loan initiations. For the borrowers involved in alliances, we trace each pair of the partners and construct several measures to capture the frequency of alliance activities and the prominence of the alliance partners. In addition, borrowing from graph theory, we conduct network analysis and construct measures of sample borrowing firms' relative network position. We investigate the influences of various measures of borrowing firms' alliance activities on the cost of bank loans as well as non-price contractual loan terms.

Consistent with our predictions, we find that firms actively involved in alliance activities experience a significantly lower cost of bank debt compared with the group of firms without any alliance experience. It is plausible that the choices of entering into alliance agreements are endogenously determined and related to certain firm and industry characteristics. Therefore, we use the propensity score-matching method to form a matching sample from both treatment (ie, firms with alliance experience) and non-treatment (ie, firms without alliance experience) groups on a set of observable characteristics to remove the relevant differences. Our main findings based on the above matching sample do not change in a material way. We further look at the prominence of alliance partners, and document that allying with an S&P 500 company is associated with

a lower cost of bank loans. We also find that borrowing firms with alliance experience are less likely to use collateral and covenants in the loan contracts.

Although network analysis is somewhat new to finance literature, it has been well adapted to analyzing the network among venture capitalists (Hochberg et al, 2007), the connection of stocks in the stock markets (Tse et al, 2010), and the social network among top executives (Fracassi and Tate, 2010). Our network measures capture the relative position of a particular firm in the product-market network and yield striking results. Our findings indicate that borrowing firms central to the network receive a lower cost of bank loans. We recognize that our network measures may capture the size effect in the sense that larger firms may participate in more alliances and tend to be at the center of the network. Similarly, our network measures may also capture other firm or industry characteristics. To address this issue, we employ a two-stage regression procedure following Yu (2008). In the first-stage regression, we regress our network measures on firm size, proxy for firm growth opportunity, several industry characteristics, and year dummies. Then we take the residuals from the first-stage regression as alternative measures of alliance network position (ie, residual measures), which represent the network effect that cannot be explained by certain observable firm and industry characteristics. Our findings based on residual measures are quite robust.

We believe our study contributes to the existing literature in several ways. First, our findings manifest a robust link between the product market and the capital market. The existing literature focuses on the strategic aspects of corporate alliances (Gulati et al, 2000). Our paper provides new insights into the financial consequences of the inter-organizational agreements. Second, we emphasize the important role of the corporate network in firms' financial activities (Hochberg et al, 2007; Lindsey, 2008). The inter-firm agreements form a widespread network for participants to share and access crucial information, and the structure of the network also controls and directs the flows of information. Being at the center of the corporate network will increase a firm's visibility and reduce the information asymmetry problem, which consequently lead to a lower cost of bank loans. Third, consistent with the existing research (Stuart et al, 1999), we provide additional evidence that allying with prestigious partners will benefit borrowers in terms of a lower cost of financing.

The rest of this paper is organized as follows. In section 2, we provide a brief review of the related literature. Section 3 details our data-collection and sample-construction procedures as well as our measurements of alliances activities. Section 4 presents our empirical results. Section 5 summarizes and concludes.

2 Literature review

According to the National Bureau of Economic Research (NBER) conference in 2002, corporate alliances can be defined as 'a cooperative agreement between two or more firms, involving substantial investment, and lying between one extreme of full ownership by one firm of the others and the other extreme of a short-term, arm's length contract between the firms' (Lerner and Rajan, 2006). If one thinks of market transactions on a spectrum from 'arm's length' to 'relational', strategic alliances are typically viewed as the latter case. Corporate alliances involve substantial relation-specific investments and long-standing cooperative mechanisms, blurring firms' boundaries through a network of relationships that can be an important source of value (Garvey, 1995; Baker et al, 2002; Gay and Dousset, 2005).

A large amount of management literature has explored the causes and consequences of corporate alliances, providing significant insights into this increasingly important phenomenon. For example, the literature has documented that strategic alliances can be motivated by gaining market power, accessing complementary resources, exploiting firm-specific competencies, or reducing environmental uncertainties (Kogut, 1988; Burgers et al, 1993). By participating in alliance activities, firms can gain advantages such as scale and scope economies and knowledge acquisition, and achieve strategic objectives such as risk sharing and outsourcing part of the value chain (Gulati et al, 2000). Organizational scholars have also emphasized the signaling value of young firms having prominent affiliations to key external resource holders (Podolny, 1993; Podolny et al, 1996; Stuart et al, 1999; Gulati and Higgins, 2003). Much of the research argues that the value that accrues to a firm in an alliance depends not only upon its own endowment, but also on its partners as well as on the social network in which it is embedded (Baum et al, 2000; Das and Teng, 2000; Gulati et al, 2000).

The finance literature has recognized the importance of strategic alliances only in recent years. Among a relatively small number of studies that directly examine the financial consequences of corporate alliances, Chan et al (1997) are the first to document the wealth-creation effects of strategic alliances. Allen and Phillips (2000) investigate block ownership purchasing by corporations and document significant increases in targets' stock prices and operating profitability when such purchases are combined with product–market relationships (ie, strategic alliances). Other research has shown that strategic alliances involving equity stakes can be used as an effective way to deter entrance (Chen and Ross, 2000; Mathews, 2006). The literature also suggests that strategic alliances are the dominant source of external financing for biotech companies to fund their research and development (R&D), especially when public market financing is

diminished (Lerner et al, 2003). Nicholson et al (2005) develop a signaling model of strategic alliances and demonstrate that in an environment with imperfect information, allying with prestigious partners can signal the quality and future growth potential of focal firms, and enable them to receive a substantially higher valuation from venture capitalists and IPO markets. Additionally, another paper by Lindsey (2008) finds that two entrepreneurial firms are more likely to form alliances if they share a common venture capitalist.

While the existing finance literature has explored some issues related to corporate alliances, evidence is still scant with respect to the financial consequences of firms' alliance activities (Lerner and Rajan, 2006). In this study, we empirically investigate the influences of strategic alliances on the price and non-price terms of bank loans, and offer some new insights. There are several reasons why the alliance activities of borrowing firms may affect bank loan financing. First, alliance activities influence firm risk and future cash flows, which will consequently be factored into the loan contracts (Strahan, 1999). Strategic decisions usually involve choices regarding the investment of organizational resources (Schendel and Patton, 1978) given uncertainty about future outcomes (Bettis, 1982). Participating in an alliance agreement can be viewed as buying a valuable option for firms to exercise later (Bodnaruk et al, 2009). The real option adds value to firms engaged in alliance activities (Chan et al, 1997), especially when they operate in industries with significant dynamism. In addition, firms can achieve better performance through synergy gains from economies of scope and scale and enhanced market competitive positions (Kogut, 1988; Baum et al, 2000). Supporting these arguments, some studies (Chan et al, 1997; Johnson and Houston, 2000; Bodnaruk et al, 2009) find a significant and positive market reaction to the announcement of alliances and joint ventures. Consequently, firms actively involved in alliance activities will be less likely to default from creditors' perspective.

