Multiple-Bank Relationships and Corporate Risk Management

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Abstract

The higher the debt ratio of a corporation, the higher its level of distress risk and the stronger its risk-shifting incentives will be. Hence, the manner in which lending banks, as creditors, play their monitoring role to mitigate this agency problem between shareholders and credit-holders becomes an important issue. Using a set of listed non-financial firms in Taiwan from 2005 to 2009, we examine the monitoring mechanism of multiple-bank relationships on corporate hedging strategies and find that for financially distressed firms, a higher number and a more divergent group of lending banks leads to more effective monitoring from these banks; this monitoring pressures the borrowing firms to pursue stronger hedging strategies that mitigate their risk-shifting incentives and protect creditors' wealth. Additionally, the association between the number of lending banks and the hedging strategies of borrowing firms with high distress risk is stronger for younger firms and for firms with more growth opportunity and less profitability. Finally, for healthy firms, the greater the number of foreign lending banks, the more effective the monitoring will be in forcing them to enhance the extent of their hedging.

Keywords: Multiple-bank lending, Monitoring, hedging, risk-shifting, risk management

JEL classification: G21, G32

1. Introduction

Bank relationships become a critical issue for corporations as they are selecting investment projects and moving toward financing decisions. A sound relationship with banks, in general, can assist by easing financial pressure to certain degree and may further support and advance business operations. (Ongena and Smith, 2000; Shen and Wang, 2004) The benefits of a long-term relationship with a single bank are an increase in credit availability (Elsas and Krahnen, 1988; Petersen and Rajan, 1994) and a reduction in both funding costs (Berger and Udell, 1995) and collateral requirements (Berger and Udell, 1995; Degryse and van Cayseele, 2000; Harhoff and Körting, 1998). Repeated borrowing allows the bank to threaten to cut future lending. The literature regarding relationships with banks mostly discusses it from the perspective of borrowing firms; there is less discussion regarding the preference between a single bank or a multiple-bank relationship with lending banks.

Boot and Thakor (2000) emphasize the monitoring role of banks in their relationship with borrowers, yet there is no consensus on the most appropriate number of monitors. According to the theory of financial intermediation, if banks could expand infinitely and achieve fully diversified portfolios, an exclusive bank-firm relationship involving a single monitor would be optimal because it would avoid free-riding problems and duplication of monitoring efforts (Allen, 1990; Diamond, 1984; Ramakrishnan and Thakor, 1984). However, in reality, banks are of a finite size, and exclusive bank-firm relationships are rarely observed. (Detragiache et al., 2000; Farinha and Santos, 2002; Petersen and Rajan, 1994). These empirical observations raise a number of important questions. If monitoring is one of the main functions of banks, why should banks share firm financing if it diminishes their monitoring role? Does multiple-bank lending entail some previously unnoticed benefits in terms of banks' incentives to monitor? These questions are of particular importance in contexts where monitoring is essential due to information opacity and the need to process soft information, such as in small- and medium-sized or highly risky business lending (Carletti et al., 2007; Cole et al., 2004).

The aforementioned theories do not explain how multiple bank loans influence the incentives of bank monitoring nor do they explain the link between multiple bank loans and the effectiveness of bank monitoring. Carletti et al. (2007) were the first to develop a static model to provide a new explanation for multiple bank loans. They show that multiple-bank lending results from a tradeoff between the benefits of risk diversification (sharing) and the costs of free-riding and duplication of effort. Their model predicts that multiple-bank lending is optimal when firms and banks are subject to moral hazard and monitoring is essential. In line with this argument, when a highly leveraged or distressed borrowing firm has extra financial needs, its primary lending bank has an incentive to share lending and thus will urge the borrowing firm to develop multiple bank relationships. Extending Carletti et al. (2007), we study the effect of lending bank structures on the risk management policies of borrowing companies to examine the monitoring effectiveness of the multiple-bank relationship.

Debt financing engenders the agency problem of risk-shifting[3]. Recent studies provide strong evidence of the effect of risk-shifting on corporate hedging and investment decisions for distressed firms (Eisdorfer, 2008; Purnanandam, 2008)[4]. Based on the financial intermediation theory, Lookman (2009) suggests that banks have a comparative advantage over non-bank lenders in information collection and integration, which make them a better party to monitor firm operations as well as to prevent risk-shifting behavior. Lookman (2009) argues that banks use hedging covenants as a channel for risk mitigation, with explicit requirements for hedging being more common for larger loans. Additionally, Campello et al. (2011) and Chen and King (2014) confirm that hedging firms face a lower cost of debt than non-hedging firms; this reveals that corporate hedging is a channel for obtaining better loan conditions. Further, the lower costs are to monitor the borrowing firms, the lower the loan spreads offered by lending banks (Datta et al., 1999). Hence, the risk-shifting behavior in the hedging activities of borrowing firms provide us with a good setting to investigate the monitoring effectiveness of lending banks. In contrast to Lookman (2009), which emphasizes monitoring effectiveness from the perspective

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[3] Risk shifting arises from the agency problem in debt financing in which equity holders have an incentive to expropriate the wealth of debt holders by transferring risk to them (Jensen and Meckling, 1976)

[4] The results of Purnanandam (2008) reveal that a firm's hedge ratio is a concave function of the leverage ratio, i.e., the leverage ratio is positively related and the square term of the leverage ratio is negatively correlated with the hedge ratio. Eisdorfer (2008) investigates the impact of risk-shifting on the relationship between return volatility and capital expenditures. His results show that the relationship between investment and return volatility is mostly positive in distressed firms and negative in non-distressed ones.

of different types of lenders, we focus on the association between the structure of lending banks and firms' hedging strategies (including risk-shifting behavior).

The findings of the positive relationship between bank loan ratios and corporate hedging in highly leveraged firms in Lookman (2009) may be due to two possibilities when taking into account the lending bank structure. One possibility is that if the loan mix is mainly provided by the primary bank, according to financial intermediation theories, information asymmetry between the single bank and the borrowing firm would be at its lowest and monitoring should be optimal. As the risk for the borrowing firm increases, the monitoring from the primary bank will also increase; thus, the borrowing firm will be pressured to improve its risk management activities. The other possible explanation conforms to the viewpoint of Carletti et al. (2007). When risk increases for a borrowing firm, it will develop relationships with multiple banks; these other banks know that this borrowing firm cannot receive any more funds from its main bank and will be aware of the higher risk of this borrowing firm. Therefore, the banks will increase their monitoring of the borrowing firm. As such, a higher bank loan ratio indicates a greater number of lending banks and stricter monitoring by these banks. Thus, free-riding and duplication of monitoring efforts will decrease. It is still unknown whether a single-bank relationship or a multiple-bank relationship will provide stricter and more effective monitoring by lending banks, especially when the risk for the borrowing firm is high. Extending the work of Lookman (2009), a further comparison of the impact of single- and multiple-bank relationships on borrowing firm risk management policies can help elucidate this effect.

Extending Carletti et al. (2007) and Lookman (2009), we address whether multiple banks do in fact manage the risks of their borrowers more aggressively compared to single-bank lenders. According to Carletti et al. (2007), we expect that when lending banks are financially sound, have low risk, and have low monitoring costs, the main bank will not have incentives to diversify risk and the other banks will be free-riders, as risk is low. In this situation, single bank monitoring will be more efficient than multiple bank monitoring. As the financial distress risk and monitoring costs increase, the moral hazard problem between the lending bank and the borrowing firm increases because the borrowing firm has an incentive to shift risk. According to Carletti et al. (2007), the main bank will not be willing to provide more financing to the company; this will drive the borrowing firm to develop multiple-bank relationships. Once other lending banks are willing to provide loans, risk information will circulate, and these banks will strengthen their monitoring of the borrowing firm, and free-riding and duplication of monitoring efforts will decrease. Therefore, monitoring via multiple-bank relationships will be superior to that from a single-bank relationship. Hence, we expect that multiple lending banks provide more effective monitoring to improve the hedging activities of highly leveraged borrowing firms and mitigate the risk-shifting incentive compared to a single bank.

To test our hypothesis, the number of lending banks and the inverse Herfindahl-Hirschman Index (HHI) of the lending banks are adopted to compare the monitoring effectiveness between multiple banks and a single bank. Adopting the set of listed non-financial firms in Taiwan from 2005 to 2009[5], Logit and Tobit regressions are employed to examine the hypotheses. Our main finding is that among firms with high risk-shifting incentives (high distress risk), the probability of hedging and the hedge ratio increases with the number and diversity of lending banks. However, this relationship between borrowers' hedging policies and lending structure is insignificant for healthy firms. These findings support the argument that multiple banks do in fact manage their borrowers more aggressively to prevent risk shifting compared to a single bank.

Further, Stein (2002) and Esty (2004) show that as the physical distance between the lender and the borrower increases, prior considerations and subsequent monitoring of the lender become more difficult, which increases the agency cost. Therefore, we also study the impact of the number of foreign banks on the borrowing firms' risk policy and examine whether foreign banks can successfully reduce the risk-shifting activities of borrowing firms with high distress risk. In contrast to the effect of the number of domestic banks, we find that foreign banks do not offer effective monitoring to reduce the risk-shifting behavior for distressed borrowers but provide effective monitoring to enhance the extent of hedging for healthy firms.

Finally, the model of Carletti et al. (2007) shows that multiple-bank lending is

[5] Because it is compulsory to report hedging information for all listed firms in Taiwan to the public every month following a mandatory standardized procedure, selection bias can be avoided and more trustworthy results produced than the results from studies using hand-collected hedging information as in previous literature.

optimal when firms and banks are subject to moral hazard and monitoring is essential. These results predict that when the borrowing company's profit drops and monitoring costs increase, multiple-bank lending exists. Therefore, this study divided the sample companies according to firm age, growth opportunity, and profitability to explore whether monitoring by multiple banks has a significantly different effect on the risk management policies and risk-shifting activities of these borrowing firms with higher monitoring costs. We find that the risk-shifting behavior in corporate hedging is stronger for younger, growth-oriented, and less profitable firms and that monitoring by multiple banks effectively enhances the willingness to hedge and the extent of hedging by these borrowing firms with higher moral hazard and uncertainty as compared to monitoring by a single bank.

Our study provides four main contributions to the literature. First, it contributes to the financial intermediation literature by identifying an effective monitoring mechanism to mitigate risk-shifting problems through the lending bank structure. Second, it improves our understanding of the role of multiple banks versus a single-bank relationship on a firm's risk management decisions. To our knowledge, we are the first to examine the role of multiple lending banks on the borrowers' hedging policy; the previous literature focuses on the role of bank lenders compared to non-bank lenders. Furthermore, the relationship between bank-borrower distance and the monitoring effectiveness of lending banks on corporate hedging is verified. Finally, we demonstrate that the monitoring effectiveness of multiple banks on borrowers' risk management depends on the borrowing firm's characteristics.

