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Diversification and the cost of debt of bank holding companies

Saiying (Esther) Deng [a,1], Elyas Elyasiani [b,*], Connie X. Mao [b,2]

[a] *University of Minnesota, Duluth, Labovitz School of Business and Economics, Duluth, MN 55812, United States*
[b] *Temple University, Department of Finance, Fox School of Business and Management, Speakman Hall, Philadelphia, PA 19122, United States*

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Abstract

In this study, we investigate the relationship between various dimensions of diversification and the cost of debt for publicly traded bank holding companies (BHCs). We find that both domestic geographic diversification of deposits and diversification of assets lead to a lower bond yield-spread. Diversification of non-traditional banking activities leads to a lower cost of debt only when yield-spread and diversification are estimated simultaneously. In addition, we find that medium-sized BHCs experience a greater reduction in bond yield-spread than small-sized and large-sized BHCs. This is consistent with the too-big-to-fail (TBTF) effects in the banking industry. Furthermore, we document that the association between diversification and yield-spread is bidirectional with higher yield-spreads being associated with greater asset and activity diversification and lower geographic deposit dispersion. The effect of diversification on bond yield-spread is robust after accounting for cross-sectional and serial correlation, and the endogeneity of diversification.

JEL classification: G21

Keywords: Bank holding company; Diversification; Cost of debt

* Corresponding author. Tel.: +1 215 204 5881; fax: +1 215 204 1697.
E-mail addresses: sdeng@d.umn.edu (S. Deng), elyas@temple.edu (E. Elyasiani), cmao@temple.edu (C.X. Mao).
[1] Tel.: +1 218 726 8453.
[2] Tel.: +1 215 204 4895.

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1. Introduction

The US Banking industry has undergone a tremendous level of consolidation during the recent decades. According to Pilloff (2004), during the period of 1980–2003, the number of banks decreased by half, from about 16,000 to 8000, while the share of industry assets and deposits held by the top ten banks rose from 22% and 19%, to 46% and 41%, respectively. This pattern can be attributed to deregulation and technological advancement in the banking industry, which have enabled banks to provide a wider range of products and services to more customers across a greater geographical area.[3]

It is well documented that merger and acquisition (M&A) activities in the banking industry can achieve cost savings and synergy gains, as well as increased market power, thereby yielding a lower cost of capital (Pilloff, 1996; Houston et al., 2001; Penas and Unal, 2004). However, M&A activities are often associated with various dimensions of diversification, e.g., geographic expansion, and diversification of assets, activities, and markets. While the aggregate impact of M&A activities in the banking industry has been documented in the literature, the economic costs and benefits of each dimension of diversification have rarely been studied.

Deng and Elyasiani (2005a) find that geographic diversification of BHCs is associated with a significant decline in equity risk, yet an insignificant effect on stock returns. Deng and Elyasiani (2005b) find that diversification of assets and non-traditional activities are associated with a significant decline in bank earning volatility, and, thus, with a lower firm risk.[4] The reduction of risk due to BHC diversification provides a rationale for the M&As witnessed in the recent decades. Yet the remaining question is how these diversification activities affect bondholder wealth, and, hence, the bond yield.

In this study, we examine whether the extent of several categories of diversification (geographic, asset, and non-traditional activity) affects the cost of debt for a sample of publicly traded bank holding companies (BHCs). The public debt market is worthy of attention because of its tremendous size and its large share in a typical corporation's total assets.[5] In addition, because bonds have well-defined future payoffs, bond pricing models are more reliable, than stock valuation models (e.g., the capital asset pricing model), and, thus, they are less subject to the criticism that the empirical findings on yields might be driven by model misspecification (Klock et al., 2005). Finally, the impact of diversification on stocks and bonds might be different because of their dissimilar payoff patterns. Specifically, bond prices increase with firm value but decrease with firm risk, while stock prices increase with both.

Moreover, the banking industry provides a unique opportunity for studying the impact of different types of diversification on cost of debt for several reasons. First, detailed data on bank operation across geographic regions, loan compositions, and non-traditional banking activities are available for this industry. Second, the highly regulated nature of

[3] Recent deregulation in banking includes the 1994 Riegle-Neal Interstate Banking and Branch Efficiency Act, which allowed nationwide banking; and the 1999 Gramm-Leach-Bliley Act, which permitted commercial banks, securities firms and insurance companies to affiliate within a Financial Holding Company structure.

[4] Deng and Elyasiani (2005b) use the same measure of non-traditional banking activities as the one employed here and described in the data section.

[5] Ljungqvist et al. (2006) document that between December 1993 and June 2002, the US capital market raised $1155 billion of public debt versus $745 billion of public equity.

the banking industry protects the banks, but it also exposes them to new vulnerabilities as they diversify.[6] Third, bank deposits are protected by FDIC insurance coverage with the largest firms in this industry being protected by the so called "Too-Big-to-Fail (TBTF)" doctrine that effectively insures 100% of all their liabilities.[7] As banks enter into new lines of activity or new regions, especially if they are large, the FDIC insurance coverage will be practically extended to the new activities and new subsidiaries. These unique features make the banking industry distinct and are likely to make the impact of diversification on cost of debt dissimilar in banking to those found for other industries. The special features of the bond market and the banking industry provide strong motivation for studying the relationship between diversification and bond yield-spread in this industry.