Second, strategic alliances can be a source of information that helps to alleviate the asymmetric information problem. Commercial banks rely on their expertise in collecting firm-specific information to address adverse selection and moral hazard (Diamond, 1984; Ramakrishnan and Thakor, 1984). Existing research documents that alliance activities can result in information spillover (Anand and Khanna, 2000; Dessein, 2005; Gomes-Casseres et al, 2006), and increased information flows among firms may well inform potential lenders about the riskiness and future prospects of borrowing firms, thus reducing the adverse selection problem. Moreover, firms frequently involved in alliances are likely to be monitored and disciplined by their partners through reciprocal business interactions (Bodnaruk et al, 2009). Firms are more concerned about building reputation and credit records (Lorenzoni and Lipparini, 1999; Thorelli, 2006), which consequently alleviate the moral hazard problem as well.

The third reason is related to signaling. When information regarding firm quality is not sufficient or cannot be observed directly, firms need to undertake certain activities to alleviate uncertainty, make potential investors aware of firm potential, and convey their superior and private information to the market. Podolny (1993) argues that evaluators and resource holders routinely take into account the characteristics of firm partners as validation of the firm's investment opportunities. To put it another way, borrowers will benefit from having a prestigious partner who can certify the quality of the borrowing firms and thus reduce the cost of external financing. The signaling and certification effects provided by prominent partners have been well established in the finance literature (Carter and Manaster, 1990; Carter et al, 1998; Fang, 2005; Nicholson et al, 2005). In line with the existing literature, we predict that borrowing firms affiliated with prominent partners will be able to obtain a lower cost of bank financing.

Lastly, corporate alliances can bring multiple value-adding network effects to the participating firms (Robinson and Stuart, 2000; Garmaise and Moskowitz, 2003; Allen and Babus, 2008). For example, the alliance network enables firms to access valuable resources not only through their current partnerships but also through past relations or indirect connections (eg, partners' partners). It is plausible that an alliance network among non-financial firms can bridge potential pairs of debtors and creditors, and thus facilitate firms to gain access to cheaper financing resources (Garmaise and Moskowitz, 2003). As another example, alliance networks may serve as an effective governance mechanism (Robinson and Stuart, 2007). A firm will be observed repeatedly and put under the spotlight if it is at the center of the network. Under such circumstances, the firm is less likely to behave opportunistically because non-cooperative activities can be observed and punished.

3 Data and methodology

3.1 Sample selection and dependent measures

We rely on three main databases to construct our sample, namely Dealscan, Compustat, and the SDC Joint Ventures database. Dealscan is our primary source of bank loan information for public firms in the US.[1] Note that bank loans in Dealscan are recorded at both 'deal' level and 'acility' level. Following most studies in the literature, we use a facility as the unit of observation to collect information on price and non-price contractual terms. The loan price recorded as

[1] See Strahan (1999) for a detailed description of the Dealscan database.

all-in spread drawn (AISD) is defined as the mark-up over LIBOR. We also retrieve the non-pricing terms including the usage of collateral and covenants in the loan contracts.

After we obtain our loan sample, we match it with Compustat to obtain borrowers' annual accounting information (Chava and Roberts, 2008).[2] We exclude financial firms (SIC codes 6000–6999) and utility firms (SIC codes 4000–4999). To ensure the accounting variables of a fiscal year can be accurately matched with the calendar date of a loan origination, we adopt the method proposed by Bharath et al (2010). To be specific, for a particular loan made in calendar year t, we use the accounting data of fiscal year t if the loan origination date is 6 months later than the fiscal year ending month; otherwise we use the accounting data of fiscal year t–1. The matching process yields 18,118 loan facilities by 3,783 unique US public firms.

We use the SDC Joint Ventures database to identify the alliance activities of our sample firms in the three-year period preceding loan originations. We focus on various types of alliances including research and development agreements, marketing agreements, manufacturing agreements, supply agreements, licensing agreements, and distribution agreements. To construct measures on the overall alliance network and identify borrowers' relative positions in the network, we keep all the alliance deals during the same three-year window preceding loan originations for the borrowing firms in our sample, regardless of whether the alliance deals are made by the borrowers or not.

3.2 Measuring alliance activities

We focus on a three-year window preceding a particular loan origination and construct several measures to capture the alliance activities of our sample firms. First, we define a dummy variable, which takes the value of one if a borrower has participated in at least one alliance deal during the three-year window, and zero otherwise. Second, we count the number of alliances and take the natural logarithm to normalize the distribution. Third, we define two dummy variables capturing the prominence of a borrowing firm and its alliance partner (Carter et al, 1998; Stuart et al, 1999). More specifically, we add indicators on whether a borrower or its alliance partner is an S&P 500 firm in the three-year window.

[2] We thank Michael Roberts for kindly providing us with the matching list of Dealscan and Compustat.

3.3 Measuring alliance networks

Borrowing from graph theory, we conduct a network analysis to identify an individual borrower's relative position in the alliance network. The advantage of this method lies in its ability to take into consideration the dyadic relationships as well as the overall structure of the interrelated alliance relationships.[3] The first step in measuring a network is to construct an adjacency matrix, the cells of which reflect whether there is a direct tie between each pair of nodes in the network. Moreover, we construct the adjacency matrix on a yearly basis using all the alliance activities in year t-2, year t-1, and year t.[4] For example, the network matrix of year 2007 and related network measures are based on all the alliances formed from 2005 to 2007. Note that both private and public firms involved in the alliances are considered in the matrix construction to obtain a broad network. However, we only measure network characteristics for those public borrowers in our sample. Following previous studies, we measure the following three network characteristics.

3.3.1 Degree centrality

Degree centrality is the most straightforward measure to capture whether a node is in the central position or 'in the thick of things' (Scott, 2000). Degree centrality counts the number of nodes to which a focal node is adjacent. Formally, let $p_{ij} = 1$ if there is one alliance relationship between firm i and j, and $p_{ij} = 0$ otherwise. Then, firm i's degree centrality is measured as $\Sigma_j p_{ij}/n$. Because degree centrality is a function of network size, which varies over time in our data set due to newly formed partnerships, we divide the degree centrality by the maximum possible degrees in an n-actor network to normalize the measure. Intuitively, a larger degree centrality means more partnerships, greater popularity, and greater visibility in our context.

3.3.2 Betweenness centrality

Betweenness centrality captures the extent to which a particular node lies between other nodes and makes pass-through communications within the network. A node with high betweenness centrality is assumed to play an important intermediary role and therefore is central to the network (Freeman, 1979). Firms with great

[3] See Wasseman and Faust (1994) for a detailed introduction to social network analysis.
[4] Normally, the duration of an alliance agreement lasts for three to five years (Pangarkar, 2003). As robustness checks, we also construct our network measures based on one-year and five-year time windows. The results are qualitatively the same.

betweenness centrality can act as ‘brokers’ or ‘gatekeepers’ by bridging potential pairs of firms in the network. Consequently, firms with greater betweenness centrality can exploit more information and are more likely to exercise control over others. Formally, firm i’s betweenness centrality is calculated as the proportion of all the paths linking any two firms that pass through firm i. Similarly, we normalize the measure using the maximum possible betweenness degree in an n-actor network.