This paper is structured as follows. Section 2 summarizes the relevant literature and develops the hypotheses. Section 3 details the data and methodologies employed, and then the empirical results are reported and discussed in Section 4. Section 5 concludes the paper.

2. Literature Review and Hypotheses Development

2.1 Risk shifting in corporate risk management

The Modigliani-Miller theorem (1958) states that in a complete market, companies can use homemade leverage to become equivalent to debt-free companies; as such, no company will hedge risk. However, the real market is not perfect and contains frictional costs, and companies must hedge to reduce operating risks. Smith and Stulz (1985) suggest that leverage and risk management are positively correlated because hedging can lower deadweight loss and distress risk and increase firm value. Therefore, as the leverage ratio and financial distress risk increase, a company becomes much more likely to hedge risk. In contrast, Jensen and Meckling (1976) suggest that when a firm borrows too much and potentially enters financial distress, shareholders might propose an extremely risky investment plan in order to break through the situation. Stockholders enjoy the majority of the investment benefits when an investment succeeds, but the creditor might not receive the originally agreed-upon capital and interest when the investment fails; this activity shifts risk and responsibility for investment failure and bankruptcy to the creditor and is called risk shifting. Risk shifting has been studied from the perspective of corporate investment strategy and risk management (Eisdorfer, 2008; Purnanandam, 2008). Purnanandam (2008) provides a theoretical model and evidence showing the risk-shifting phenomenon in corporate hedging. In the beginning, as company leverage increases, the willingness of corporate hedging also increases; but after leverage increases past a certain point, the incentive of corporate hedging begins to slow and even decrease. In other words, firms with high distress risk or high leverage are more likely to transfer risk to creditors in accordance with Jensen and Meckling's (1976) theory.

As risk-shifting behavior is a type of agency problem between shareholders and debtholders, most prior literature suggests different types of restrictions in bond covenants or CEO compensation design to reduce it (see Barclay and Smith, 1995; Barnea et al., 1980; Chesney and Gibson-Asner, 2001; Friend and Lang, 1988; Frierman and Viswanath, 1994; Guedes and Opler, 1996; Smith and Warner, 1979). Compared to the above literature, Lookman (2009) is the first to take the monitoring perspective of lending banks and demonstrate that banks have a greater ability than non-bank lenders to mitigate borrowers' risk-shifting activity to protect creditor's wealth; that is, the bank's loan ratio and the hedging activities of firms with high distress risk are found to be positively correlated. Lookman (2009) is the first to explore whether the source of debt has a significant effect on borrower's corporate hedging policies; however, Lookman (2009) only focuses on total bank loan ratio as the bank's incentive for monitoring and does not explore whether various lending bank structures influence corporate hedging strategies differently.

2.2 Lending bank structures and corporate risk management

The bank relationship is one of the key issues for corporate risk management because it will determine the direction of investment and financing. Generally, if a firm has a good relationship with a bank, it can relieve capital pressure to a certain degree and promote and support operating activities. In addition, Boot and Thakor (2000), Degryse and Ongena (2001), and Shen and Wang (2004) note that banks can improve the imperfect and asymmetric information in the financial market. When granting loans and monitoring borrowers, banks can obtain detailed client information and increase the investment value of a firm while also lowering information asymmetry between the bank and the borrower. Despite the emphasis on the role of banks as monitors in the past literature, there is no clear opinion on the most appropriate number of monitoring banks.

As for the lending structure between banks and borrowing firms, the past literature mostly focuses on whether the best financing structure for a company is a single bank or multiple banks. Diamond (1984), Ramakrishnan and Thakor (1984), and Allen (1990) noted that the optimal bank-firm relationship is a single-bank relationship because free-riding problems and the duplication of monitoring efforts can be avoided. However, in reality, the exclusive bank-firm relationship is difficult to observe. For example, Ongena and Smith (2000) showed that among 20 European countries, fewer than 15% of firms could maintain an exclusive bank-firm relationship. In addition, Petersen and Rajan (1994), Detragiache et al. (2000), and Farinha and Santos (2002) noted that the number of lending banks increases as the firm size increases and that in the USA, Italy, and Portugal, most small and medium firms take loans from more than one bank. Multiple bank loans allow banks to finance more firms and increase risk diversification because multiple loans can decrease the variance in the bank's combined rate of return on assets. The disadvantage of multiple bank loans for lending banks is the potential for free-riding and the duplication of monitoring efforts. However, even if the agency problem between banks and borrowers is severe, the benefits of diversification may still be greater than the problems of free-riding and the duplication of efforts. Carletti et al. (2007) provide a model to show that when the bank has a limited ability to grant loans, a multiple bank relationship can reduce the agency problem between the bank and borrowing firms. Using public firms in Taiwan as a sample, Chan et al. (2013) show that when the information between lending banks and borrowing firms is asymmetric, a relationship with multiple banks might prompt borrowing firms to accept more risk. They also find that small companies with more growth opportunities tend to establish a multiple-bank relationship. As such, this study hopes to explore the influence of a multiple-bank relationship on corporate hedging policies to see whether a multiple-bank relationship can reduce the agency problem between borrowing firms and creditors comparison to a single bank relationship.

Extending Carletti et al. (2007), Lookman (2009), and Chan et al. (2013), we propose that when a borrowing firm is highly leveraged or in financial distress, the lending banks' risk assessment of the firm will lead the firm to borrow from multiple banks; these lending banks providing additional loans have an incentive to diversify their risk and to offer stronger monitoring on these highly risky borrowing firms. This, in turn, will decrease free-riding and the duplication of efforts. Hence, we expect that a multiple-bank relationship provides a more effective monitoring function over borrowers' risk management than a single bank, especially when the borrowing firm is under financial distress. This leads to the proposal of Hypothesis 1 as follows:

Hypothesis 1: The willingness to hedge and the extent of hedging is higher in a multiple-bank relationship than in a single-bank relationship for borrowing firms with high distress risk or high monitoring cost.

In the literature on foreign bank monitoring efficacy, Stein (2002) and Esty (2004) showed that as the physical distance between the lender and borrower increases, prior considerations and subsequently lender monitoring become more difficult, which increases the agency cost. Therefore, foreign banks are often unwilling to lend to borrowers given this high monitoring cost. Esty (2004) also showed that foreign banks are often unwilling to accept highly risky borrowers. Khanna and Palepu (1999), Petersen and Rajan (2002), Buch (2003), and Mian (2006) all emphasized that compared to domestic banks, the disadvantage that foreign banks face is a lack of information on the local market and companies (soft information);

further, they must overcome barriers such as culture and regulations in the host country. We explore the monitoring effectiveness of foreign banks over corporate hedging, which has not been addressed before. Based on the disadvantage of distance for foreign banks, we expect that foreign banks do not provide sufficient effective monitoring on borrowing firms' risk-shifting behavior. This leads to the proposal of Hypothesis 2 as follows:

Hypothesis 2: The risk-shifting incentive of corporate hedging is not correlated with the number of foreign lending banks.

Carletti et al. (2007) emphasize that banks can lower a borrower's moral hazard problem through monitoring. Monitoring activity that is difficult to observe will increase the moral hazard problems between the bank and their borrowers. As banks cannot completely diversify for each loan, the incentive for bank monitoring is determined by their credit rights, monitoring costs, firm profitability, and the loan structure. In the literature on multiple bank loans, Winton (1995) finds that the diversification of an investment portfolio and the market value can influence the incentives for banks to monitor. Petersen and Rajan (1994), Detragiache et al. (2000), Farinha and Santos (2002), and Guiso and Minetti (2010) show that when loans are given to companies experiencing worsening operations, the lending banks do not like to lend more, driving the borrowers to take loans from multiple banks. Guiso and Minetti (2010) show that when bank monitoring costs are high, multiple bank loans are more attractive. The monitoring costs and the ease with which banks can obtain company information are related. In other words, banks are less likely to give multiple loans to a transparent company. The model of Carletti et al. (2007) is deduced similar results; a bank with lower equity rights, and a company with lower profitability and higher monitoring costs will be more likely to choose multiple banks loans. Whether the risk diversification incentives of multiple banks as mentioned in the above studies provide a stronger monitoring effect on borrowers' risk management is still an unanswered question, which this study will address.

Extending Carletti et al. (2007), we expect multiple banks to more effectively monitor those borrowers with higher monitoring costs, including younger firms, firms with less profit, and firms with more growth opportunity; hence the following hypothesis is provided:

Hypothesis 3: The positive correlation between corporate hedging and the number of lending banks is stronger when borrowing firms are more difficult to monitor.

3. Research methodology

3.1 Sample and data sources

Derivatives holdings, bank loans, and financial accounting information for listed firms in Taiwan are compiled from the Taiwan Economic Journal (TEJ); the sample period is from 2005 to 2009. Financial firms are not included in our sample because their financial characteristics and the stricter government regulations affecting their risk-management incentives make them not comparable to other industrial firms. To ensure that the results of this study would not be affected by outliers, we excluded firms with net sales below NT $1 dollar. After further excluding those firms with missing data, our final sample size is 2,777 firm-year observations.

3.1.1 The uniqueness of the data

Following earlier empirical studies of risk management, hedging strategies are measured by firm derivatives holdings that are not written off by the fiscal year end. According to the laws and regulations in Taiwan[6], listed firms are *obligated* to report unwritten derivatives positions to the Market Observation Post System (MOPS) every month in a standard procedure.[7] Hence, in contrast to most related studies, in which derivatives positions for hedging are hand-collected from SEC 10-K reports, our sample firms can be compared across all listed companies over several years to provide a comprehensive analysis.

Statements of Financial Accounting Standards (SFAS) No. 34 and No. 36 state that derivatives products can be classified into those held for trading and those held

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[6] Article 36-1 of Securities and Exchange Act and Article 2 of Taiwan Stock Exchange Corporation Procedures for Verification and Disclosure of Material Information of Companies with Listed Securities

[7] These data were collected and made available by TEJ from 2005.

for effective hedging.[8] Trading derivatives products can be sold and bought back for short-term profits only. Those derivatives held for effective hedging have to conform to the standards of hedging accounting. Therefore, effective hedging derivatives products can truly reflect a firm's hedging position. Hence, the dummies for effective hedging and effective hedge ratios are used to proxy corporate hedging strategy.

3.1.2 Distribution of firms using derivatives

Panel A of Table 1 provides the sample distributions and effective hedging across years. The sample distribution is statistically steady across observation years. Out of a total of 2,777 observations, 55.20% of the firm-year sample use derivatives as effective hedging.