In this paper, we employ deposit dispersion as a measure of geographic diversification. This measure is superior to those used in prior studies because it accounts for both, the number of locations, where a BHC operates, and the level of deposits in each location. Measures used in prior studies account for either of the two, but not both (i.e., Doukas and Pantzalis, 2003). Our sample includes publicly traded BHCs for which corporate bond information is available in the Lehman Brothers Bond Database (LBBD) during the sample period of 1994–1998. Based on this sample, we provide a comprehensive analysis of the effects of multiple dimensions of diversification, namely, geographic, asset, and non-traditional banking activity diversification on bondholder wealth. We find that, after controlling for both bond-specific and issuing-bank-specific characteristics, both domestic geographic diversification and asset diversification lead to a lower bond yield-spread. An increase of one standard deviation in geographic diversification and asset diversification measures, respectively, lead to a reduction of 5.9 and 4.6 basis points in bond yield-spread. These figures correspond to a saving of $2.79 and $2.18 millions, respectively, in interest payments per year for a BHC. The results are robust when we use the Fama-MacBeth procedure and when we use the Rogers (1993) standard errors to correct for both time and firm effects. Diversification of non-traditional banking activities leads to a lower cost of debt only when yield-spread and diversification are estimated simultaneously. The impact of diversification on bond yield-spread seems to reflect portfolio risk reduction and synergy gains.

The effect of size on the findings is of special interest because the "too-big-to-fail (TBTF)" provisions in the banking industry engender incentives for banks to grow in size to, in effect, benefit from full liability insurance and maximum implicit government guarantees, at little cost. We find that medium-sized BHCs experience a significantly greater reduction in their bond yield-spread than small-sized and large-sized BHCs. An increase of one standard deviation of geographic diversification reduces 25.7 more basis points for median-sized BHCs than for small-sized BHCs, and 3.6 more basis points for median-sized BHCs than for large-sized BHCs.

While most studies investigate the effect of diversification on bond yield-spread as being unidirectional, in reality the interaction may be of mutual character because high

[6] For instance, Regulation Y obligates a bank holding company (BHC) to act as a source of managerial and financial strength to its subsidiaries, e.g., even to inject capital to failing subsidiaries. This requirement, called the 'source-of-strength' doctrine, makes the BHCs sensitive to the problems of all their subsidiaries as they diversify.

[7] Penas and Unal (2004) attribute the positive bond market reaction to diversification gains to too-big-to-fail status, and to a lesser degree, synergy gains. Reeb et al. (2001) show that the level of international diversification is associated with better credit rating and lower cost of debt for industrial firms but overlook the banking entities.

yield-spreads might motivate or compel firms to diversify. We examine this issue within a simultaneous equation system that controls for endogeneity of the diversification decision and document a bidirectional relationship. We find that increased diversification in deposits, assets or non-traditional activities reduces the yield-spread, while higher yield-spreads lead to increased diversification in assets and non-traditional activities but reduce the scope of bank deposit geographic dispersion.

Our study fills a gap in the literature by employing more accurate measures of diversification as discussed earlier, providing a comprehensive analysis of a variety of diversifications on bondholder wealth of publicly traded BHCs, and documenting a 'too-big-to-fail' effect on the cost of debt in banking. In addition, our study complements Reeb et al. (2001); they show a negative relationship between internationalization and the cost of debt for industrial firms, we find that domestic geographic expansion has a similar effect on cost of debt of BHCs. Our result on geographic diversification is also consistent with Penas and Unal (2004) who find that geographic diversification is associated with an increase in bond prices (decrease in bond yield). The paper is organized as follows. Section 2 reviews the related literature and develops the hypotheses. Section 3 describes the data and methodology. Section 4 presents the empirical results and Section 5 concludes.

2. Related literature and hypothesis development

Studies examining the impact of bank diversification on the cost of debt are rare. An exception is Penas and Unal (2004), which explores the changes in bond returns around bank mergers. They find that geographic diversification is associated with an increase in bank's bond price (decrease in yield) around the time of bank merger announcement. Their study is, however, restricted to bank mergers, instead of general geographic diversification, and it uses a very crude measure of geographic diversification (a dummy variable that equals one if the merger is between banks with headquarters in different states, and zero otherwise). In contrast, Stiroh (2004) has shown that diversification in the form of a shift from traditional to non-traditional banking activities produces few gains. DeYoung and Roland (2001) also document that as the fee-based activities of banks increase, their total revenue becomes more volatile. Acharya et al. (2006) document different impacts from different types of diversification on bank performance and risk based on a sample of 105 Italian banks.

In terms of the channels of the effect, diversification puts in motion several forces. Portfolio theory suggests that diversification reduces risk because of the imperfect correlation among different markets or different regions. As a result, earning volatility, the probability of bankruptcy and firm risk all decrease (Galai and Masulis, 1976; Shapiro, 1978; Boot and Schmeits, 2000). In addition, diversification may help banks to explore better investment opportunities and create synergies in different regions and different business sectors, thereby enhancing firm value (Jensen and Ruback, 1983). Both of these arguments suggest a negative relation between bank diversification and the cost of debt.

H_{1A}: Diversification is negatively associated with the cost of debt.