3.3.3 Eigenvector centrality

Eigenvector centrality is a more sophisticated criterion to assess the importance of an individual node in the network. This measure considers both the number of connections and the relative importance of the connected nodes based on their degree centrality. Specifically, if we express the centrality of a particular node as the sum of its connections to other nodes weighted by their respective degree centrality, the solution to the system of equations equals the eigenvector associated with the largest eigenvalue of the standardized matrix of the network (Bonacich, 1972; Bonacich, 1987). Eigenvector centrality can be used to proxy the closeness of a particular firm to those firms central to the network. To put it another way, the eigenvector centrality associated with a firm gives a sense of how the firm is connected with other well-connected firms. We normalize the measure by the highest possible eigenvector centrality in an n-actor network.

3.4 Control variables

In addition to our main measures of sample firms’ alliance activities, we enter two sets of control variables into the regression analysis to control for various loan features and firm characteristics that have been documented to be important determinants of loan contracts (Strahan, 1999). We retrieve other loan contractual terms such as loan size, maturity, syndicated loans, and loans with covenants from the Dealscan database. Loan size is measured as the natural logarithm of the dollar amount of a facility. We also use several indicator variables to capture different loan characteristics. Syndication is a dummy that takes the value of one when the loan is syndicated and zero otherwise. Collateral is a dummy variable that takes the value of one when the loan is backed by collateral and zero otherwise. Covenant is a dummy variable that takes the value of one when the loan includes covenants and zero otherwise.

We measure firm size as the natural logarithm of the book value of assets. We measure firm leverage as the total debt divided by the book value of total assets.

We include the market-to-book ratio as a proxy for the growth potential of a particular firm. Himmelberg and Morgan (1995) argue that tangible assets reduce firm opaqueness and thereby increase a firm's access to external capital. To account for asset opaqueness, we include asset tangibility measured as the ratio of tangible assets (ie, net property, plant and equipment net of depreciation plus inventories) to total assets. We control for firm profitability by using the profit margin calculated as the ratio of earnings before interest, taxes, depreciation, and amortization (EBITDA) to the book value of assets. We also calculate the modified Altman's (1968) Z-score for our samples to gauge the likelihood of default for our sample borrowers.

3.5 Sample description and univariate comparison

Table 1 presents the descriptive statistics of the key variables for our final sample. We perform a 98% winsorization of the data to deal with the problem of potential outliers. In Panel A (Table 1), we report summary statistics of the loan characteristics. The mean (median) AISD is 184 bps (175 bps), the mean facility amount is $227 million, and the maturity is 45 months on average. In addition, 88% of our sample loan facilities are syndicated, 67% have covenants, and 75% are secured by collateral.[5]

With respect to the firm characteristics (Panel B of Table 1), our sample firms have an average asset value of $2281 million, an average leverage ratio of 0.29, and an average market-to-book ratio of 1.69. In addition, we report that the modified Altman's (1968) Z-score is 1.93 on average, and the mean credit rating score of the sample borrowers is 2.99. The summary statistics of our sample are generally comparable with other recent studies using LPC bank loan data (Strahan, 1999; Graham et al, 2008; Bharath et al, 2010).

Panel C of Table 1 reports various measures of alliance activities for our sample firms. About 25% of the loans in our sample are granted to borrowers with alliance experience, and the mean frequency of alliance participations is 3.29. Moreover, 36% of the sample borrowers are S&P 500 companies, and 32% have alliance partners that are S&P 500. The relative network positions of the borrowers are measured by degree centrality, betweenness centrality, and eigenvector centrality, the means of which are 0.008, 0.031, and 0.437, respectively.

We conduct univariate comparison tests to examine whether previous alliance experience makes any difference in terms of the cost of bank loans (AISD in

[5] Out of 18,118 observations in our sample, only 13,212 have collateral information in LPC. Following Bharath et al (2009), we treat such loans as unsecured. We also add an indicator (Collateral missing) in the regression analysis if the information on collateral is missing.

logs). We partition our sample into two sub-groups: borrowers with and without alliance experience in the three-year window preceding the loan originations. Table 2 presents comparison tests across different years during our sample period, whereas Table 3 reports similar tests across different industries defined at the 1-digit SIC level. The results are quite consistent in that the sample borrowing firms with alliance experience are associated with a lower cost of bank loans. The difference of 0.398 in the logged AISD is both statistically significant ($p < 0.01$) and economically significant (51 bps) for the entire sample.

4 Empirical results

4.1 The effect of alliance activities on loan pricing

Table 4 presents the regression results relating loan pricing to firms' involvement in the alliance activities. We use an indicator variable to capture whether a borrowing firm has any alliance experience in the 3-year window before a particular loan origination. Column 1 in Table 4 enters the alliance dummy along with a set of variables controlling for various firm characteristics. Column 2 adds a set of variables controlling for different loan features in addition to the alliance dummy, and Column 3 is the full model. For all the model specifications, we use AISD in logs as the dependent variable, and control for year fixed effects and industry fixed effects at the 4-digit SIC level. We also enter the number of lenders and an indicator for missing information about collateral (results not reported). We find consistent results across all the model specifications that those borrowing firms with alliance experience enjoy a lower cost of bank loans ($p < 0.01$). Using model 3 as an example (Column 3 in Table 4), the coefficient of the alliance dummy is -0.0273 ($p < 0.01$), which means, on average, the loan price for firms with alliance experience is 2.73% lower than those for firms without any alliance experience, all else being equal.

With regard to the other control variables, we generally find the results to be consistent with the existing literature (Strahan, 1999). For example, the leverage ratio is positively associated with the loan spread because higher leverage ratios imply reduced debt capacity and a higher likelihood of defaulting. Consequently, borrowing firms with higher leverage usually pay higher interest to obtain bank loans. Additionally, higher asset tangibility and higher profitability are associated with a lower loan spread. The MTB (market-to-book ratio) is a proxy for firm growth potential and is negatively correlated with the loan price. Strahan (1999) argues that growth firms may have more uncertainty since their value depends more on profit growth than on the current cash flow, which indicates a positive relation between the market-to-book ratio and the loan spread. However, Graham

et al (2008) explain that if the tangibility of book assets is controlled, the market-to-book ratio should negatively affect the loan spread because it represents the additional value over book assets that debt holders can access in the event of default. It appears that our finding on MTB is consistent with Graham et al's (2008) argument.

Regarding the variables measuring various loan contractual terms, we find that the loan size (as proxied by the natural logarithm of facility dollar amount) and loan maturity are positively correlated with the loan spread. The presence of collateral is positively correlated with the loan price. It is plausible that collateral is used as a contractual mechanism to mitigate the moral hazard problem and also signal lower credibility of the borrowing firms (Besanko and Thakor, 1987; Bharath et al, 2010). In addition, we find that syndicated loans have a lower loan spread, which is consistent with the risk-sharing motive of banks to provide funds jointly to borrowing firms (Lerner, 1994).