The sample distribution across industries is presented in Panel B of Table 1. The highest hedging sample, 88.24%, is attributed to the automobile industry partly because their large purchases of auto parts from overseas markets pushes the requirement of foreign exchange exposure hedging. Also, more than 70% of hedging samples are in the cement, food, electrical, and cable industries. It is interesting to note that the tourism industry in the sample is found to have less need for hedging. In terms of the hedge ratio, the highest ratio is for the shipping and transportation industry, followed by the trading and consumer goods industries. The effective hedge ratio scaled by total assets in the shipping and transportation industry is approximately 23.88%, which is the highest among peers, possibly because their profits are greatly impacted by the price volatility of raw materials in the international markets.

[insert Table 1 here]

3.2 Empirical model

Bank loan financing engenders the agency problem of risk shifting, as shown by Jensen and Meckling (1976). Lookman (2009) tests whether lending banks, being effective monitors, support borrowing firms in increasing their hedging probability and hedging extent to protect their wealth. Extending Lookman (2009), we examine whether a firm that borrows from multiple banks has a higher incentive to hedge their

[8] SFAS No. 34 Financial Instruments: Recognition and Measurement; SFAS No. 36 Financial Instruments: Disclosure and Presentation

risks compared to single-bank borrowers. In this study, the proposed hypotheses will be investigated using Logit or Tobit regressions for the firm's hedging decision, as in Eq. (1):

$$\begin{aligned} H_{it} &= \alpha_0 + \alpha_1 RSI_{it} + \alpha_2 Multiple\_Bank_{it} + \alpha_3 (RSI_{it} \times Multiple\_Bank_{it}) \\ &+ \alpha_4 Ln(TotalAssets)_{it} + \alpha_5 CF\_sigma_{it} + \alpha_6 Quick_{it} + \alpha_7 R\&D\_Ratio_{it} \\ &+ \alpha_8 MB_{it} + \alpha_9 Leverage_{it} + \alpha_{10} Industry\_HHI_{it} + Year\ Dummies + \varepsilon_{it} \end{aligned} \tag{1}$$

where H_{it} is the measurement of the corporate hedging strategy, including whether it hedges or not and the hedging extent. RSI_{it} is a measure of the risk-shifting incentive of a firm. $Multiple\_Bank_{it}$ are measurements of the multiple-bank structure, including the number of lending banks (*Bkno*) and the inverse bank loan HHI (*Inv_HHI*). The controlling variables include $Ln(TotalAsset_{it})$ as total assets, CF_sigma_{it} as the volatility of cash flow, $Quick_{it}$ as the quick ratio, $R\&D_{it}$ as the R&D ratio, *MB* as the market to book ratio, $Leverage_{it}$ as the leverage ratio, $Industry\_HHI_{it}$ as the industry Herfindahl-Hirschma index, and ε_{it} as the error term.

When the dependent variable is the dummy for effective hedging, Logit regressions are used to test the relationship between the hedging incentive and the structure of the multiple-bank relationship. When the dependent variable is the effective hedge ratio, Tobit regressions are used to analyze the relationship between the extent of hedging and the multiple-bank relationship. If a multiple-bank relationship provides more effective monitoring over the borrowing firms' hedging activities than a single-bank relationship when the borrowing firms have a stronger risk-shifting incentive, we expect α_3 to be significantly positive.

3.3 Variable measure

3.3.1 Dependent variable – derivatives as a proxy for hedging

Following Purnanandam (2008) and Lookman (2009), the dependent variable in Eq. (1), H_{it}, is two proxies of corporate hedging strategy. One is based on the firm's binary decision of whether to use derivatives for hedging purposes (*Dummy for* *effective hedging*), and the other is based on the extent of the firm's hedging (*Effective hedge ratio*). *Dummy for effective hedging* is equal to one for firms using derivatives in conformance with hedging accounting principles and zero otherwise. *Effective hedge ratio* is the total notional dollar amount of derivatives that conform to hedging accounting principles scaled by total assets or net sales. Although derivatives are a measure of hedging activity in this study, it is reasonable to question whether a firm is using these instruments for hedging purposes or for speculative reasons. Providentially, a large number of studies suggest that most firms use derivative instruments for the former rather than the latter purpose (Allayannis and Ofek, 2001; Guay, 1999; Hentschel and Kothari, 2001).

3.3.2 The explanatory variables

3.3.2.1 Risk-shifting incentive

One of the main independent variables of interest in Eq. (1) is RSI_{it}, which is the indicator of risk-shifting incentive. As suggested by Jensen and Meckling (1976), highly levered firms have stronger incentives to engage in risk-shifting activities because the option to declare bankruptcy is valuable for the equity holders of such firms. Accordingly, the proxy for the risk-shifting incentive, denoted *RSI*, is based on whether or not the firm is highly levered. Following Lookman (2009) and Purnanandam (2008), we rank the sample firms by their leverage ratio in each industry every year and set the dummy *RSI* equal to one for firms in the top 10% of the ranking. If the borrowing firms act on their risk-shifting incentives by reducing their hedge positions, we expect the estimated coefficient of *RSI* in Eq. (1) to be significantly negative. We also use the 70th, 75th and 80th percentile of the leverage ratio ranking to create *RSI* and check the robustness of our results.

3.3.2.2 Bank loan structure

To examine whether multiple-bank monitoring has a greater measurable impact on a firm's risk-shifting incentives in terms of hedging decisions than single-bank monitoring, our main tests are based on the explanatory variable $RSI_{it} \times Multiple\_Bank_{it}$, which is the interaction of *RSI* and measurements of the multiple-bank structure, $Multiple\_Bank_{it}$. The measurements of $Multiple\_Bank_{it}$

include the number of long-term lending banks of a firm (*bkno*) and the inverse HHI index of bank loans (*Inv_HHI*), which is one minus the HHI of long-term bank loans. If the monitoring of multiple banks is able to mitigate the risk-shifting incentives of borrowing firms with high financial distress risk, we expect the estimated coefficient of $RSI_{it} \times Multiple\_Bank_{it}$ in Eq. (1) to be significantly positive. If monitoring by the multiple-bank structure is able to enhance the hedging probability and the hedging extent of healthy borrowing firms, the estimated coefficient of $Multiple\_Bank_{it}$ in Eq. (1) is expected to be significantly positive. Additionally, we construct a dummy variable *Sbank*, which is equal to one when the borrowing firm is in a single-bank relationship, to investigate the monitoring effect of a single-bank relationship.

3.3.3 Control variables

Risk management theories posit several motivations for hedging unrelated to the source of borrowing. Our construction of control variables is broadly consistent with those used in the existing literature (see Haushalter, 2000; Lookman, 2009; Purnanandam, 2008). First, we control for firm size (*Ln(Total Assets*)), as measured by the natural logarithm of total assets, to capture the size effects in derivative usage (Dolde, 1993; Lookman, 2009; Nance et al., 1993). Next, the ratio of research and development expenses to total sales is measured as the firm's growth opportunity (*R&D Ratio*). It is notable that Froot et al. (1993) suggested a positive relationship between the firm's growth opportunity and hedging incentives because hedging can minimize the under-investment problem of the firm when its cash flow is low. Market-to-book ratio (*MB*) is also utilized as an additional control variable for the growth opportunity of a firm. In addition, because under-investment problems can also be reduced by retaining more liquid assets, the quick ratio (*QUICK*), constructed as a ratio of cash and short-term investments to the current liabilities of the firm, is also considered here. In the model, we further include the volatility of cash flows (*CF_SIGMA*), which is measured by the standard deviation of cash flows in the most recent past 5 years; industry concentration (*INDUSTRY_HHI)*, which is measured by the HHI (Purnanandam, 2008), and leverage (*LEVERAGE*) (Graham and Rogers, 2002; Smith and Stulz, 1985). Finally, year fixed effect is included (Eisdorfer, 2008).

3.4 Summary Statistics

We summarize the basic statistics for all of the variables we use in the empirical analysis in Table 2. The percentage of effective hedging is 55.2%. When scaled by total assets, the average standardized derivatives effective hedge ratio is 4.3%. These numbers are comparable to those found by Purnanandam (2008)[9]. Moreover, the average firm size measured by book value and net sales is $21,981,949 thousand NTD and $19,095,361 NTD, respectively. In addition, the leverage ratios have a mean of 37.85 and a median of 37.69, which implies that the distribution may not be skewed. The average of the industry concentration ratio (*INDUSTRY_HHI*) is 0.109, implying competitive environments for all sampled industries. The average market-to-book ratio (*MB*) is approximately 1.389, and the quick ratio of the sampled firms (*QUICK*) is 163, both of which imply limited protection for debtors.

From the summary statistics of the measurements of bank structure, we find that 58.19% of the sample has debt from banks. The mean of the long-term bank ratio (*Bank Loan*) is 17.1% for our sample, which is smaller than that found by Lookman (2009) but is comparable to Cantillo and Wright (2000)[10]. The average number of lending banks is approximately 2.41, and approximately 0.13 are foreign banks and 2.28 are domestic banks. The largest number of lending banks is 39 and the smallest is 0, implying substantial differences in the sampled firms' bank structure. The mean of the inverse bank loan concentration ratio (*Inv_HHI*) is 0.23, while the highest ratio is 0.95, implying that bank loans are not concentrated in a single bank. Additionally, it is interesting that the percentage of firms with multiple-bank relationships is over 71.5% of our sample, which shows that most firms borrow from more than a single bank.

[insert Table 2 here]

Table 3 shows the correlation matrix among the variables we use in the regression analysis. We find that the correlation coefficient is 0.79 between the number of lending banks (*Bkno*) and the inverse bank loan concentration ratio (*Inv_HHI*), and thus, we did not put these two measurements of a multiple-bank relationship in one regression to avoid the problem of collinearity. The correlation coefficient between the number of foreign lending banks (*FBkno*) and the number of

[9] In Purnanandam (2008), the mean (median) of the notional value of derivatives scaled by the book value of the firm's total assets is 8.62% (4.43%).
[10] Cantillo and Wright (2000) document a mean private-to-total-debt ratio of 0.77 in a broad sample.

domestic lending banks (*DBkno*) is greater than 0.4, and thus we put these two measurements of a multiple-bank relationship into two separate regressions. The correlation between the bank loan ratio (*Bank Loan*) and the number of lending banks (*Bkno*) is 0.59, which shows that the higher the bank loan ratio is, the more lending banks there are. The absolute value of the correlations between each pair of the other controlling variables are all below 0.4, which reveal that there is no serious collinearity problem.