Other arguments, however, lead to the opposite conclusion. As firms expand their business operation to different activities, assets and geographic regions, the organizational structure of the firm becomes more complex, and information asymmetry between shareholders and managers strengthens (Krishnaswami et al., 1999). The severe information

asymmetry problem escalates the difficulties shareholders face in monitoring managers, and, thus, intensifies the agency problems.[8] As a result, managers may maintain a diversification strategy even if doing so reduces firm value. These agency problems reduce bond value ex-ante, thereby increasing the cost of debt.[9] In addition, Winton (1999) argues that a bank's risk depends on the monitoring incentive (and effectiveness) of its monitors, as well as its degree of portfolio diversification. Due to conflicts of interests between bank shareholders and creditors, an increase in the probability of default reduces the incentives of bank shareholders to monitor their bank loans, especially when the loan portfolio has high downside risk.[10]

Other potential impacts of geographic diversification include weakened market power and lesser cost savings observed in geographically-diversifying mergers (Pilloff, 1996; Prager and Hannan, 1998; Houston et al., 2001). For example, Houston et al. (2001) find that stock prices react more favorably to mergers with greater geographic overlap. This type of merger makes it more feasible to close overlapping bank branches and redundant headquarters. In addition, it helps consolidate back office functions such as custody, escrow, and trust services, settlement services, and research and advisory functions. Therefore, geographic diversification might be associated with less cost saving and, hence, would reduce firm value and bond price, in turn increasing the cost of debt. The above arguments suggest the following hypothesis:

H_{1B}: Diversification is positively associated with the cost of debt.

We are particularly interested in geographic diversification because of the new interstate branching laws and the effect of regional factors on bank performance.[11] Regulations at the state level are important because they influence not only the market for corporate control but also the activities banks may engage in and the characteristics of a bank's assets. A bank's loan portfolio is greatly influenced by the regulation and business opportunities in its area.

Demsetz and Stranhan (1997) document a positive relation between size and diversification. If a bank diversifies through geographic expansion and/or M&A, and reaches the too-big-to-fail (TBTF) status, all its uninsured liabilities would have de facto insurance coverage and the value of the implicit government guarantees would be maximized. Along these lines, Penas and Unal (2004) document a TBTF effect on bond returns around bank mergers; only medium-sized bank mergers lead to higher bondholder returns. By the same token, we propose that if a TBTF effect does result from diversification, one would expect the medium-sized BHCs to benefit more from it on their bond yield-spread, than either the large-sized or the small-sized BHCs. This is because, given the fact that small-sized BHCs are far away from the TBTF status, and large-sized BHCs may have already achieved the

[8] To maximize their interests, managers may pursue riskier investment opportunities (the risk shifting problem) or underinvest in positive NPV projects (the underinvestment problem) (Jensen and Meckling, 1976; Myers, 1977). In addition, they may pursue their personal objectives such as empire building (Jensen and Meckling, 1976), protecting their specific human capital from firm risk (Amihud and Lev, 1981), and entrenchment (Shilerfer and Vishny, 1989).

[9] Several empirical studies support this agency view, e.g., Denis et al. (1997), and Scharfstein and Stein (2000).

[10] This is because the cost of monitoring is borne by the bank shareholders, while creditors capture most of the gains of lowering the default risk.

[11] The provisions of the new interstate branching laws are described in the data section.

TBTF status, further increases in diversifications in these two groups would have limited effect on bond yield-spread. Contrary to this, medium-sized BHCs have the potential to achieve the TBTF status through increased diversification, benefiting from increased government guarantees and, thereby, a larger reduction in their bond yield-spread. As a result, we propose the following hypothesis:

H_2: Bond yield-spread is reduced the most by diversification for bonds issued by medium-sized BHCs.

3. Data description

3.1. Data sources

We employ four databases in our empirical analysis: the Lehman Brothers Bond database (LBBD), the Bank Holding Company (BHC) database, the FDICs Summary of Deposits (SOD) database, and the CRSP (Center for Research in Security Prices of University of Chicago) database. The LBBD database contains month-end bond-specific information, such as traders' quotes of bond prices and yields, coupons, Moody's and S&P's credit ratings, and durations, on over 10,000 publicly traded, nonconvertible corporate bonds from January 1973 to March 1998.[12] The Bank Holding Company database provides quarterly data on BHC-specific variables such as total assets, total equity, total loans, loans to different economic sectors, and various non-interest income activities, etc. The SOD database provides annual information on the amount of deposits and location for each and every branch of subsidiary banks, as well as their associated parent BHCs. These data are the most detailed data available on bank geographic expansion. The CRSP database provides both monthly and daily data on stock prices and returns.

The SOD database starts from 1994, and the LBBD database ends in March 1998. Hence, our sample is restricted to the period of 1994–1998. Our sample selection procedure is as follows. First, we hand-match the 1959 financial firms extracted from CRSP based on SIC codes with the 6443 BHCs from the SOD and BHC databases and obtain 617 matched BHCs. Second, we hand-match the 617 BHCs with the LBBD database based on issuer name. In addition to bonds issued by BHCs, we also identify bonds that are issued by their subsidiary banks. This yields 564 bonds issued by 74 BHCs. Since geographic diversification is constructed from the annual SOD database, we retain bond information at each year-end. After deleting the BHCs with missing values on either BHC-specific, CRSP or bond-specific variables, we obtain a final sample of 492 bonds issued by 64 BHCs, with a total of 1458 bond-year observations for analysis of geographic diversification. Asset and non-traditional activity diversification data are constructed from the quarterly BHC database, thereby we retain bond information at each quarter-end. For analysis of asset and non-traditional activity diversification, our final sample contains 488 bonds issued by 61 BHCs, with a total of 4041 bond-quarter observations.

[12] Although the LBBD does not include the universe of traded bonds, we have no reason to suspect a systematic bias within the sample. This data set is commonly used in the literature (e.g., Reeb et al., 2001; Penas and Unal, 2004).