4.2 Endogeneity of the alliance formation – propensity score-matching approach

In observational studies, it can be problematic to make causal inference by simply comparing a treatment group (eg, borrowers with alliance experience) with a non-treatment group (eg, borrowers without alliance experience). Although we have shown that borrowing firms with alliance experience enjoy a low cost of bank loans, we recognize that firms self-selecting into alliance agreements may possess certain characteristics related to low costs of private debt financing. Therefore, the alliance dummy becomes endogenous in the regression model and leads to biased estimations. The propensity score-matching method is especially useful for pairing treatment and non-treatment groups on a set of observable characteristics to remove the relevant differences. As shown by Dehejia and Wahba (2002), the propensity score-matching method provides a natural weighting scheme that yields unbiased estimates of the treating impact. To perform the matching, we employ the propensity score-matching technique described by Heckman et al (1997) and Heckman et al (1998), which has been widely used in recent studies (Drucker and Puri, 2005; Bharath et al, 2010).

The propensity score, the conditional treatment probability of having alliance experience, is estimated through a probit model on a multi-dimensional set of pretreatment characteristics. Building on existing theories and empirical evidence (Kogut, 1988; Burgers et al, 1993), we include firm leverage, market-to-book ratio, asset tangibility, profitability, year fixed effects, and industry fixed effects to calculate the propensity score for each borrowing firm our sample. For each loan facility in the treatment group, we calculate a propensity score and identify n

observations as the nearest neighbors in the non-treatment group. We compare the mean difference of the treatment and control groups based on the propensity score-matching method, and report the results in Table 5. More specifically, for each observation in the treatment group, we perform one-one, one-five and one-ten matches. Across the three types of matching criteria, borrowing firms with alliance experience have a consistently and significantly lower loan spread than the control group.

4.3 The effects of the frequency of alliance activities on loan pricing

We further explore the relation between the frequency of a firm's alliance participation and its cost of bank loans. We use a count measure to gauge the number of alliance deals for a borrowing firm within the 3-year period preceding a particular loan origination, and we also take the natural logarithm of the count to normalize the distribution. Table 6 presents the regression results relating bank loan pricing to the frequency of alliance activities. We use both the count measure (Column 1) and the logged count measure (Column 2) as the dependent variables. In Columns 1 and 2, we report a significantly negative relation between the loan price and the frequency of loan participations ($p < 0.01$). The result in Table 6 indicates that, ceteris paribus, borrowing firms that actively participate in alliances enjoy a lower cost of bank loans.

4.4 The prominence of alliance partners and loan pricing

In this section, we examine whether the prominence of alliance partners can serve as certification to mitigate the asymmetric information problem and help the borrowing firms to obtain a low cost of bank financing. We define an alliance partner as a prominent partner if it is an S&P 500 company within the three-year window, as detailed previously. It is plausible that the borrowing firm has sufficient reputation and the certification effect of the alliance partner will be less important under such circumstances. We thereby define a dummy to indicate whether a particular borrowing firm is an S&P 500 company. In this way, we can separate out the effects of the prominence of the borrowers and their alliance partners.

Table 7 presents the regression analysis relating the loan price to the prominence of alliance partners. The result in Column 1 of Table 7 indicates that allying with an S&P 500 company is associated with a lower loan price, controlling for the other variables. Having an S&P 500 alliance partner will

reduce the loan spread by 5.04% ($p < 0.01$). Consistent with our prediction, the indicator of being an S&P 500 company for the borrowing firm itself is also negatively correlated with the loan price. We then partition our sample according to whether a borrowing firm is an S&P 500 company. Columns 2 and 3 present the results based on two sub-samples. It appears that the indicator of allying with an S&P 500 company is only significant (Column 2 of Table 7) when the borrowing firm is not an S&P 500 company. In other words, if the borrowing firm has sufficient reputation capital at stake, the certification effect of having a reputable partner does not help the borrowing firms to reduce their cost of bank financing further.

4.5 Alliance network positions and loan pricing

Inter-firm alliances establish a network allowing firms to gain access to various resources through a web of relationships. However, crucial resources are not equally available to all the members of the network (Gulati et al, 2000). Rather, resources can be accessed differently depending on how a firm is connected to others in the network. Moreover, the network can function as governance and monitoring mechanisms, but the effectiveness of such mechanisms differs across the network with firms central to the network experiencing a strong disciplinary effect (Robinson and Stuart, 2000; Baker et al, 2002; Robinson, 2008). In this section, we investigate the relation between a firm's relative position in the network and its cost of bank debt. We borrow from the social network literature (Wasserman and Faust, 1994) and employ three measures, namely degree centrality, betweenness centrality, and eigenvector centrality, to gauge the relative network positions of our sample borrowers.

Table 8 presents the regression results relating loan price to the three measures of network positions. It is arguable that a firm's network position may be related to other firm and industry characteristics. For example, a large firm may establish more alliance relations with other firms, and consequently be located central to the network. To address this issue, we follow Yu (2008) to regress three centrality measures on firm size, market-to-book ratio, year fixed effects, and industry-specific factors including marketing competition and technological instability.[6] We then obtain three residual measures as robustness

[6] We obtain market share information from the 1990, 1993, 1997, 1999, 2001, and 2002 editions of Ward's Business Directory, which rank firms by sales within four-digit SIC codes. For each four-digit SIC industry, we calculate the average market share change over a ten-year period as a proxy for market competition. We obtain industry research and development (R&D) expenditures from the National Science Foundation. For each four-digit SIC industry, we regress R&D expenditures on year dummies from 1972 to 2002, and then divide the standard errors of the slope coefficient by the mean industrial R&D expenditures. We use this measure as a proxy for industry-level technology instability (Tosi et al, 1973; Snyder and Glueck, 1982).

checks. The residual measures will reflect the portion of the raw centrality measures that cannot be explained by the abovementioned firm characteristics as well as economy-wide shocks and industry-specific factors.

In Columns 1–3 of Table 8, we enter three raw measures of network centrality, and in Columns 4–6, we enter three residual measures of network centrality. We find that, in general, a borrowing firm central to the network experiences a significantly lower cost of bank loans except for the eigenvector centrality (Columns 4 and 6). The results support the notion that a well-positioned firm will benefit from increased visibility and less information asymmetry. Moreover, centrally located firms are subject to more intense monitoring in the repeated interactions with other firms in the network, and thus have less incentive to behave opportunistically (Larson, 1992; Robinson and Stuart, 2000). Our findings show that both the raw and the residual measures of eigenvector centrality are insignificant in the regressions. Note that degree centrality and betweenness centrality measure how a firm is directly positioned in the network through direct ties with other firms and serves as a bridge to connect other firms, whereas eigenvector centrality measures the closeness of a borrower to those firms central to the network. Our results indicate that the beneficial effects of participation in the alliance network by our sample borrowing firms on the cost of bank loans arise mainly from direct connections in the network but not from indirect connections.

4.6 The effect of alliance activities on the non-price terms of bank loans

In this section, we turn to examine the relation between non-price contractual terms, focusing on the usage of collateral and covenants. Collateral is commonly used in bank loan contracts to alleviate the potential moral hazard problem, reduce the likelihood of misuse of the resources, and serve as a claim against negative consequences. Borrowing firms with poor prospects and necessitating intensive monitoring are more likely to use collateral to pledge external finance (Berger and Udell, 1990; Jimenez et al, 2006). We argue that alliance participation will increase the visibility of borrowing firms and enhance mutual monitoring and governance (Nicholson et al, 2005), and hypothesize that the likelihood of using collateral should be less for firms with alliance involvement, controlling all other things.