[insert Table 3 here]

4. Empirical results

4.1 Univariate analysis

To further preview whether the relationship between the lending bank structure and corporate hedging activities depends on the financial status of borrowing firms, Table 4 first shows comparisons of hedging activities, the lending bank structure, and the financial characteristics for the distressed sample and the healthy sample, which are separated based on the order of their leverage ratios for each industry-year. The top 10% of sampled companies are labeled as distressed firms and the rest are considered to be healthy companies. We find that the probability of hedging and the effective hedge ratio show no significant difference between these two groups of samples. At the same time, the number of lending banks and the inverse concentration index are significant larger in the distressed sample than in the healthy sample, and the proportion of multiple-bank relationships and the bank loan ratio are also significantly higher in the distressed sample. These results are consistent with the prediction of risk diversification by Carletti et al. (2007): the main bank will not provide further loans and will force the firm to borrow from other banks if the risk of the borrowing firm is too high. Additionally, distressed firms are those with a greater size, lower liquidity, and a lower growth opportunity.

Further, we separate healthy firms into multiple-bank and single-bank samples to investigate the relationship between the lending bank relationship and corporate hedging activities. We find that the proportion of effective hedging and the effective hedge ratio are significantly larger in firms with a multiple-bank relationship than those with a single-bank relationship in the healthy sample; meanwhile, the number of lending banks (foreign and domestic lending banks), the inverse bank loan concentration index, and the bank loan ratio are significantly larger in the multiple-bank sample than in the single-bank one. In terms of firm characteristics, healthy firms with multiple banks relationship are those with a larger size, higher net sales, less liquid assets, and less growth opportunity as well as being in a less competitive industry and more highly leveraged.

In the distressed sample, we also divide the sample into a multiple-bank and a single-bank sample, but the proportion of effective hedging and the effective hedge ratio are not significantly different between these two samples. In terms of firm characteristics, distressed firms with a multiple-bank relationship are firms with a larger size, a lower quick ratio, less growth opportunity, a competitive environment and lower leverage than those with a single-bank relationship; the firm characteristics between these two types show similar differences in the healthy sample. However, the cash flow volatility of firms with a multiple-bank relationship is higher than the volatility of those with a single-bank relationship, and the leverage ratio is significantly lower in distressed firms with a multiple-bank relationship than in those with a single-bank relationship. This result shows that distressed firms with a multiple-bank relationship meet more financial constraints in financing from other channels than distressed firms with a single-bank relationship.

[insert Table 4 here]

4.2 Baseline Multivariate Regressions

To further investigate the monitoring effectiveness of multiple banks on borrowing firms' hedging policies, the Logit and the Tobit models are used to estimate the coefficients of Eq. (1), with all other factors affecting the hedging policies held constant. In the Logit regression analysis, the dependent variable is the dummy variable representing whether the borrowing firm adopts derivatives that conform to hedging principles to hedge. In the Tobit regression analysis, the dependent variable is the effective hedge ratio deflated by total assets. The results are shown in Table 5.

Table 5 shows that the coefficients of *RSI* are all significantly negative in all models at less than 5% significance levels, showing that companies with high distress risk tend to have a lower willingness to hedge and hedge to a lesser extent, thereby transferring risk to their creditors. These results support the findings of Purnanandam (2008) and Lookman (2009) that companies with high distress risk tend to risk-shifting. In model (1) and model (5), the coefficient of *bank loan* is positive but not significant while the coefficient of the interaction term of *RSI* and *bank loan* is significantly positive at 5%, the latter result being consistent with the findings of Lookman (2009). If bank lenders are effective monitors, they can mitigate the borrowers' risk-shifting behavior in risk management. A firm with a higher bank loan ratio implies two possibilities. One is that a greater number of lending banks have led to a higher bank loan ratio and that the effective monitoring of the borrowers' corporate hedging results from a collective effort by multiple lending banks. The other possibility is that a single primary bank has offered a higher bank loan, that their long-term relationship with the borrowing firm reduces the information asymmetry between them, and thus that their effective monitoring could mitigate the borrowers' risk-shifting incentive in corporate hedging. To identify whether a multiple-bank or a single-bank relationship provides more effective monitoring, we first use the *Sbank* dummy to replace the bank loan ratio in the regressions, and the results are presented in model (2) and model (6) in Table 5. Neither the coefficients of *Sbank* or the interaction term of *Sbank* and *RSI* are significantly positive, which shows that single banks do not provide more effective monitoring than non-bank lenders. However, the coefficients of the number of banks (*Bkno*) are not significant in model (3) and model (7), while the coefficients of the interaction term of *bkno* and *RSI* are significantly positive, which reveals that a relationship with multiple banks does not provide more effective monitoring over the borrower's hedging when its financial status is healthy but does offer stronger monitoring over the willingness of highly leveraged borrowers' to hedge and the extent of their hedging when their financial status approaches distress. In model (4) and model (8), the coefficients of *Inv_HHI* and the interaction term of *Inv_HHI* and *RSI* show a similar pattern to the results for the number of banks (*Bkno*). These results support our hypothesis 1: when the borrowing firm is financially sound, banks have less need to diversify risk, and multiple-bank relationships will exacerbate free-riding and the duplication of monitoring efforts; in addition, a primary single bank will not exercise more effective monitoring of the borrowing firm due to less information asymmetry and a lower monitoring cost. When the borrowing firm is in financial distress, banks are more motivated to diversify risk: multiple-bank relationships can diversify risk and increase efforts to ensure that debt is repaid. Thus, free-riding and duplication of effort are non-existent, and risk management for the borrowing firm is more effective.

[insert Table 5 here]

4.3 **Robustness checks**

4.3.1. Endogeneity

We interpret the significantly positive coefficients of the interaction term of multiple bank structure (*Bkno* and *Inv_HHI*) and *RSI* as supporting a causal link between multiple bank monitoring and a reduction in the extent of opportunistic risk shifting. Because the number of lending banks is a choice variable, a concern about our results is that they are simply an artifact of endogeneity. For instance, a variable omitted in the hedging model specification might be influencing the hedging decision as well as the multiple-bank borrowing decision. This omitted variable could potentially lead to a spurious correlation between the interaction term of multiple-bank structure and the risk-shifting index and hedging variable. To address the endogeneity issue, we employ a two-stage estimation procedure using instrumental variables that are related to our multiple-bank relationship but unlikely to be correlated with corporate hedging decisions. The first-stage equations consist of the Logit and Tobit models for risk shifting and multiple-bank relationships, whereas the second equation models a borrowing firm's hedging decisions. In the first stage, we estimate models for the risk-shifting decision as Eq. (2) and for the multiple-bank relationship as Eq. (3).

The first-stage *RSI* logit regression is as follows:

$$\begin{aligned} RSI_{it} &= \gamma_0 + \gamma_1 \ln(TA_{it}) + \gamma_2 (CF\_sigma_{it}) + \gamma_3 Quick_{it} + \gamma_4 MB_{it} \\ &+ \gamma_5 (PPE/TA)_{it} + \gamma_6 ModifiedZ_{it} + \gamma_7 (DA/TA)_{it} \\ &+ Industry\_Dummies + Year\_Dummies + \mu_{it} \end{aligned} \quad (2)$$

For the first-stage estimation, we first select instruments to identify risk-shifting incentive (*RSI*) and multiple-bank relationships (*Bkno* and *Inv_HHI*). In Eq. (1), we sort the leverage ratio for every industry-year to define the top 10% as being firms with a higher distress risk (higher risk-shifting incentive) (i.e., distressed firms, *RSI*=1); otherwise, they are defined as healthy firms (*RSI*=0). Here, we use the Modified Z score as an instrument; other determinants of a firm's risk shifting include firm size, tangible assets, book-to-market ratio, earnings volatility, and profitability (see Bradley et al., 1984; Eisdorfer, 2008; Graham et al., 1998; Lang et al., 1996; Lookman, 2009; Purnanandam, 2008; Titman and Wessels, 1988, among others). We include the natural log of total assets (*ln(TA)*) to capture the well-known size effects in borrowing. We also include the volatility of cash flows (*CF_SIGMA*) measured by the standard deviation of cash flows in the last five years to measure earnings volatility. The quick ratio (*QUICK*), which is constructed as a ratio of cash and short-term investments to the current liabilities of the firm, is also considered. Because the underinvestment problem of a firm can be reduced by keeping more liquid assets, the market-to-book ratio (*MB*) is also used as the control variable for growth opportunities. Property, plant, and equipment scaled by total assets (*PPE*) is used to control for the collateral available for borrowing. Finally, following Graham et al. (1998), we incorporate the non-debt tax shield (*DA/TA*) into the models, as measured by depreciation and amortization scaled by total assets. Firms with large amounts of deferred tax liabilities already have considerable tax shields, so that the tax benefit of issuing debt will be smaller for these companies. It is thus reasonable to assume that firms with greater deferred taxes will have a lower risk-shifting incentive.

The first-stage multiple-bank structure Tobit regression is as follows:

$$\begin{aligned} Multiple\_Bank_{it} = {} & \theta_0 + \theta_1 AVGNPL_{it} + \theta_2 \ln\left(AVGBKTA_{it}\right) \\ & + \theta_3 DSyndicated_{it} + \theta_4 ROA_{it} + \theta_5 \ln\left(TA_{it}\right) + \theta_6 R\&D_{it} \\ & + \theta_7 Leverage_{it} + \theta_8 Industry\ Comovement_{it} + \theta_9 AGE_{it} \\ & + Industry\_Dummies + Year\_Dummies + v_{it} \end{aligned} \tag{3}$$

In equation (3), the dependent variables, $Multiple\_Bank_{it}$ are two proxies of multiple bank structure, including the number of lending banks (*Bkno*) and the inverse bank loan HHI (*Inv_HHI*). Following Detragiache et al. (2000), we use the following instruments for the multiple-bank structure in the Tobit regression model. First, the average share of nonperforming loans on loanable funds across relationship banks ($AVGNPL$) and the logarithm of the average size of each relationship bank to each firm ($AVGBKTA$) are used to capture bank fragility. With regard to the search and switching costs hypotheses, banks with a higher share of nonperforming loans are more prone to face credit risk, and thus induced higher probability of bankruptcy. Once a relationship bank goes to bankruptcy, the borrowing firms need to search and switch to a new suitable relationship bank. Thus, borrowing firms avoid search costs from increasing the number of lending banks. In addition, bank size may also be related to bank fragility and should have a negative effect on the number of bank relationships (Buchinsky and Yosha, 1995). Further, $DSyndicated$ is a dummy variable that equals one for firms obtaining a syndicate loan and zero otherwise. $DSyndicated$ should have a positive effect on the number of banking relationships. Other explanatory variables included are the profit of the borrowing firm (ROA), its size ($\ln(TA)$), its R&D ratio ($R\&D$), its leverage ratio ($Leverage$), its age and its industry comovement.