3.2. Variable construction

We use three groups of variables in our analysis: diversification measures, and BHC-specific and bond-specific variables. This section provides details on how these variables are constructed.

3.2.1. Measures of diversification

Following Hughes et al. (1999), we construct a measure of deposit dispersion that accounts for both the number of regions where a BHC operates and the level of operations in each region. This measure is computed as one minus the squared ratio of a BHCs deposits in each state (or MSA) to the sum of its deposits over all states (or MSAs) where the BHC operates:

$$\text{GeodivSt} = 1 - \sum_j \left(\frac{\text{deposit}_j}{\sum_j \text{deposit}_j} \right)^2, \quad j = 1, 2, \ldots, m, \tag{1}$$

$$\text{GeodivMSA} = 1 - \sum_j \left(\frac{\text{deposit}_j}{\sum_j \text{deposit}_j} \right)^2, \quad j = 1, 2, \ldots, n. \tag{2}$$

In this formulation, GeodivSt (GeodivMSA) is deposit dispersion based on the States (MSAs), deposit_j is deposits in the jth State (or MSA), and $\sum_j \text{deposit}_j$ is the sum of deposits over all of the States (or MSAs) in which the BHC operates.[13] The deposit dispersion indexes have features similar to a Herfindahl index and present two advantages relative to the diversification measures used in prior literature. First, they account for both the number of regions in which BHC operates and the size of operation in each region. Second, they are continuous variables bounded between zero and one, and increase with the degree of diversification.

Following Acharya et al. (2006) and Doukas and Lang (2003), we employ a Herfindahl-type index to measure asset and non-traditional activity diversifications. The diversification Herfindahl index (HHI) is calculated as one minus the sum of the squared exposures as a fraction of total exposure under a given category

$$\text{HHI} = 1 - \sum_i \left(\frac{S_i}{TS} \right)^2, \quad i = 1, 2, \ldots, n, \tag{3}$$

where S_i is the exposure of category i (e.g., category sales, category assets), and TS is the total exposure (e.g., total sales, total assets). HHI ranges between zero and one, and increases with the degree of diversification.

Generally, commercial banks pursue two broad categories of business: traditional and non-traditional banking. Traditional banking includes making loans to different economic sectors such as commercial and industrial, real estate, agriculture, financial institutions, individuals, and others. We construct an asset diversification index (AHHI) based on the above loan categories. Non-traditional banking activities include fiduciary income, service charges, trading revenue, foreign exchange transaction income, and other off balance

[13] The data on BHCs deposits in each state (MSA) are extracted from the SOD database, and are computed as the sum of deposits at the branch level within a state (MSA). Data on BHCs loans in each state (MSA) are unavailable.

sheet, fee-based activities. We construct a non-traditional activity diversification index (ACTHHI) based on the above non-interest income activities.[14]

3.2.2. BHC-specific variables

BHC size is measured by the logarithm of total market value (MV) of equity plus the book value (BV) of total debt, where the MV of equity is measured as the number of shares outstanding multiplied by the year-end stock price. BHC size is expected to be negatively related to yield-spread, since larger BHCs are usually more well-established and associated with better credit quality and lower default risk. Leverage is measured as the book value of total debt divided by book value of total debt plus market value of equity. A higher leverage ratio leads to a larger default risk, and, therefore, a higher yield-spread. To measure the firm level risk, we compute Volatility as the standard deviation of monthly stock return of the issuing BHC over a 12-month period in each calendar year. The more volatile the stock return is, the riskier the BHC is, and, thus, the higher the yield-spread.

Following Barclay and Smith (1995), we use a firm's market-to-book ratio to proxy for agency problems. The market-to-book ratio proxies for growth options in a firm's investment opportunity set. Myers (1977) argues that firms with larger growth options relative to assets in place are subject to greater agency problems. We expect a positive relationship between this Agency proxy and bond yield-spread since agency problems raise the cost of debt financing.

Reeb et al. (2001) have documented a significant impact from international diversification on the cost of debt. To control for the possible confounding impact of international diversification, we also introduce a measure of international diversification (Int'l Div), which is computed as one minus the sum of squared exposures of total deposits in domestic offices and foreign offices, in the geographic diversification analysis.

3.2.3. Bond-specific variables

Bond yield-spread is the difference between the bond yield and the yield of a matched Treasury security with similar coupon rate and maturity. Bond credit rating is based on Moody's and S&P's credit rating. A conversion scale is adopted by LBBD in which AAA+ rated bonds are assigned a value of 1, and D-rated bonds receive a value of 23. Therefore, the higher the value, the poorer the credit quality, and the higher the yield-spread is expected to be. Maturity is the length of time (in years) before the bond matures. Based on liquidity premium theory, securities with longer maturities have greater risks, and, hence, investors would demand larger premiums for these securities. Therefore, we expect a positive relation between maturity and yield-spread.

To measure bond liquidity, we employ two measures: bond issue-size, and bond age. Prior studies have shown that bond yield-spread is negatively related to issue-size, and positively related to bond age (Warga, 1992; Yu, 2005). This is because a larger issue-size is associated with higher liquidity, and thus a lower yield-spread. A more recently issued bond is more liquid than an older bond and is, therefore, associated with a lower yield-spread. We use the natural logarithm of the amount of bond outstanding (in thousand

[14] Over the last two decades, the share of non-traditional banking activities has been rising at the expense of traditional banking. For example, DeYoung and Roland (2001) report that non-interest income at FDIC-insured commercial banks increased from 25% to over 40% of aggregate income over the period of 1984–2001.

dollars) to proxy for issue-size. Bond age is the length of time (in years) since the bond was issued.