Column 1 of Table 9 presents the regression result based on a probit model linking the usage of collateral in the loan contracts to borrowing firms' alliance experience. The dependent variable is an indicator of whether collateral is required in a particular loan contract, and we exclude those loan observations that

do not explicitly specify terms about collateral. We control for other firm characteristics and several loan features in the regression analysis along with year fixed effects and industry fixed effects. We find a negative relation between the usage of collateral in loan contracts and borrowing firms' alliance experience ($p < 0.1$). Column 2 reports the marginal effects of those variables used in the probit model, which indicates that previous alliance experience of the sample borrowing firms reduces the likelihood of using collateral by 1.6%, all else being equal.

We also examine the effect of previous alliance experience on the usage of covenants in loan contracts. The presence of covenant provisions puts restrictions on firm behaviors to protect the claims of debt holders (ie, bank lenders), and the number of covenants generally increases with the need for monitoring (Rajan and Winton, 1995). Following Bradley and Roberts (2004), we construct three covenant indexes to capture the usage of covenants in loan contracts. To be specific, overall covenant intensity is the sum of general and financial covenants; general covenant intensity is the total number of general covenants; financial covenant intensity is the total number of financial covenants.

Columns 3–5 (Table 9) report the regression results using overall covenant intensity, general covenant intensity, and financial covenant intensity as dependent variables, respectively. Because these three measures are non-negative count variables, Poisson regression is used to conduct the analysis with the indicator of previous alliance experience being the main explanatory variable. We find that the alliance dummy is significantly negative in all three regression models. The results indicate that banks impose fewer covenants in the loan contracts for borrowers with previous alliance experience.

5 Conclusion

With increased competition in the product market, the collaborations among non-financial firms have increased sharply during the past three decades. Strategic alliances as an inter-firm organizational form not only allow the participating firms to gain a broad array of resources, but also create a network to allow information to diffuse rapidly. A well-connected firm in the network can enhance its visibility, and thus reduce the information asymmetry with potential lenders and other stakeholders in the markets. Furthermore, it is less likely for a firm to behave opportunistically if the focal firm repeatedly engages in alliance activities with many other partners. The corporate finance literature has increasingly recognized the importance of strategic alliances (Lerner and Rajan, 2006). Our paper adds to the literature some new evidence and insights regarding the financial consequences of such inter-firm collaborations.

We investigate whether borrowing firms' alliance activities may affect the price and non-price terms of bank loan contracts. Our research establishes a robust link between product-market relationships and non-financial firms' activities in the financial markets. We document that borrowing firms actively involved in alliance activities experience a low cost of bank loans. We also take the necessary steps to address the endogeneity issue using the propensity score-matching method, and our results are robust to this specification. Borrowing from graph theory and building on the existing literature, we measure the relative positions of our sample firms in the alliance network, and the network analysis yields striking findings. We report that, in general, firms central to the network enjoy a low cost of bank loans. Moreover, we construct residual measures to gauge the portion of network effects that cannot be explained by firm and industry characteristics and find consistent results.

Tables 1–9

Table 1. **Summary statistics**

Table 1 presents the summary statistics of our sample. See the Appendix for a detailed description of variable definitions.

Variable name	N	Mean	Median	St. Dev	Min	25th Percentile	75th Percentile	Max
Panel A: Loan Characteristics								
AISD	18,118	183.907	175.000	118.880	17.500	80.000	255.000	650.000
Facility amount ($millions)	18,118	226.553	100.000	358.793	1.000	25.000	250.000	2550.000
Maturity (in months)	18,118	44.694	48.000	22.936	4.000	24.000	60.000	122.000
Lender number	18,108	7.330	4.000	8.376	1.000	1.000	10.000	141.000
Collateral	13,212	0.750	1.000	0.433	0.000	1.000	1.000	1.000
Syndication	17,594	0.880	1.000	0.325	0.000	1.000	1.000	1.000
Covenant	18,118	0.672	1.000	0.470	0.000	0.000	1.000	1.000
Overall covenant intensity	18,118	4.924	5.000	4.283	0.000	0.000	9.000	15.000
General covenant intensity	18,118	3.283	3.000	3.136	0.000	0.000	7.000	8.000
Financial covenant intensity	18,118	1.642	2.000	1.580	0.000	0.000	3.000	7.000
Panel B: Firm Characteristics								
Asset	18,118	2281.895	483.795	5646.220	4.921	135.194	1781.972	107949.000
Leverage	18,118	0.294	0.281	0.196	0.000	0.147	0.417	0.997
MTB	18,118	1.692	1.437	0.860	0.686	1.132	1.949	6.618
Tangibility	18,118	0.306	0.255	0.216	0.001	0.138	0.434	0.903
Profitability	18,118	0.142	0.134	0.070	0.000	0.095	0.180	0.421
Z-score	17,302	1.931	1.891	1.315	-26.796	1.223	2.623	16.650
Rating score	18,118	2.988	0.000	3.166	0.000	0.000	6.000	10.000
Panel C: Alliance Measures								
Alliance dummy	18,118	0.246	0.000	0.431	0.000	0.000	0.000	1.000
Alliance number	4,424	3.209	2.000	4.505	1.000	1.000	3.000	47.000
Partner S&P500	4,424	0.321	0.000	0.467	0.000	0.000	1.000	1.000
Borrower S&P500	4,424	0.358	0.000	0.480	0.000	0.000	1.000	1.000
Degree	4,424	0.008	0.004	0.015	0.001	0.002	0.009	0.621
Betweenness	4,424	0.031	0.000	0.123	0.000	0.000	0.017	2.926
Eigenvector	4,424	0.437	0.000	1.818	0.000	0.000	0.032	33.257

Table 2. **Sample distribution and comparison tests across different years**

Table 2 reports the sample distribution across different years. Our sample consists of US public firms that obtained bank loans between 1991 and 2007 as recorded in Dealscan database. We partition our sample into two subsamples based on whether the borrowers have participated in at least one alliance deal during three years prior to starting date of the loan facility. This table also reports the mean AISD (in logs) for each subsample and the comparison tests (t-test) across different years. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Year	Subsample for Borrowers with Alliance Experience		Subsample for Borrowers without Alliance Experience		Difference of AISD in Logs
	N	Log AISD	N	Log AISD	*t*-test
1991	53	5.195	462	5.195	0.067
1992	100	4.885	530	5.163	0.278***
1993	158	4.599	612	5.121	0.522***
1994	257	4.516	802	4.923	0.407***
1995	244	4.538	720	4.850	0.312***
1996	287	4.641	928	4.968	0.327***
1997	348	4.486	1,231	4.912	0.427***
1998	333	4.748	964	5.017	0.269***
1999	280	4.826	927	5.194	0.368***
2000	370	4.697	815	5.116	0.419***
2001	393	4.619	755	5.157	0.538***
2002	362	4.695	774	5.220	0.526***
2003	337	4.789	776	5.252	0.463***
2004	254	4.549	904	5.094	0.545***
2005	256	4.631	911	4.940	0.309***
2006	218	4.548	762	4.871	0.324***
2007	216	4.510	779	4.953	0.443***
Total	4,466	4.647	13,652	5.045	0.398***