We use the return on assets (ROA) to capture the profitability of the borrowing firm, and it may have positive effect on the number of lending banks. We control for firm size measured by the natural log of the firm's total assets ($\ln(TA)$). Firm size is expected to affect the banking relationship for three reasons. First, large firms may have to rely on multiple banks so that the banks can diversify firm-specific credit risk. Second, more complex firms may need to serve plants located in different regions, thus relying on several banks. Finally, if a cost exists to setting up a new relationship, then larger firms with larger borrowing requirements should be more inclined to rely on multiple banks. $Leverage_{it}$, measured by the ratio of total debt to total assets, may increase the number of lending banks because the probability of default is higher for more leveraged firms, and the adverse selection problem should be more severe. Thus, higher leveraged firms are unwilling to establish a long-term relationship with a bank. Hence, a higher leveraged firm tends to establish a multiple-bank relationship. We use the R&D ratio and firm age to capture the uncertainty and transparency of borrowing firms. Older firms and firms with a lower R&D ratio may have less uncertainty and higher transparency. They can more easily obtain funding from the direct capital market or through a non-relationship financing channel, so they may also be less likely to have multiple banks. Therefore, we expect that the R&D ratio of the firm has a negative effect on the number of lending banks and that the firm's age has a positive effect on the number of lending banks. Finally, we use industry comovement to capture the correlation between the net sales of the firm and those of other firms in the same industry (Guiso and Parigi, 1999). To construct the indicator, we regress the net sales of the firm on the net sales of its industry. There is higher comovement between the firm and other firms in its industry when it has a higher square root of R^2 for this regression relative to other industries.

After performing the first-stage estimation, first, we use the predicted probability of *RSI* from Eq. (2) to create a new RSI, *P_RSI*, to be an indicator of financial distress (risk-shifting incentive): the dummy equals unity if the predicted probability of *RSI* is in the top decile of the predicted probability in each year for the firms in our sample. Then, we use *P_RSI* and the predicted values of *bkno* and *Inv_HHI* from Eq. (3), respectively, to estimate the hedging model in the second-stage Logit and Tobit regressions. The results for the first and second stage are shown in Table 6. As seen, the estimation results for the second-stage estimation are qualitatively the same as those in Table 5. The *RSI* has significant negative impact on the hedging incentive and the hedging ratio at a 5% to 1% level. In the hedging incentive decision of models (4)-(5), the coefficients of $Bkno$ （Inv_HHI） are insignificant and the interaction term of *RSI* and $Bkno$ （Inv_HHI） have a significant and positive impact on the hedging incentive. In the extent of hedging decision of models (6)-(7), the coefficients of $Bkno$（Inv_HHI）are insignificant while the interaction terms of *RSI* and $Bkno$ （Inv_HHI） have significant and positive impact on the hedge ratio. These findings show that multiple-bank relationships provide an effective monitoring function in financially distressed firms. Therefore, our supporting results in Table 5 are robust to the possibility of endogeneity problems.

[insert Table 6 about here]

4.3.2. Subsample analysis

Table 5 above shows that the significantly positive coefficients of the interaction terms *Bkno* (*Inv_HHI*) and *RSI* may reflect the monitoring by the lending banks relative to non-bank lenders; therefore, this study further filtered and tested the sample including a bank loan to better confirm that multiple bank monitoring is superior to single bank monitoring. The results are presented in Table 7. The coefficients of the interaction terms of multiple-bank structure (*Bkno* and *Inv_HHI*) and risk-shifting incentives (*RSI*) are significant and positive at the 10% to 5% level in the Logit and Tobit regressions for the willingness and the extent of borrowers' hedging. The results are qualitatively similar to those in Table 5.

[insert Table 7 about here]

4.3.3. Alternative proxies for risk-shifting incentives

In the previously reported results, the firms ranked at the top 10% for leverage are labeled as the distress sample following Lookman (2009). To test whether our results are affected by the selection of a different threshold for the leverage ratio, different thresholds for financial distress are used to break the firms into distressed (high risk-shifting incentive) and healthy groups based on whether their leverage ratio is below or above the 70th, 75th, and 80th percentile in our sample. The results for the different critical values of the rank order of leverage are reported in Panel A of Table 8. The coefficients of the interaction of terms *Bkno* (*Inv_HHI*) and *RSI* are all positive in the Logit regressions for the dummy for effective hedging, while the coefficients of these interaction terms are all significant and positive in the Tobit regressions for the effective hedge ratio. The results in Panel A of Table 8 are very similar to those in Table 5, demonstrating that the results of this study are robust.

4.3.4. Alternative proxy for effective hedge ratio

Using a new hedge ratio measured by the notional hedge dollar amount divided by net sales, the results show that the direction and significance of the estimating coefficients in Panel B of Table 8 are similar to those in Table 5. Therefore, the empirical results in the present study are not driven by the measure of the hedge ratio.

[insert Table 8 about here]

4.4 The effect of foreign banks

An increased number of banks can effectively decrease the risk-shifting activity of companies with high distress risk, but as the distance and monitoring cost for foreign banks is higher than those of domestic banks, this study also explored whether the number of foreign banks has the same effect as that of domestic banks on the borrowers' hedging policy. Table 9 shows the results of a regression analysis of borrowers' willingness to hedge and the extent of hedging on the number of foreign banks and of domestic banks. The coefficients of number of foreign banks (*Fbkno*) and the interaction term of the number of foreign banks (*Fbkno*) and the risk-shifting incentive index (*RSI*) are insignificant in the Logit regression for the effective hedging dummy. In terms of the effective hedge ratio in the Tobit regressions, the coefficient of *Fbkno* is significant and positive at a 1% level, while the coefficient of the interaction term of *Fbkno* and *RSI* is insignificant, showing that as the number of foreign lending banks increases, the extent of hedging of the borrowing firms will increase if they are financially sound. For highly leveraged firms, monitoring by foreign banks does not lower risk-shifting activity, perhaps due to their higher cost of monitoring, so they avoid granting loans to companies with high distress risk; hence, their monitoring efficiency over companies with high distress risk is limited. In contrast, the direction and significance of the estimating coefficients of the number of domestic banks (*Dbkno*) are very similar to those in Table 5, which shows that the effective monitoring function on highly leveraged firms is mainly driven by domestic lending banks.

[insert Table 9 here]

4.5 Extended multivariate regressions

4.5.1. Information asymmetry

Guiso and Minetti (2010) noted that the monitoring costs for companies with lower transparency or higher information asymmetry are higher, and thus they are forced to take loans from multiple banks. Older firms provide more information to the public, and their information asymmetry is lower. Therefore, the sample is separated into old firms and young firms based on the median of the number of years after listing in the same industry-year; these two samples are used to analyze the influence of lending bank structure on corporate hedging policies. The results in Table 10, Panel A show that the coefficients for the risk-shifting incentive index (*RSI*) for young firms with higher information asymmetry are more significantly negative than those for old firms, showing that highly leveraged firms with higher information asymmetry have a greater incentive to shift risk to creditors.

In terms of the effect of bank structure on corporate hedging, the coefficients for the interaction terms of *RSI* and the number of lending banks (*bkno*) are significantly positive at the 5%-10% level for young firms, while the same coefficients are insignificant for old firms. A similar pattern can be found in the effect of *Inv_HHI*. These results reveal that for lower information asymmetry firms with high distress risk, a higher number of lending banks and more diverse lending bank relationships will improve monitoring effectiveness and lower risk-shifting activity.

4.5.2. Growth opportunity

As the growth opportunity of a firm increases, uncertainty also grows, increasing the risk for lending banks and their motivation to diversify risk. Therefore, the sample is also analyzed after being separated into growth companies and value companies based on the median of the book-to-market ratio in the same industry-year. The results in Table 10, Panel B, show that for willingness to hedge, the coefficients for the risk-shifting incentive index (*RSI*) are significantly negative for growth companies and insignificant for value companies. Additionally, the coefficients of *RSI* in the regressions for the hedge ratio are significantly negative for both growth and value companies, but the absolute value of the *RSI* coefficients are larger for growth firms than value firms. These results reveal that the risk-shifting activities are more significant for growth companies.

The coefficients for the interaction term of *RSI* and the number of lending banks (*Bkno*) are significantly positive for growth firms at the 5% to 10% level, while the same coefficients for the interaction terms are insignificant for value firms. Similar results could also be found in the effect of the inverse HHI (*Inv_HHI*). This shows that for a borrowing firm with high distress risk, an increased number of lending banks and a higher dispersion of lending banks is more likely to improve the hedging policy monitoring effectiveness of growth firms compared to value firms, lowering their risk-shifting activity.

4.5.3. Profitability effect

Guiso and Minetti (2010) showed that companies with low prior earnings are less likely to take loans from single banks because monitoring costs are higher. Therefore, this study defined more-profit companies as those with a return on assets greater than the median for the same industry-year and less-profit companies as those with a return on assets below the median. Then, we examine the influence of bank structure on corporate hedging policies for these two separate samples. The results in Table 10, Panel C, show that the coefficients for the risk-shifting incentive index (*RSI*) are significantly negative in both more- and less-profit firms in the regressions of the dummy for effective hedging and the hedge ratio, but the absolute values of the *RSI* coefficient are larger for less-profit firms compared to more-profit firms. These results reveal that risk-shifting activities are more significant for less-profit firms.

The coefficients for the interaction terms of *RSI* and the number of lending banks (*RSI*bkno*) are significantly positive at the 1% to 5% level for less-profit firms while the same coefficients are insignificant for more-profit firms. A similar pattern is found in the effect of *Inv_HHI*. These results reveal that with high distress risk, a higher number of lending banks and a higher dispersion of lending banks increases the monitoring effectiveness of hedge policies for less-profit firms compared to more-profit firms.

[insert Table 10 here]

5. Conclusion

This study used public non-financial companies in Taiwan from 2005 to 2009 as a sample to explore whether multiple-bank relationships provide more effective monitoring to mitigate expropriation via risk shifting by examining their borrowers' hedging strategies. Consistent with Carletti et al. (2007), we find that among firms with high risk-shifting incentives, firms that borrow through multiple bank relationships tend to hedge a significantly greater fraction of their exposure compared to firms with a single bank relationship. As the number of lending banks increases and the source of loans becomes more dispersed, banks more diligently fulfill their monitoring responsibility and urge these companies to hedge and reduce potential damage to the creditor, thus reducing the risk-shifting activity of companies with high distress risk. The results of this study are still robust after controlling for endogeneity. Further, we divided the sample companies into two groups according to firm age, book-to-market ratio, and return on assets to explore whether differences in firm characteristics influence the effects of the lending bank structure on company hedging activity. The results showed that for younger high distress firms with higher growth opportunities and lower profit, multiple banks are more effective in influencing corporate hedging policies. To our knowledge, we are the first to document the importance of the bank-borrower relationship on a firm's hedging policy, and our findings have implications for corporate risk management and financial intermediation.