In addition to the above bond-specific variables, along the lines in Bhojraj and Sengupta (2003), we also include four dummy variables to control for bond provisions. CALL, PUT, SINK, and SENIOR take the unit value, respectively, if the bond is identified, in the LBBD, as a bond which is callable, putable, supported by sinking fund provision, and holds seniority status, and zero otherwise. Since investors demand a call interest premium, we expect a positive relationship between the call dummy and the yield-spread. Put provision allows bondholders to sell bonds to the issuer at pre-specified prices. Thus, it raises the bond price and lowers the yield-spread. Both sinking fund provision and senior bond status reduce default risk, and, thus, are expected to be negatively related to the bond yield-spread.

3.3. Sample descriptive statistics

Table 1 reports the descriptive statistics for the variables used in our analysis. Among the bond-specific variables reported in Panel A, the average bond yield of our sample is 6.91%, and the average bond yield-spread is 84 basis points. Yield-spreads of our sample appear much smaller than those of a much broader sample of industrial firms (2194 firm-year observations) used in Reeb et al. (2001), which stands at 217 basis points. One explanation is that BHCs benefit from FDIC insurance and, at least, some of them have the advantage of being considered too-big-to-fail. Moreover, BHCs in our sample are considerably larger and better rated than average industrial firms. The average bond maturity in our sample is 12.23 years, with a mean duration of 5.6 years. The average issue-size is $207 million, and the average bond age is about 3 years. Panel B reports summary statistics on firm-specific variables. Our sample is populated mostly with very large and highly leveraged BHCs; the mean (median) of total assets is $134.01 ($88.54) billion, and the average (median) of total debt to total assets ratio is 0.84 (0.85).The average standard deviation of monthly stock return (Volatility) is 7%.

As for the variables of our most interest, the mean (median) of the geographic diversification measure based on states is 0.53 (0.55). The mean (median) of the geographic diversification measure based on MSA is 0.47 (0.48). International diversification (Int'l DIV), asset diversification (AHHI) and non-traditional activity diversification (ACTHHI) measures average at 0.18, 0.65, and 0.53, respectively.

4. Multiple regression analysis

Following Bhojraj and Sengupta (2003) and Yu (2005), we conduct the empirical analysis using bond level data.

4.1. Effect of geographic diversification on bond yield-spread

If diversification has an impact on firm value and firm risk, and the corporate bond market incorporates these impacts in bond pricing, we would expect an association between the level of BHC diversification and the bond yield-spread. To examine this association, following Bhojraj and Sengupta (2003) and Yu (2005), we estimate the regression model as

Table 1
Summary statistics of our sample (1994–1998)

Variable	*N*	Mean	Median	St. Dev.	Min	Max
Panel A. Bond-specific variables[a]						
Yield (%)	1458	6.91	6.61	0.96	4.35	11.41
Yield spread (%)	1458	0.84	0.76	0.54	0.00	4.41
Moody rating (Aaa+ = 1)	1458	6.57	7.00	1.94	2.00	14
Maturity (years)	1458	12.23	10.01	7.49	1.93	40.03
Duration (years)	1458	5.60	5.44	3.22	0.04	29.63
Issue-size ($mil)	1458	207.41	200.00	128.45	2.26	1000.00
Bond Age (years)	1458	2.83	2.38	2.22	0.00	23.22
CALL dummy	1458	0.12				
PUT dummy	1458	0.03				
SINK dummy	1458	0.11				
SENIOR dummy	1458	0.22				
Panel B. BHC-specific variables[b]						
Total assets ($mil)	1458	134,007	88,540	118,314	184.69	617,679
Leverage	1458	0.84	0.85	0.08	0.47	0.99
Volatility	1458	0.07	0.07	0.03	0.01	0.16
GeodivSt	1458	0.53	0.55	0.28	0.00	0.88
GeodivMSA	1458	0.47	0.48	0.30	0.00	0.92
Agency Proxy	1458	1.12	1.09	0.12	0.92	1.92
Int'l Div	1458	0.18	0.12	0.16	0.00	0.49
AHHI (asset)	4041	0.65	0.68	0.12	0.07	0.76
ACTHHI (activity)	4041	0.53	0.56	0.12	0.01	0.74

[a] Yield spread is the yield-spread between bond yield and the yield of a treasury security with similar coupon rate and maturity. For Moody rating, the LBBD adopts a conversion scale in which Aaa+ (or AAA+) rated bonds are assigned a value of 1 and D-rated bonds receive a value of 23. Maturity is the length of time (in years) before the bond matures. Duration refers to Macaulay duration and is defined as the discounted time-weighted cash flow of the bond divided by its price. Issue-size is the amount of bond outstanding (in million dollars). Bond age is the length of time (in years) since the bond was originally issued. CALL, PUT, SINK, and SENIOR are dummy variables that take the unit value, respectively, when the bond is callable, putable, backed by sinking fund provision, and assigned seniority status. Otherwise, they take a value of zero.