Table 3. **Sample distribution and comparison tests across different industries**

Table 3 reports the sample distribution across different industries. Our sample consists of US public firms that obtained bank loans between 1991 and 2007 as recorded in Dealscan database. We partition our sample into two subsamples based on whether the borrowers have participated in at least one alliance deal during three years prior to starting date of the loan facility. This table also reports the mean AISD (in logs) for each subsample and the comparison tests (t-test) across different industries. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

SIC	Subsample for borrowers with Alliance Experience		Subsample for borrowers without Alliance Experience		Difference of AISD in Logs
	N	Log AISD	N	Log AISD	*t*-test
1000-1999	297	4.773	1,224	5.025	0.252***
2000-2999	1,032	4.312	2,635	4.865	0.553***
3000-3999	1,619	4.630	4,521	5.071	0.441***
5000-5999	610	4.680	2,721	5.017	0.338***
7000-7999	652	4.947	1,574	5.189	0.242***
8000-8999	256	5.117	977	5.280	0.163***
Total	4,466	4.647	13,652	5.045	0.398***

Table 4. **Regression relating loan spread to alliance experience**

Table 4 provides the OLS regression relating cost of bank loans to our sample firms' alliance experience three-year prior to the starting date of loan facilities. The dependent variable is all-in spread drawn (AISD) in logs. The main explanatory variable is an indicator of alliance experience, which takes the value one if a sample firm has participated in at least on alliance deal three-year prior to the starting date of a particular loan facility, and zero otherwise. We control for various firm-specific and loan-specific characteristics, and include industry fixed effects at 4-digit SIC level and year fixed effects for all model specifications. We include an indicator variable to capture missing information of collateral and the number of lenders in all model specifications (results not reported). Robust t-statistics are reported in parenthesis. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Independent Variables	Dependent Variable: AISD in Logs		
	(1)	(2)	(3)
Alliance dummy	-0.0388***	-0.1041***	-0.0273***
	(-3.4787)	(-9.6183)	(-2.6689)
Firm characteristics			
Log (asset)	-0.2690***		-0.1596***
	(-68.1194)		(-29.2105)
MTB	-0.0854***		-0.0648***
	(-13.2078)		(-10.6777)
Leverage	0.9340***		0.6935***
	(32.5601)		(26.3248)
Tangibility	-0.3569***		-0.2677***
	(-10.1754)		(-8.4617)
Profitability	-1.5001***		-1.1267***
	(-16.2588)		(-13.7115)
Z-score	-0.0550***		-0.0387***
	(-8.0507)		(-6.9962)
Rating score	-0.0145***		-0.0130***
	(-7.2871)		(-7.1842)
Loan characteristics			
Log (facility amount)		-0.1799***	-0.0665***
		(-38.4962)	(-12.1017)
Log (maturity)		0.0971***	0.0630***
		(12.5781)	(8.6598)
Collateral		0.7465***	0.5618***
		(60.6929)	(45.2116)
Syndication		0.0346**	-0.0099
		(2.2178)	(-0.6608)
Covenant		-0.0043	-0.0195*
		(-0.3459)	(-1.7031)
Constant	6.8580***	5.0338***	5.9099***
	(177.6279)	(123.7576)	(120.8971)
Year fixed effects	YES	YES	YES
Industry fixed effects	YES	YES	YES
N	17,302	17,584	16,802
Adjusted R-squared	0.5622	0.5628	0.6380

Table 5. **Effect of alliance on loan spread-propensity score match estimation**

This table reports the average difference in loan spread of borrowers with alliances activities and borrowers without alliance activities. To examine mean AISD spread differences, we control for various borrower and lender characteristics: we compute propensity scores using the following probit model:

$$\text{Alliance} = \beta_0 + \Sigma\beta_i(\text{Borrewer\_Characteristicsi}) + \Sigma\beta_k(\text{Controls}_k)$$

The dependent variable is Alliance, a dummy variable that equals one if the borrower has participated in any alliance during the past 3 years before the present loan, and 0 otherwise. The borrower characteristics include log of assets, profitability, tangibility, leverage, market to book ratio, and credit rating scores. Other controls include industry fixed effects at four-digit SIC code level and year fixed effects. To search for the matching firm(s), we use the NEAREST NEIGHBOR estimator. For each alliance loan, we obtain the n non-alliance loans with closest propensity scores and use the arithmetic average of AISD for these n non-alliance loans. We use n = 1, n = 10 and n = 50. For all matching methods, we present the sample averages of treated and control groups. Difference in log AISD is also reported with standard errors and t-statistics. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Estimator	Treated Group	Control Group	Difference in Log AISD	Standard Error	*t*-statistic
Nearest neighbor (1 to 1 match)	4.647	4.718	-0.071**	0.026	-2.700
Nearest neighbor (1 to 10 match)	4.647	4.790	-0.143***	0.017	-8.350
Nearest neighbor (1 to 50 match)	4.647	4.799	-0.153***	0.016	-9.420

Table 6. **The effect of alliance frequency on loan spread**

This table provides the OLS regression relating cost of bank loans and alliance frequency. The dependent variable is log AISD (all-in spread drawn). Alliance frequency is measured as the number of alliance the borrower participated during the three years before loan facility starting date. Column 1 reports the regression with the raw number of alliances as the proxy for alliance frequency. Column 2 uses the logarithm of alliance number. We control various firm- and loan characteristics. Variable definitions are reported in Appendix. We control for various firm-specific and loan-specific characteristics, and include industry fixed effects at 4-digit SIC level and year fixed effects for all model specifications. Collateral missing dummy and number of lenders are included in the regressions but not reported. Robust t-statistics are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Independent Variables	Dependent Variable: AISD in Logs	
	(1)	(2)
Alliance number	-0.0080***	
	(-3.6235)	
Alliance number in log		-0.0610***
		(-3.6198)
Firm characteristics		
Log (asset)	-0.1525***	-0.1507***
	(-12.5571)	(-12.4497)
MTB	-0.0953***	-0.0945***
	(-8.3070)	(-8.2418)
Leverage	0.7918***	0.7897***
	(12.8989)	(12.8166)
Tangibility	-0.1970**	-0.1975**
	(-2.2991)	(-2.2963)
Profitability	-1.1005***	-1.1079***
	(-6.2033)	(-6.2329)
Z-score	-0.0262***	-0.0269***
	(-2.6226)	(-2.6476)
Rating score	-0.0170***	-0.0171***
	(-4.2570)	(-4.2866)
Loan characteristics		
Log (facility amount)	-0.0702***	-0.0702***
	(-5.4607)	(-5.4590)
Log (maturity)	0.0645***	0.0643***
	(4.7922)	(4.7690)
Collateral	0.6012***	0.5998***
	(22.8390)	(22.7814)
Syndication	-0.0874**	-0.0870**
	(-2.1973)	(-2.1859)
Covenant	0.0615***	0.0621***
	(2.7087)	(2.7365)
Constant	6.0016***	6.0401***
	(51.3234)	(51.6391)
Year fixed effects	YES	YES
Industry fixed effects	YES	YES
N	4,124	4,124
Adjusted R-squared	0.7184	0.7185