Our findings also have important implications for the banking sector. Our results showing higher per-project monitoring for multiple-bank lending than for single-bank lending suggest that firms sometimes enter into the hedging required by the bank loan contract with the lending bank itself. Hence, a bank with an active derivatives book may have a comparative advantage in pricing its loans because its costs to monitor hedging covenants are lower. Further, a derivatives desk might make a bank less risky because the market risk of the derivatives book offsets some of the credit risk of the loan book. Our study departs from the existing theory of financial intermediation in suggesting that increasing the number of monitors may lead to higher overall effort when banks have limited risk-sharing opportunities.

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Table 1 Sample distribution

Panel A. Sample Distribution and Hedging Behavior by Year

YEAR	obs.	% of obs.	Proportion of Effective Hedging (%)	Effective Hedge Ratio (%)
2005	555	19.99	54.41	4.16
2006	524	18.87	58.78	4.70
2007	524	18.87	53.05	3.90
2008	602	21.68	48.50	3.85
2009	572	20.60	61.71	4.78
Total	2,777	100.00	55.20	4.27

Panel B. Sample Distribution and Hedging Behavior by Industry

SIC (following TWSE SIC code)	no. of obs.	% of obs.	no. of firms	% of firms	Proportion of Effective Hedging (%)	Effective Hedge Ratio (%)	Number of Banks
Cement (01)	23	0.83	5	0.61	73.91	1.99	5.43
Food (02)	48	1.73	11	1.35	75.00	5.89	3.98
Plastic (03)	77	2.77	19	2.33	61.04	2.34	3.39
Textile (04)	105	3.78	29	3.55	48.57	4.12	3.63
Electric Machinery (05)	143	5.15	46	5.64	51.75	3.00	2.59
Electrical and Cable (06)	29	1.04	9	1.10	75.86	5.25	4.07
Glass and Ceramic (08)	10	0.36	3	0.37	50.00	2.60	2.70
Paper and Pulp (09)	22	0.79	6	0.74	50.00	2.14	7.45
Iron and Steel (10)	104	3.75	30	3.68	62.50	4.43	5.14
Rubber (11)	26	0.94	8	0.98	46.15	0.79	5.92
Automobile (12)	17	0.61	4	0.49	88.24	5.77	0.65
Building Material and Construction (14)	14	0.50	6	0.74	64.29	0.79	2.79
Shipping and Transportation (15)	48	1.73	15	1.84	68.75	23.88	6.63
Tourism (16)	7	0.25	3	0.37	0.00	0.00	0.29
Trading and Consumers Goods Industry (18)	24	0.86	7	0.86	50.00	15.79	4.21
Others (20)	111	4.00	29	3.55	63.06	4.24	2.95
Chemical Industry (21)	97	3.49	25	3.06	50.52	2.43	2.31
Biotechnology and Medical Care (22)	65	2.34	24	2.94	44.62	2.65	1.00
Oil, Gas and Electricity Industry (23)	7	0.25	3	0.37	57.14	3.87	2.43
Semiconductor Industry (24)	275	9.90	82	10.05	61.45	3.90	2.81
Computer and Peripheral Equipment Industry (25)	326	11.74	88	10.78	50.61	4.36	0.88
Optoelectronic Industry (26)	265	9.54	81	9.93	58.49	4.86	2.70
Communications and Internet Industry (27)	176	6.34	52	6.37	53.98	4.30	0.90
Electronic Parts/Components Industry (28)	466	16.78	143	17.52	54.08	3.76	1.84
Electronic Products Distribution Industry (29)	107	3.85	30	3.68	55.14	4.09	1.20
Information Service Industry (30)	53	1.91	14	1.72	30.19	1.29	0.30
Other Electronic Industry (31)	124	4.47	41	5.02	46.77	3.48	2.55
Managed Stock (80)	8	0.29	3	0.37	37.50	2.59	2.63
Total	2777	100.00	816	100.00	55.20	4.27	2.41

Table 2 Summary Statistics

This table provides descriptive statistics of variables used in the sample. *Effective Hedge ratio* is the nominal amount of derivatives holding which is conformed to hedging accounting principles divided by total assets. *Bkloan* is the fraction of the total long-term debt held by banks. *Bkno* is the number of lending banks. *FBkno* is the number of foreign lending banks. *DBkno* is the number of domestic lending banks. *Inv HHI* is the one minus the bank loan ratio Herfindalh index of sample firm. *sbank* is a dummy variable which equals to 1 when the firm have long-terms loans from single bank and 0 otherwise. *Total Assets* is the book value of the firm in thousands in NT dollars. *Ln(Total_Assets)* is natural logarithm of total assets. *Net Sales* is net sales of the firm in thousands of NT dollars. *CF_SIGMA* is standard deviation of past five annual cash flows. *Quick Ratio* is constructed as the ratio of cash and short-term investments to current liabilities. *LEVERAGE* is leverage ratio downloaded from TEJ database at the end of year. *R&D* is R&D Expenses divided by net sales. *MB* is market-to-book ratio downloaded from TEJ database at the end of year. *INDUSTRY_HHI* is industry concentration ratio calculated following the equation of Herfindalh Index.

variable	Mean	S.D.	Min	Q1	Median	Q3	Max
dummy for effective hedging	0.552	0.497	0	0	1	1	1
effective hedge ratio	0.043	0.109	0.000	0.000	0.006	0.047	2.639
Bkno	2.413	3.988	0	0	1	3	39
FBkno	0.133	0.534	0	0	0	0	7
DBkno	2.279	3.708	0	0	1	3	37
Inv_HHI	0.233	0.314	0.000	0.000	0.000	0.497	0.951
Bank Loan	0.171	0.209	0.000	0.000	0.072	0.311	0.911
sbank	0.166	0.372	0	0	0	0	1
mbank	0.416	0.493	0	0	0	1	1
Total Assets	$21,981,949	$64,288,388	$198,590	$1,952,191	$4,591,170	$11,759,169	$833,471,970
Ln(Total Assets)	15.530	1.447	12.199	14.484	15.340	16.280	20.541
Net Sales	$19,095,361	$72,818,850	$7,145	$1,540,762	$3,479,408	$10,524,922	$1,473,026,282
Sigma of Cash Flow	2.139	13.456	0.026	0.487	0.849	1.526	580.518
Quick Ratio	163.045	206.920	1.530	82.350	119.620	186.490	7619.980
R&D Ratio	0.036	0.111	0.000	0.004	0.019	0.040	5.190
MB	1.389	0.830	0.294	0.894	1.159	1.592	11.951
Industry HHI	0.109	0.120	0.020	0.041	0.076	0.120	0.888
Leverage Ratio	37.850	15.587	1.270	26.370	37.690	48.230	97.400

Table 3 Correlation Matrix

All variables are defined as Table 2. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Hedge Ratio	**1**													
(2) Effective Hedge Ratio	0.35 ***	**1**												
(3) Bank Loan	0.11 ***	0.08 ***	**1**											
(4) Bkno	0.11 ***	0.10 ***	**0.59** ***	**1**										
(5) Fbkno	0.10 ***	0.20 ***	0.28 ***	**0.57** ***	**1**									
(6) Dbkno	0.10 ***	0.07 ***	**0.59** ***	**0.99** ***	**0.47** ***	**1**								
(7) Inv_HHI	0.08 ***	0.09 ***	**0.62** ***	**0.79** ***	0.37 ***	**0.79** ***	**1**							
(8) Ln(Total Assets)	0.29 ***	0.21 ***	0.26 ***	0.35 ***	0.31 ***	0.33 ***	0.26 ***	**1**						
(9) Sigma of Cash Flow	-0.01	-0.01	-0.01	-0.01	0.02	-0.02	-0.02	0.03	**1**					
(10) Quick Ratio	-0.08 ***	-0.03	-0.19 ***	-0.19 ***	-0.09 ***	-0.19 ***	-0.21 ***	-0.13 ***	0.02	**1**				
(11) R&D ratio	-0.03 *	-0.03	-0.07 ***	-0.08 ***	-0.04 *	-0.08 ***	-0.07 ***	-0.13 ***	0.00	0.11 ***	**1**			
(12) MB	0.03	-0.02	-0.22 ***	-0.16 ***	-0.05 ***	-0.16 ***	-0.19 ***	0.01	0.08 ***	0.15 ***	0.08 ***	**1**		
(13) Industry HHI	-0.01	0.02	0.09 ***	0.08 ***	0.04 *	0.08 ***	0.11 ***	0.15 ***	0.05 **	-0.02	-0.04 **	-0.02	**1**	
(14) Leverage Ratio	0.05 **	0.08 ***	0.31 ***	0.30 ***	0.13 ***	0.31 ***	0.30 ***	0.11 ***	0.00	**-0.44** ***	-0.08 ***	-0.21 ***	0.00	**1**
(15) RSI90	-0.02	-0.01	0.12 ***	0.13 ***	0.05 ***	0.13 ***	0.12 ***	0.04 *	0.02	-0.15 ***	0.01	-0.09 ***	0.07 ***	**0.56** ***

Table 4 Difference Tests

All variables are defined as Table 2. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

	Healthy Sample	Distressed Sample	Difference	Healthy Sample		Difference	Distressed Sample		Difference
	Full Sample	Full Sample	tests	Multi-Bank Sample	Single Bank Sample	tests	Multi-Bank Sample	Single Bank Sample	tests
Variable	# of obs.: 2428	# of obs.: 349	t-value	# of obs.: 954	# of obs.: 390	t-value	# of obs.: 202	# of obs.: 70	t-value
Proportion of Effective Hedging	0.5564	0.5215	1.23	0.5985	0.5436	1.85 *	0.5693	0.4857	1.21
Effective Hedge Ratio	0.0433	0.0385	1.02	0.0542	0.0360	3.08 ***	0.0423	0.0362	0.52
Bkno	2.2129	3.8023	-5.32 ***	5.2233	1.0000	29.45 ***	6.2228	1.0000	12.32 ***
Fbkno	0.1227	0.2063	-2.00 **	0.2977	0.0359	10.12 ***	0.3416	0.0429	4.14 ***
Dbkno	2.0902	3.5960	-5.50 ***	4.9256	0.9641	29.75 ***	5.8812	0.9571	12.81 ***
Inv HHI	0.2193	0.3305	-5.87 ***	0.5582	0.0000	75.30 ***	0.5710	0.0000	34.63 ***
Bank Loan	0.1615	0.2340	-5.73 ***	0.3407	0.1721	16.21 ***	0.3445	0.1725	7.07 ***
Percentage of Single Bank	0.1606	0.2006	-1.76 *						
Percentage of Multi-Bank	0.3929	0.5788	-6.64 ***						
Total Assets	$20,908,922	$29,447,023	-2.09 **	$28,623,376	$9,514,830	7.85 ***	$37,173,608	$16,707,286	2.78 ***
Net Sales	$17,543,154	$29,894,101	-2.32 **	$17,549,941	$11,319,196	2.38 **	$22,332,119	$35,165,591	-0.92
Sigma of Cash Flow	2.0450	2.7928	-1.34	1.5101	3.0082	-1.00	3.5052	2.0504	1.68 *
Quick Ratio	175.1338	78.9453	19.16 ***	114.5051	143.8141	-4.98 ***	70.7482	90.9317	-3.16 ***
R&D Ratio	0.0350	0.0399	-0.32	0.0229	0.0276	-1.87	0.0468	0.0394	0.26
MB	1.4178	1.1909	8.15 ***	1.1970	1.3057	-2.70 ***	1.1206	1.2298	-1.87 *
Industry HHI	0.1058	0.1293	-2.81 ***	0.1175	0.0969	2.86 ***	0.1493	0.0904	3.35 ***
Leverage Ratio	34.5660	60.6965	-38.09 ***	40.5712	37.1673	4.89 ***	59.9706	62.9181	-2.04 **