[b] Total assets are the book value of total assets (in million dollars). Leverage is the book value of debt divided by market value of total assets. Volatility is the standard deviation of monthly stock returns over a 12-month period in a calendar year. GeodivSt (GeodivMSA) is the deposit dispersion based on state (MSA). It is computed as one minus the squared ratio of a BHCs deposit in each state (MSA) to the sum of its deposits over all states (MSAs) in which the BHC operates. Agency proxy is measured by market-to-book ratio of BHCs. International diversification (Int'l Div) is measured as one minus the sum of squared exposures of total deposits in domestic offices and foreign offices. Asset diversification (AHHI) is measured by the sum of squared exposures (measured as a fraction) in the form of real estate loans, loans to agriculture sector, commercial and industrial loans, loans to individuals, loans to depositary institutions, and other loans, etc. Non-traditional activity diversification (ACTHHI) is measured by the sum of squared exposures (measured as a fraction) of fiduciary income, service charges, foreign exchange transaction income, trading income, and other non-interest income to total non-interest income.

$$\begin{aligned}\text{Yield Spread} = {} & \alpha_0 + \gamma_1 \text{Credit Rating} + \gamma_2 DIV + \gamma_3 \text{Agency Proxy} \\ & + \gamma_4 \text{Int'l DIV} + \gamma_5 \text{Maturity} + \gamma_6 \text{Issue Size} + \gamma_7 \text{Bond Age} \\ & + \gamma_8 \text{Firm Size} + \gamma_9 \text{Leverge} + \gamma_{10} \text{Volatility} + \gamma_{11} \text{CALL} \\ & + \gamma_{12} \text{PUT} + \gamma_{13} \text{SINK} + \gamma_{14} \text{SENIOR} + \gamma_{15} \text{YearDummy}, \end{aligned} \tag{4}$$

where Yield Spread is the difference between the bond yield and the yield of a matched Treasury security with similar coupon rate and maturity. The explanatory variables include various bond-specific and firm-specific variables, and a set of year dummy variables to control for the time effects. Our parameter of interest is the diversification coefficient (γ_2). A negative coefficient would support the portfolio theory while a positive coefficient would support the agency theory, and the arguments of weakened market power and less cost savings attributed to diversification.

Panels A and B in Table 2 present the multiple regression results on geographic diversification measured as the deposit dispersion within the state (GeodivSt) and within the

Table 2
Geographic diversification and bond yield-spread

	Panel A. DIV = GeodivSt			Panel B. DIV = GeodivMSA		
	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	1.8283***	1.2677***	1.4513***	2.1644***	1.7079***	1.7511***
	(4.28)	(2.97)	(3.34)	(5.46)	(4.31)	(4.36)
Moody rating		0.052***	0.0376***		0.05***	0.0352***
		(7.04)	(4.17)		(6.75)	(3.93)
DIV	−0.1946***	−0.2136***	−0.117**	−0.1172**	−0.0927*	−0.0394
	(−2.88)	(−3.21)	(−1.98)	(−2.27)	(−1.82)	(−0.88)
Agency Proxy	0.2632	0.4153	0.5938	0.5263	0.762	0.8071*
	(0.4)	(0.74)	(1.21)	(0.95)	(1.40)	(1.69)
Int'l DIV	0.4738***	0.403***	0.3048***	0.5713***	0.5422***	0.3896***
	(3.55)	(3.06)	(2.62)	(4.65)	(4.48)	(3.65)
Maturity	0.0131***	0.0121***	−0.0015	0.0125***	0.0116***	−0.0017
	(7.24)	(6.76)	(−0.70)	(6.87)	(6.45)	(−0.81)
Issue-size	−0.0815***	−0.086***	−0.0746***	−0.0797***	−0.0828***	−0.0739***
	(−4.05)	(−4.34)	(−3.94)	(−3.96)	(−4.18)	(−3.89)
Bond Age	−0.0395***	−0.045***	−0.035***	−0.0396***	−0.0447***	−0.0347***
	(−6.51)	(−7.48)	(−6.53)	(−6.52)	(−7.41)	(−6.47)
Firm-size	−0.0564***	−0.0188	−0.0204	−0.0758***	−0.0451***	−0.0365***
	(−3.21)	(−1.04)	(−1.24)	(−5.13)	(−2.96)	(−2.66)
Leverage	1.0829***	0.6767***	0.5186**	0.9955***	0.5767**	0.4466*
	(4.20)	(2.60)	(2.21)	(3.92)	(2.24)	(1.93)
Volatility	0.7622	0.4419	−0.1838	0.7293	0.403	−0.182
	(0.91)	(0.53)	(−0.25)	(0.87)	(0.49)	(−0.24)
CALL			0.7931***			0.797***
			(18.97)			(19.06)
PUT			−0.1145			−0.12
			(−1.45)			(−1.52)
SINK			−0.0083			−0.0172
			(−0.15)			(−0.32)
SENIOR			−0.0147			−0.0193
			(−0.43)			(−0.57)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs	1458	1458	1458	1458	1458	1458
Adj. R^2	0.1324	0.1607	0.351	0.1306	0.1566	0.3496

Note: This table reports the OLS regression results explaining bond yield-spread using geographic diversification measures (Eq. (4)). The dependant variable is bond yield-spread (the difference between bond yield and the yield of a matched treasury security with similar coupon rate and maturity). Firm-size is the log of (BV of total debt plus MV of equity). All other independent variables are as defined in Table 1. Dummy variables of each calendar year are included to control for the time effects. *t*-Statistics are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

MSA (GeodivMSA). In model (1), we do not include credit ratings and the four bond provision dummies. The results show that, consistent with our expectations, maturity and leverage are positively related to bond yield-spread, while issue-size and firm-size are negatively related to it. In contrast to Reeb et al. (2001), our measure of international diversification is significantly and positively related to bond yield-spread. It might be that as BHCs expand their operations internationally, they are subject to more severe agency problems and greater exchange rate risk and, thus, a higher cost of debt. Unexpectedly, the coefficient estimate on Volatility is insignificant and that on Bond age is significantly negative. For the variables of our interest, the coefficient estimates on both geographic diversification measures are negative and significant.