Table 7. **Effect of partner prominence on bank loan spread**

This table presents regression results relating cost of bank loans and alliance partner prominence. The dependent variable is log AISD (all-in spread drawn). We use S&P 500 to proxy the prominence of the borrower and its partner. "Partner S&P500" equals to one if the firm has a partner ranked in S&P500, zero otherwise. "Borrower S&P500" equals to one if the firm is ranked in S&P500, zero otherwise. Column 1 reports the regression based on the entire sample. Column 2 reports the regression for the subsample where the borrowers are not S&P500. And Column 3 reports the regression for the subsample where the borrowers themselves are S&P500. We control for various firm-level and loan-level characteristics. Variable definitions and measures are reported in Appendix. We control for various firm-specific and loan-specific characteristics, and include industry fixed effects at 4-digit SIC level and year fixed effects for all model specifications. Collateral missing dummy and number of lenders are included in the regressions but not reported here. Robust t-statistics are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Independent Variables	Dependent Variable: AISD in Logs		
	Entire Sample	Subsample Borrower S&P500=0	Subsample Borrower S&P500=1
	(1)	(2)	(3)
Partner S&P500	-0.0504***	-0.0937***	-0.0172
	(-2.6378)	(-3.5508)	(-0.6234)
Borrower S&P500	-0.2683***		
	(-8.3028)		
Firm characteristics			
Log (asset)	-0.1030***	-0.1102***	-0.1326***
	(-7.9024)	(-7.2451)	(-4.7769)
MTB	-0.0860***	-0.0430***	-0.1489***
	(-7.6304)	(-3.3896)	(-6.2945)
Leverage	0.7482***	0.6811***	0.8791***
	(12.3566)	(10.5467)	(5.8668)
Tangibility	-0.1788**	-0.2640***	-0.0311
	(-2.1155)	(-2.5968)	(-0.1626)
Profitability	-1.1162***	-0.9868***	-1.2915***
	(-6.4991)	(-5.2372)	(-3.0844)
Z-score	-0.0251***	-0.0180**	-0.0859**
	(-2.7484)	(-2.0963)	(-2.3800)
Rating score	-0.0130***	-0.0018	-0.0437***
	(-3.2360)	(-0.3812)	(-4.0855)
Loan characteristics			
Log (facility amount)	-0.0779***	-0.0634***	-0.1046***
	(-6.1782)	(-4.3836)	(-4.7631)
Log (maturity)	0.0607***	0.0269	0.0559***
	(4.5834)	(1.5358)	(3.0372)
Collateral	0.5911***	0.5505***	0.7566***
	(22.5422)	(17.7598)	(12.1732)
Syndication	-0.1109***	-0.1347***	0.1352
	(-2.8572)	(-3.4440)	(0.4662)
Covenant	0.0635***	-0.0556**	0.1024***
	(2.8512)	(-2.0245)	(2.7226)
Constant	5.8336***	5.9833***	5.8935***
	(50.1375)	(45.8351)	(15.0101)
Year fixed effects	YES	YES	YES
Industry fixed effects	YES	YES	YES
N	4,165	2,654	1,511
Adjusted R-squared	0.7182	0.5876	0.7043

Table 8. **Effect of alliance network centrality on bank loan spread**

This table represents regression results relating bank loan spread and the dominance position of alliance networks. The dependent variable is log AISD (all-in spread drawn). The main explanatory variables are firms' relative network positions, measured using three centrality measurements: 'Degree', 'Betweenness', and 'Eigenvector'. Columns 1–3 report the raw network measures and Columns 4–6 report the residual network measures, which are obtained from regressing raw network measures on a group of firm and industry-level characteristics. Variable definitions and measures are reported in Appendix. We control for various firm-specific and loan-specific characteristics, and include industry fixed effects at 4-digit SIC level and year fixed effects for all model specifications. Collateral missing dummy and number of lenders are included in the regressions but not reported here. Robust t-statistics are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Independent Variables	Dependent Variable: AISD in Logs					
	Raw Network measures			Residual network measures		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Degree	-1.5953*			-1.4868*		
	(-1.7909)			(-1.7130)		
Betweenness		-0.1479**			-0.1453**	
		(-2.0609)			(-2.0213)	
Eigenvector			0.0019			0.0005
			(0.4159)			(0.1110)
Firm characteristics						
Log (asset)	-0.1572***	-0.1590***	-0.1633***	-0.1550***	-0.1553***	-0.1568***
	(-12.8598)	(-13.1940)	(-13.4688)	(-12.5596)	(-12.5786)	(-12.6177)
MTB	-0.0953***	-0.0956***	-0.0956***	-0.0920***	-0.0915***	-0.0905***
	(-8.2980)	(-8.3037)	(-8.3079)	(-7.8600)	(-7.8250)	(-7.7658)
Leverage	0.7997***	0.8001***	0.8056***	0.7909***	0.7907***	0.7954***
	(12.9944)	(13.0176)	(13.0834)	(12.5615)	(12.5688)	(12.6197)
Tangibility	-0.1936**	-0.1936**	-0.1881**	-0.2204**	-0.2210**	-0.2162**
	(-2.2582)	(-2.2587)	(-2.1933)	(-2.4423)	(-2.4500)	(-2.3954)
Profitability	-1.1064***	-1.1069***	-1.1149***	-1.1643***	-1.1638***	-1.1711***
	(-6.2262)	(-6.2262)	(-6.2638)	(-6.4414)	(-6.4351)	(-6.4703)
Z-score	-0.0265***	-0.0262***	-0.0261***	-0.0257**	-0.0255**	-0.0254**
	(-2.6236)	(-2.6096)	(-2.5830)	(-2.5628)	(-2.5557)	(-2.5275)
Rating score	-0.0170***	-0.0169***	-0.0168***	-0.0170***	-0.0169***	-0.0169***
	(-4.2584)	(-4.2206)	(-4.2008)	(-4.1826)	(-4.1522)	(-4.1402)
Loan characteristics						
Log (facility amount)	-0.0707***	-0.0701***	-0.0705***	-0.0730***	-0.0725***	-0.0729***
	(-5.4968)	(-5.4523)	(-5.4846)	(-5.4648)	(-5.4260)	(-5.4467)
Log (maturity)	0.0663***	0.0658***	0.0665***	0.0653***	0.0649***	0.0656***
	(4.9172)	(4.8773)	(4.9228)	(4.6908)	(4.6579)	(4.6996)
Collateral	0.5996***	0.6010***	0.5996***	0.6001***	0.6015***	0.6003***
	(22.7680)	(22.7843)	(22.7242)	(21.9120)	(21.9332)	(21.8845)
Syndication	-0.0832**	-0.0843**	-0.0840**	-0.0963**	-0.0974**	-0.0974**
	(-2.0860)	(-2.1161)	(-2.1017)	(-2.3794)	(-2.4094)	(-2.4004)
Covenant	0.0632***	0.0621***	0.0621***	0.0625***	0.0616***	0.0617***
	(2.7773)	(2.7320)	(2.7286)	(2.6344)	(2.5933)	(2.5968)
Constant	6.0847***	6.0358***	6.0396***	6.0239***	6.0349***	6.0256***
	(51.0941)	(51.7720)	(51.8735)	(50.5631)	(51.0835)	(51.0780)
Year fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
N	4,124	4,124	4,124	3,896	3,896	3,896
Adjusted R-squared	0.7180	0.7178	0.7175	0.7145	0.7144	0.7141