Table 5 The Impact of Lending Bank Structure on Corporate Hedging

Model (1)-(4) are estimated by a Logit regression for dummy for effective hedge. Model (5)-(8) are estimated by a Tobit regression for effective hedge ratio. All other variables are defined as Table 2. The dependent variable in Model (5)-(8), Effective Hedge Ratio, is winsorized at 2%. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

	Dummy for Effective Hedging				Effective Hedge Ratio			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parameter	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
RSI	-0.6414 ***	-0.3701 **	-0.6343 ***	-0.6712 ***	-0.0411 ***	-0.0287 ***	-0.0393 ***	-0.0423 **
	(-3.19)	(-2.32)	(-3.43)	(-3.39)	(-4.21)	(-3.72)	(-4.63)	(-4.42)
Bkno			-0.0063				-0.0003	
			(-0.45)				(-0.46)	
RSI*Bkno			0.0706 **				0.0025 **	
			(2.17)				(2.24)	
Inv_HHI				-0.1236				-0.0057
				(-0.79)				(-0.78)
RSI*Inv_HHI				0.8217 **				0.0369 **
				(2.14)				(2.07)
Bank_Loan	0.2434				0.0138			
	(1.04)				(1327)			
RSI*Bank_Loan	1.1867 **				0.0515 **			
	(1.99)				(1.94)			
Sbank		0.0432				0.00004		
		(0.37)				(0.01)		
RSI*Sbank		-0.1043				-0.0029		
		(-0.34)				(-0.19)		
Ln(Total Assets)	0.4709 ***	0.4833 ***	0.4810 ***	0.4859 ***	0.0222 ***	0.0229 ***	0.0228 ***	0.0231 ***
	(13.84)	(14.46)	(13.80)	(14.24)	(15.74)	(16.49)	(15.73)	(16.30)
Sigma of Cash Flow	-0.0027	-0.0026	-0.0025	-0.0026	-0.0001	-0.0001	-0.0001	-0.0001
	(-0.81)	(-0.77)	(-0.75)	(-0.78)	(-0.80)	(-0.75)	(-0.74)	(-0.78)
Ln(Quick Ratio)	0.1278 *	0.1191	0.1265 *	0.1251 *	0.0158 ***	0.0153 ***	0.0158 ***	0.0156 ***
	(1.75)	(1.63)	(1.72)	(1.70)	(4.45)	(4.30)	(4.41)	(4.34)
R&D Ratio	0.1106	0.1145	0.1149	0.0970	0.0020	0.0019	0.0019	0.0012
	(0.31)	(0.32)	(0.32)	(0.27)	(0.12)	(0.11)	(0.12)	(0.07)
MB	0.0142	0.0032	0.0002	-0.0001	-0.0015	-0.0022	-0.0023	-0.0024
	(0.27)	(0.06)	(0.00)	(0.00)	(-0.57)	(-0.85)	(-0.90)	(-0.91)
Leverage Ratio	0.0097 **	0.0104 ***	0.0110 ***	0.0115 ***	0.0012 ***	0.0012 ***	0.0012 ***	0.0013 ***
	(2.43)	(2.65)	(2.78)	(2.90)	(6.15)	(6.48)	(6.55)	(6.62)
Industry HHI	-0.8571 **	-0.7938 **	-0.7890 **	-0.7993 **	-0.0357 *	-0.0332 *	-0.0326 *	-0.0337 *
	(-2.49)	(-2.31)	(-2.29)	(-2.32)	(-2.12)	(-1.97)	(-1.93)	(-1.99)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of observations	2777	2777	2777	2777	2777	2777	2777	2777
Pesudo R-square	0.0789	0.0769	0.0784	0.0781	0.3532	0.3449	0.3505	0.3492

Table 6 Two Stage Regression for The Impact of Multiple-Bank Relationship on Hedging

Model (1) is estimated by Logit regression for the first stage regression for RSI. Model (2) & (3) are estimated by Tobit regression for the first stage regression for Bkno and Inv_HHI. The predicted probability of RSI is sort by industry and year, and defined the top 10% of ranking as RSI is 1, and otherwise 0. Then, the predicted RSI, Bkno and Inv_HHI are used in model (4)-(7) for the second regressions for corporate hedging. Model (4)-(5) are estimated by a Logit regression for dummy for effective hedge. Model (6)-(7) are estimated by a Tobit regression for effective hedge ratio. All other variables are defined as Table 2. The dependent variable in Model (6)-(7), Effective Hedge Ratio, is winsorized at 2%. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

	First Stage Regressions					Second Stage Regressions for Corporate Hedging			
	RSI		Bkno	Inv_HHI		Dummy for Effective Hedging		Effective Hedge Ratio	
	(1)		(2)	(3)		(4)	(5)	(6)	(7)
Parameter	Estimate	Parameter	Estimate	Estimate	Parameter	Estimate	Estimate	Estimate	Estimate
Intercept	5.3414 ***	Intercept	-17.2294 ***	-1.8261 ***	RSI	-0.6002 ***	-0.6283 ***	-0.0406 ***	-0.0400 **
	(5.74)		(-8.85)	(-7.95)		(-2.49)	(-2.52)	(-3.52)	(-3.30)
Ln(Total Assets)	-0.0321	Nonperforming Loans	54.8757 ***	5.1656	Bkno	0.0154		0.0005	
	(-0.69)		(4.52)	(4.18)		(0.66)		(0.52)	
Sigma of Cash Flow	0.0025 **	Ln(Average Size of Lending Banks)	0.0015	0.0429 **	RSI*Bkno	0.0810		0.0046 **	
	(0.52)		(0.01)	(3.15)		(1.61)		(2.14)	
Ln(Quick Ratio)	-1.3136	Syndicated	0.6196 **	-0.0525	Inv_HHI		0.1360		-0.0021
	(-12.54)		(2.55)	(-2.12)			(0.51)		(-0.17)
MB	-0.1463	ROA	2.4311 *	0.3127	RSI*Inv_HHI		1.0524 *		0.0553 *
	(-1.23)		(1.77)	(2.20)			(1.68)		(1.93)
PPE/TA	-0.9667 ***	Ln(Total Assets)	1.0626 ***	0.0720 ***	Ln(Total Assets)	0.4608 ***	0.4683 ***	0.0219 ***	0.0226 ***
	(-2.48)		(12.83)	(8.52)		(12.46)	(13.21)	(13.92)	(15.17)
Modified Z	-0.4139	R&D Ratio	-0.2625	0.0388	Sigma of Cash Flow	-0.0021	-0.0021	-0.0001	-0.0001
	(-4.86)		(-0.35)	(0.52)		(-0.67)	(-0.67)	(-0.55)	(-0.57)
DA/TA	10.8707 *	Leverage Ratio	5.5240 ***	0.4356 ***	Ln(Quick Ratio)	0.1257 *	0.1275 *	0.0155 ***	0.0151 ***
	(0.74)		(6.98)	(5.33)		(1.70)	(1.72)	(4.29)	(4.17)
		Industry Comovement	0.5466	0.0343	R&D Ratio	0.0042	0.0035	-0.0023	-0.0026
			(1.45)	(0.88)		(0.08)	(0.07)	(-0.90)	(-1.00)
		Firm Age	0.0236 ***	0.0049	MB	0.0938	0.0627	0.0009	-0.0009
			(2.84)	(5.74)		(0.26)	(0.17)	(0.05)	(-0.06)
					Leverage Ratio	0.7903 **	0.8302 **	0.1045 ***	0.1088 ***
						(2.02)	(2.15)	(5.58)	(5.88)
					Industry HHI	-0.8302 **	-0.8458 **	-0.0359 **	-0.0363 **
						(-2.42)	(-2.46)	(-2.13)	(-2.15)
		Year Fixed Effect	Yes	Yes	Year Fixed Effect	Yes	Yes	Yes	Yes
# of observations	2777	# of observations	1616	1616	# of observations	2777	2777	2777	2777
Pesudo R-square	0.1571	Pesudo R-square	0.0781	0.6768	Pesudo R-square	0.0773	0.0773	0.3438	0.3415

Table 7 Subsample

The Sample of non-zero bank loan is analyzed in the Table. The number of this observation is 1616. Model (1)-(2) are estimated by a Logit regression for dummy for effective hedge. Model (3)-(4) are estimated by a Tobit regression for effective hedge ratio. All other variables are defined as Table 2. The dependent variable in Model (3)-(4), Effective Hedge Ratio, is winsorized at 2%. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

	Dummy for Effective Hedging		Effective Hedge Ratio	
	(1)	(2)	(3)	(4)
Parameter	Estimate	Estimate	Estimate	Estimate
RSI	-0.4625 *	-0.4992 *	-0.0356 ***	-0.0386 ***
	(-1.95)	(-1.87)	(-3.35)	(-3.02)
Bkno	-0.0097		-0.0006	
	(-0.59)		(-0.86)	
RSI*Bkno	0.0669 *		0.0026 **	
	(1.84)		(2.08)	
Inv_HHI		-0.1848		-0.0093
		(-0.96)		(-1.02)
RSI*Inv_HHI		0.7559		0.0359 *
		(1.64)		(1.67)
Ln(Total Assets)	0.5525 ***	0.5591 ***	0.0274 ***	0.0276 ***
	(11.53)	(12.13)	(14.11)	(14.85)
Sigma of Cash Flow	-0.0051	-0.0053	-0.0002	-0.0002
	(-0.88)	(-0.89)	(-0.90)	(-0.92)
Ln(Quick Ratio)	0.2719 ***	0.2701 ***	0.0218 ***	0.0216 ***
	(2.89)	(2.86)	(4.80)	(4.75)
R&D Ratio	0.3230	0.3053	0.0126	0.0120
	(0.83)	(0.78)	(0.72)	(0.68)
MB	-0.0165	-0.0143	0.0018	0.0019
	(-0.18)	(-0.15)	(0.40)	(0.42)
Leverage Ratio	0.0080	0.0086	0.0012 ***	0.0013 ***
	(1.48)	(1.59)	(4.80)	(4.87)
Industry HHI	-0.2220	-0.2246	0.0033	0.0022
	(-0.52)	(-0.53)	(0.16)	(0.10)
Year Fixed Effect	Yes	Yes	Yes	Yes
# of observations	1616	1616	1616	1616
Pesudo R-square	0.0922	0.0917	0.4157	0.4134