In model (2), we include Moody's credit rating to control for the impact of credit rating on bond yield-spread.[15] The Moody's rating variable is positively related to yield-spread. More importantly, we find that even after controlling for credit ratings, the coefficient estimates of both geographic diversification measures remain negative and significant. Model (3) expands model (2) by adding the four bond provision dummies as regressors. While the CALL dummy is significantly positive, the other three dummies are insignificant. Interestingly, after controlling for the credit rating and bond provision variables, the coefficient estimates of both geographic diversification measures remain negative, though statistically significant only for GeodivSt.

The results in these three models suggest that the degree of geographic diversification is negatively related to bond yield-spread, providing support for hypothesis H_{1A}. Furthermore, our findings suggest that credit rating agencies do not fully incorporate BHC diversification activities in their rating analysis, as the cost of debt financing of BHCs is inversely related to the degree of geographic diversification beyond what is captured by credit rating. The magnitude of the coefficient estimates on GeodivSt, in panel A, is between 12 and 21 basis points, suggesting that an increase of one standard deviation in GeodivSt leads to a reduction of 3.4–5.9 basis points in yield-spread.[16] Since the mean bond issue-size of each BHC in our sample is $4.73 billion, this is equivalent to a saving of $1.61–$2.79 millions in interest payments per year for a BHC. This indicates that the impact of geographic diversification on the cost of debt is not only statistically significant, but also economically significant.

4.2. Effect of asset and non-traditional activity diversification on bond yield-spread

In this section, we investigate the relationship between bond yield-spread and other dimensions of diversification; namely, asset diversification (AHHI), and non-traditional activity diversification (ACTHHI). The estimation results, based on Eq. (4), are presented in Table 3. After controlling for all the BHC-specific and bond-specific variables, asset diversification (AHHI) is found to be negatively and significantly related to bond yield-spread. The magnitude of the coefficient estimate on AHHI is approximately 38 basis points (from model (3)), suggesting that an increase in asset diversification by one standard deviation leads to a reduction of 4.6 basis points in yield-spread. This is equivalent to a

[15] We obtain similar results with S&P credit rating.

[16] This figure is computed by multiplying the STD of GeodivSt in the sample (0.28) by the coefficient estimates (0.12 and 0.21) in the regressions, which gives the average economic impact of about 3.4–5.9 basis points.

Table 3
Asset and non-traditional activity diversification, and bond yield-spread

	Panel A. DIV = AHHI			Panel B. DIV = ACTHHI		
	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	1.373***	0.5581	0.7341***	1.5944***	0.7718***	0.7221***
	(6.45)	(2.64)	(3.22)	(7.41)	(3.62)	(3.16)
Moody rating		0.0855***	0.0683***		0.0851***	0.0732***
		(17.06)	(11.47)		(17.01)	(12.31)
DIV	−0.3258***	−0.3139***	−0.3784***	0.361***	0.3611***	0.1270
	(−3.41)	(−3.40)	(−4.32)	(3.73)	(3.87)	(1.44)
Agency Proxy	0.0815***	0.0429***	0.0567***	0.0522***	0.0143	0.0358***
	(4.98)	(2.68)	(3.78)	(3.21)	(0.90)	(2.40)
Maturity	0.015***	0.0136***	0.0025	0.0154***	0.0139***	0.0027*
	(11.29)	(10.50)	(1.54)	(11.58)	(10.79)	(1.68)
Issue-size	−0.0889***	−0.1065***	−0.0802***	−0.0831***	−0.1004***	−0.0692***
	(−6.08)	(−7.52)	(−5.57)	(−5.70)	(−7.11)	(−4.84)
Bond Age	−0.0412***	−0.0511***	−0.0435***	−0.0407***	−0.0505***	−0.0432***
	(−9.54)	(−12.14)	(−11.04)	(−9.43)	(−12.00)	(−10.96)
Firm-size	−0.0338***	0.019**	0.0109	−0.0536***	−0.0004	−0.0041
	(−3.71)	(2.03)	(1.27)	(−6.29)	(−0.04)	(−0.50)
Leverage	1.3574***	0.7939***	0.7225***	0.8735***	0.3188**	0.4358***
	(9.74)	(5.73)	(5.65)	(5.63)	(2.08)	(3.08)
Volatility	12.8842***	12.3364***	6.4305***	14.8626***	14.2256***	7.7404***
	(5.64)	(5.59)	(3.11)	(6.55)	(6.49)	(3.76)
CALL			0.6889***			0.6841***
			(23.89)			(23.57)
PUT			−0.2826***			−0.2543***
			(−4.49)			(−4.04)
SINK			0.0806**			0.1180***
			(2.13)			(3.12)
SENIOR			−0.0874***			−0.0732***
			(−3.63)			(−3.05)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs	4041	4041	4041	4041	4041	4041
Adj. R^2	0.1519	0.2088	0.3293	0.1518	0.2084	0.3265

Note: This table reports the OLS regression results explaining bond yield-spread using asset and non-traditional activity diversification measures (Eq. (4)). The dependant variable is bond yield-spread (the difference between bond yield and the yield of a matched treasury security with similar coupon rate and maturity). Firm-size is the log of (BV of total debt plus MV of equity). All other independent variables are as defined in Table 1. Dummy variables of each calendar year are included to control for the time effects. *t*-Statistics are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

saving of $2.18 millions interest payments per year for a BHC. Therefore, the impact of asset diversification also appears to be economically significant.