Table 9. **Effect of alliance on other loan contract terms**

This table represents regression results relating alliance dummy and two loan contract terms: collateral and loan maturity. Collateral is a dummy variable, capturing whether the loan is secured by collateral. Column 1 reports the probit estimation of the probability of pledging collateral. Column 2 reports the marginal effect of the probit estimators. Column 3–5 are Poisson regressions with three covenant intensity indexes as dependent variables. We control for various firm-level and loan-level characteristics. Variable definitions and measures are reported in Appendix. We control for various firm-specific and loan-specific characteristics, and include industry fixed effects at 4-digit SIC level and year fixed effects for all model specifications. Robust t-statistics are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Independent Variable	Dependent Variables				
	Collateral	Collateral	Overall	General	Financial
	(1)	(2)	(3)	(4)	(5)
Alliance dummy	-0.0656*	-0.0160*	-0.0364***	-0.0358**	-0.0374**
	(-1.6853)	(-1.6853)	(-2.7826)	(-2.4406)	(-2.4227)
Firm characteristics					
Log (asset)	-0.4396***	-0.1055***	-0.0413***	-0.0180**	-0.0885***
	(-18.9182)	(-18.9182)	(-6.1811)	(-2.3867)	(-11.4047)
MTB	-0.0858***	-0.0206***	-0.0363***	-0.0444***	-0.0225**
	(-3.7322)	(-3.7322)	(-4.6376)	(-4.8066)	(-2.5043)
Leverage	2.0847***	0.5001***	0.1524***	0.2105***	0.0316
	(17.5031)	(17.5031)	(4.7809)	(5.7315)	(0.8212)
Tangibility	-1.0864***	-0.2606***	-0.0534	-0.1278***	0.0791*
	(-7.7767)	(-7.7767)	(-1.2801)	(-2.6467)	(1.6661)
Profitability	-2.2545***	-0.5408***	0.4777***	0.5121***	0.4118***
	(-6.5630)	(-6.5630)	(4.8377)	(4.3493)	(3.4729)
Z-score	-0.2061***	-0.0494***	-0.0045	-0.0209***	0.0278***
	(-7.8120)	(-7.8120)	(-0.8799)	(-3.1062)	(4.0128)
Rating score	0.0035	0.0008	-0.0017	0.0018	-0.0077***
	(0.5124)	(0.5124)	(-0.7671)	(0.7490)	(-2.8387)
Loan characteristics					
Log (facility amount)	-0.1619***	-0.0388***	0.0695***	0.0908***	0.0282***
	(-7.4254)	(-7.4254)	(10.7278)	(12.1657)	(3.7573)
Log (maturity)	0.4035***	0.0968***	0.1300***	0.1399***	0.1140***
	(15.1429)	(15.1429)	(13.1673)	(12.1360)	(10.2457)
Collateral	/	/	0.2121***	0.3093***	0.0182
	/	/	(15.6451)	(19.6956)	(1.1510)
Syndication	0.2587***	0.0680***	0.6564***	1.0577***	0.1901***
	(3.9167)	(3.9167)	(25.2355)	(24.5692)	(7.3983)
Covenant	-0.0172	-0.0041	/	/	/
	(-0.3332)	(-0.3332)	/	/	/
Constant	3.4062***	/	-4.9035***	-5.9650***	-5.0636***
	(10.7809)	/	(-9.1270)	(-10.1448)	(-5.0377)
Year fixed effects	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES
N	11,982	11,982	16,812	16,812	16,812
Pseudo R-squared	0.357	0.357	0.257	0.201	0.276

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Appendix

Measures and variable definitions

Variables	Variable Definitions
	Panel A: Firm Characteristics[7]
Asset	Total asset: (data6)
Leverage	Total debts including long-term debt and short term debt over firm book assets: (data34+data9)/data6
MTB	Raito of market value of the firm over book value of assets:(data6-data60+data25*data199)/data6
Tangibility	Net property, plant, and equipment plus inventories over asset: data8/data6
Profitability	EBITDA over total assets: data13/data6
Z-score	Modified Altman's (1968) Z-score 1⁄4 (1.2 working capital+1.4 retained earnings+3.3 EBIT+0.999sales)/total assets 1⁄4 (1.2 data179+1.4data36+3.3data170+0.999data12)/ data6.
Rating score	We assign an Aaa rating a value of 10, a Aa rating a value of 9, a A rating a value of 8, a Bbb rating a value of 7, a Bb rating a value of 6, a B rating a value of 5, a Ccc rating a value of 4, a Cc rating a value of 3, a C rating a value of 2, a D class rating a value of 1, and 0 for not-rated firms.
Partner S&P500	Dummy variable equal to one if a borrowing firm has allied with an S&P500 firm during 3 years preceding the loan origination, zero otherwise
Borrower S&P500	Dummy variable equal to one if a borrowing firm itself has been ranked as S&P500 during 3 years preceding the loan origination, zero otherwise
	Panel B: Loan Characteristics
AISD	All in spread drawn obtained from Dealscan, it is defined as the loan spread over LIBOR at the time of the loan origination
Facility amount	Loan facility amount, measured in million dollars
Maturity	Loan maturity measured in months
Collateral	Dummy variable equals to one if the loan is secured by collaterals, zero otherwise
Syndication	Dummy variable equal to one if the loan is syndicated, zero otherwise
Covenants	Dummy variable equal to one if the loan is combined with any covenants, zero otherwise
Covenant intensity	total number of covenants included in the loan contract
General covenants intensity	total number of general covenants in the loan contract
Financial covenants intensity	total number of financial covenants in the loan contract
Lender number	total number of lenders in a loan facility
	Panel C: Alliance Measures[8]
Alliance dummy	Dummy variable equal to one if the firm has at least one alliance during 3 years before loan origination, zero otherwise
Alliance number	Number of alliances a firm has during 3 years before loan origination
Degree centrality	A ratio of actual alliance linkages over the maximum linkages the firm could have during three years before loan origination
Betweenness centrality	Proportion of shortest paths between other firms in the alliance network that must pass through a focal firm
Eigenvector centrality	The eigenvector associated with the largest eigenvalue of the standardized matrix of the network, it captures the extent to which a firm is connected with other well-networked firms.

[7] All data times are from Compustat annual industry data file.

[8] Degree, betweenness, and eigenvector measures are normalized values.

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