Table 8 Robustness Checks

Model (1)-(6) are estimated by a Logit regression for dummy for effective hedge. Model (7)-(12) are estimated by a Tobit regression for effective hedge ratio. All other variables are defined as Table 2. In Panel B, the dependent variable is hedge ratio standardized by net sales. To save spaces, only coefficients for main explanatories are reported. The dependent variable in Model (7)-(12) in Panel A and in Model (2) in Panel B, Effective Hedge Ratio is winsorized at 2%. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

Panel A Robustness of Threshold of Risk-Shifting Incentive

	Dummy for Effective Hedging						Effective Hedge Ratio					
	RSI70	RSI75	RSI80	RSI70	RSI75	RSI80	RSI70	RSI75	RSI80	RSI70	RSI75	RSI80
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Parameter	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
RSI	-0.3430 **	-0.3537 **	-0.4647 ***	-0.2873 *	-0.3118 **	-0.4323 ***	-0.032 ***	-0.034 ***	-0.036 ***	-0.029 **	-0.033 ***	-0.034 ***
	(-2.38)	(-2.38)	(-2.95)	(-1.88)	(-1.97)	(-2.58)	(-4.81)	(-4.98)	(-4.95)	(-4.04)	(-4.34)	(-4.30)
Bkno	-0.0103	-0.0021	-0.0057				-0.001	-0.001	-0.001			
	(-0.61)	(-0.13)	(-0.37)				(-1.23)	(-0.98)	(-1.13)			
RSI*Bkno	0.0415 *	0.0266	0.0432				0.002 **	0.002 **	0.003 **			
	(1.71)	(1.08)	(1.64)				(2.53)	(2.37)	(2.89)			
Inv_HHI				-0.0677	-0.0232	-0.0712				-0.005	-0.006	-0.006
				(-0.37)	(-0.13)	(-0.42)				(-0.64)	(-0.68)	(-0.82)
RSI*Inv_HHI				0.2309	0.1346	0.3297				0.017	0.019	0.027 *
				(0.82)	(0.46)	(1.07)				(1.29)	(1.43)	(1.85)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of observations	2777	2777	2777	2777	2777	2777	2777	2777	2777	2777	2777	2777
Pesudo R-square	0.0768	0.0767	0.0775	0.0760	0.0763	0.0769	0.3519	0.3537	0.3535	0.3464	0.3494	0.3479

Table 8 Robustness Checks (continued)
Panel B Alternative Measure of Hedge Ratio

	Effective Hedge Ratio	
	(1)	(2)
Parameter	Estimate	Estimate
RSI	-0.0408 ***	-0.0416 ***
	(-3.34)	(-3.00)
Bkno	0.0018 **	
	(2.07)	
RSI*Bkno	0.0033 **	
	(2.08)	
Inv_HHI		0.0259 **
		(2.47)
RSI*Inv_HHI		0.0424 *
		(1.65)
Controls	Yes	Yes
Year Fixed Effect	Yes	Yes
# of observations	2777	2777
Pesudo R-square	0.5310	0.5139

Table 9 The Impact of Number of Foreign and Domestic Banks on Corporate Hedging

Model (1)-(2) are estimated by a Logit regression for dummy for effective hedge. Model (3)-(4) are estimated by a Tobit regression for effective hedge ratio. All other variables are defined as Table 2. The dependent variable in Model (3)-(4), Effective Hedge Ratio, is winsorized at 2%. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

	Dummy for Effective Hedging		Effective Hedge Ratio	
	(1)	(2)	(3)	(4)
Parameter	Estimate	Estimate	Estimate	Estimate
RSI	-0.3816 **	-0.6560 ***	-0.0283 ***	-0.0408 ***
	(-2.51)	(-3.54)	(-3.86)	(-4.77)
Fbkno	0.1255		0.0132 ***	
	(1.09)		(3.19)	
RSI*Fbkno	-0.0414		-0.0017	
	(-0.18)		(-0.22)	
Dbkno		-0.0096		-0.0006
		(-0.64)		(-0.99)
RSI*Dbkno		0.0802 **		0.0030 **
		(2.33)		(2.48)
Ln(Total Assets)	0.4721 ***	0.4827 ***	0.0215 ***	0.0230 ***
	(13.71)	(13.91)	(14.98)	(15.98)
Sigma of Cash Flow	-0.0026	-0.0025	-0.0001	-0.0001
	(-0.80)	(-0.76)	(-0.77)	(-0.76)
Ln(Quick Ratio)	0.1228 *	0.1257 *	0.0161 ***	0.0156 ***
	(1.68)	(1.71)	(4.55)	(4.36)
R&D Ratio	0.1053	0.1158	0.0011	0.0020
	(0.29)	(0.32)	(0.07)	(0.12)
MB	0.0040	-0.0009	-0.0020	-0.0025
	(0.08)	(-0.02)	(-0.77)	(-0.97)
Leverage Ratio	0.0102 ***	0.0112 ***	0.0012 ***	0.0013 ***
	(2.61)	(2.82)	(6.34)	(6.64)
Industry HHI	-0.7956 **	-0.7872 **	-0.0325 *	-0.0322 *
	(-2.32)	(-2.29)	(-1.94)	(-1.91)
Year Fixed Effect	Yes	Yes	Yes	Yes
# of observations	2777	2777	2777	2777
Pesudo R-square	0.0773	0.0786	0.3575	0.3511

Table 10 The Impact of Bank Structure on Risk-shifting in Classified Samples

The observations are separated into old firms and young firms by the median of firm age of sample firms in each year, and the regression results are presented in Panel A. The observations are separated into growth firms and value firms by the median of market to book ratio of sample firms in each year, and the regression results are presented in Panel B. The observations are separated into more profitable firms and less profitable firms by the mean of ROA of sample firms in each year, and the regression results are presented in Panel C. To save spaces, only coefficients for main explanatories are reported. The dependent variable, Effective Hedge Ratio, is winsorized at 2%. The symbols *,**,*** denote significance at 10%,5%,1%, respectively.

Panel A. Classified by Firm Age

	Dummy for Effective Hedging		Effective Hedge ratio			Dummy for Effective Hedging		Effective Hedge ratio	
	Old firms	Young firms	Old firms	Young firms		Old firms	Young firms	Old firms	Young firms
Parameter	Estimate	Estimate	Estimate	Estimate	Parameter	Estimate	Estimate	Estimate	Estimate
RSI	-0.5934 ***	-0.6912 ***	-0.0384 ***	-0.0424 ***	RSI	-0.5294 *	-0.8023 ***	-0.0384 ***	-0.0450 ***
	(-2.27)	(-2.61)	(-2.93)	(-3.73)		(-1.84)	(-2.91)	(-2.57)	(-3.64)
Bkno	0.0006	-0.0278	0.0007	-0.0018 *	Inv_HHI	0.1721	-0.6007 **	0.0151	-0.0329 ***
	(0.03)	(-1.19)	(0.81)	(-1.94)		(0.81)	(-2.47)	(1.44)	(-3.03)
RSI*Bkno	0.0685	0.0811 *	0.0025	0.0036 **	RSI*Inv_HHI	0.5226	1.2644 **	0.0268	0.0524 **
	(1.55)	(1.65)	(1.33)	(2.45)		(1.01)	(2.06)	(1.03)	(2.00)

Panel B. Classified by Market to Book Ratio

	Dummy for Effective Hedging		Effective Hedge ratio			Dummy for Effective Hedging		Effective Hedge ratio	
	Growth firms	Value firms	Growth firms	Value firms		Growth firms	Value firms	Growth firms	Value firms
Parameter	Estimate	Estimate	Estimate	Estimate	Parameter	Estimate	Estimate	Estimate	Estimate
RSI	-1.0227 ***	-0.3527	-0.0656 ***	-0.0243 **	RSI	-1.0720 ***	-0.3002	-0.0678 ***	-0.0225 *
	(-3.56)	(-1.46)	(-4.47)	(-2.31)		(-3.61)	(-1.10)	(-4.34)	(-1.83)
Bkno	0.0138	-0.0180	0.0005	-0.0009	Inv_HHI	-0.0420	-0.1613	0.0011	-0.0102
	(0.60)	(-0.98)	(0.54)	(-1.15)		(-0.17)	(-0.77)	(0.09)	(-1.09)
RSI*Bkno	0.1402 **	0.0304	0.0050 **	0.0018	RSI*Inv_HHI	1.5299 **	0.1737	0.0606 *	0.0151
	(2.29)	(0.85)	(2.09)	(1.40)		(2.38)	(0.35)	(1.91)	(0.70)

Panel C. Classified by ROA

	Dummy for Effective Hedging		Effective Hedge ratio			Dummy for Effective Hedging		Effective Hedge ratio	
	More Profit Firms	Less Profit Firms	More Profit Firms	Less Profit Firms		More Profit Firms	Less Profit Firms	More Profit Firms	Less Profit Firms
Parameter	Estimate	Estimate	Estimate	Estimate	Parameter	Estimate	Estimate	Estimate	Estimate
RSI	-0.6361 **	-0.6739 ***	-0.0368 **	-0.0387 ***	RSI	-0.7628 **	-0.6628 ***	-0.0373 **	-0.0432 ***
	(-2.01)	(-2.87)	(-2.39)	(-3.92)		(-2.27)	(-2.63)	(-2.12)	(-3.91)
Bkno	0.0175	-0.0264	0.0004	-0.0010	Inv_HHI	0.0235	-0.2942	0.0071	-0.0197 **
	(0.79)	(-1.39)	(0.44)	(-1.29)		(0.10)	(-1.34)	(0.62)	(-2.07)
RSI*Bkno	0.0741	0.0886 **	0.0006	0.0035 ***	RSI*Inv_HHI	1.0835	0.8879 *	0.0088	0.0522 ***
	(1.08)	(2.28)	(0.29)	(2.75)		(1.49)	(1.88)	(0.25)	(2.61)