As shown in Table 3, in contrast to the results on geographic diversification (Geodiv) and asset diversification (AHHI), the coefficient estimates of non-traditional activity diversification (ACTHHI) are positive and significant, except in model (3). An increase of one standard deviation in activity diversification is associated with an increase of 1.6 basis points in yield-spread, or an extra cost of $0.7 millions interest payments per year for a BHC. This result is consistent with H_{1B}, suggesting that diversification in non-traditional activities might aggravate the agency problems, resulting in a higher cost of debt. Another

possible explanation is that since ACTHHI is constructed based on different categories of non-interest income (income from trading, foreign exchange transactions, fiduciary, and service charges), and these activities are much riskier than the traditional banking activities, diversification through these venues may increase bank risk, thereby yielding an increase in the bond yield-spread. The findings by Stiroh (2004) that diversification in non-traditional banking activities (measured by non-interest income) produces few gains and by DeYoung and Roland (2001) that as banks' fee-based activities increase, the total revenue of banks becomes more volatile are consistent with our finding that diversification of non-traditional activities fails to reduce bond yield-spread.

4.3. Diversification, bank size, and bond yield-spread

To test the TBTF effect of diversification on bond yield-spread, as proposed in H_2, we introduce in the regressions, two size-based binary variables; DummySm and DummyBg take the unit value for the BHCs whose total assets belong to the bottom and the top quartile of the sample, respectively, and zero otherwise.[17] In these models, the impact of diversification on bond yield-spread of medium-sized banks is the base case and, hence, it is reflected in the diversification variable (DIV) itself. The TBTF effect implies that medium-sized banks experience the greatest reduction of bond yield-spread from diversification, compared to the small-sized and large-sized banks.

As shown in Table 4, after we include an interaction term between diversification and the two size dummy variables (DIV * DummySm, and DIV * DummyBg) in the regressions, the coefficient estimate of the diversification measure (DIV) remains negative and significant for geographic diversification (Geodiv) and asset diversification (AHHI), but becomes insignificant for activity diversification (ACTHHI). These findings suggest that for medium-sized BHCs, increased geographic and asset diversification do significantly reduce the bond yield-spread, but increased activity diversification does not.

More interestingly, the coefficient estimate of the interaction term (DIV * DummySm) is positive and highly significant in all the regressions, suggesting that all three types of diversification are associated with less reduction in yield-spread for small-sized banks than for medium-sized banks. An increase of one standard deviation of geographic diversification reduces 25.7 (0.9178 * 0.28) more basis points in the yield-spread of the median-sized BHCs than the reduction it generates in the yield-spread for the small-sized BHCs. Similarly, the coefficient estimate of the interaction term (DIV * DummyBg) is positive in all regressions, and statistically significant for GeodivSt and ACTHHI, suggesting that diversification is associated with less reduction in yield-spread for large-sized banks than for medium-sized banks. An increase of one standard deviation of geographic diversification reduces 3.6 (0.1298 * 0.28) basis points more for the medium-sized BHCs than it does for the large-sized BHCs. These results support the TBTF effect proposed in hypothesis H_2, denoting that medium-sized banks experience the greatest reduction in the bond yield-spread when they diversify through geographic regions, assets, and non-traditional activities.

[17] The total assets of the bottom and top quartiles are below $10.11 billions and above $41.25 billions, respectively.

Table 4
Diversification, bank size, and bond yield-spread

	DIV = GeodivSt	DIV = GeodivMSA	DIV = AHHI	DIV = ACTHHI
Intercept	1.5461***	1.4491***	0.4496	0.8925***
	(3.34)	(3.26)	(1.50)	(3.07)
Moody rating	0.0326***	0.037***	0.066***	0.0695***
	(3.58)	(4.15)	(11.09)	(11.62)
DIV	−0.2429***	−0.1153	−0.4042***	−0.0805
	(−2.94)	(−1.63)	(−4.53)	(−0.84)
DIV * DummyBg	0.1298*	0.0475	0.0352	0.1536***
	(1.83)	(0.70)	(0.77)	(2.69)
DIV * DummySm	0.9178***	0.7265***	0.6191***	0.5267***
	(3.54)	(4.69)	(5.70)	(4.99)
Agency Proxy	0.6282	0.8155*	0.0171	0.0144
	(1.28)	(1.72)	(1.05)	(0.94)
Int'l DIV	0.2678**	0.3348***		
	(2.29)	(3.12)		
Maturity	−0.0015	−0.0011	0.0028*	0.003*
	(−0.72)	(−0.51)	(1.78)	(1.87)
Issue-size	−0.0844***	−0.0849***	−0.0947***	−0.0882***
	(−4.41)	(−4.41)	(−6.49)	(−6.04)
Bond Age	−0.0342***	−0.0357***	−0.0443***	−0.0441***
	(−6.40)	(−6.69)	(−11.28)	(−11.21)
Firm-size	−0.0156	−0.0058	0.0432***	0.0115
	(−0.85)	(−0.34)	(3.05)	(0.81)
Leverage	0.4478*	0.2294	0.5779***	0.2644*
	(1.91)	(0.98)	(4.46)	(1.83)
Volatility	0.1301	0.1498	4.6104**	5.1181**
	(0.17)	(0.20)	(2.22)	(2.44)
CALL	0.7834***	0.7861***	0.6727***	0.6746***
	(18.77)	(18.90)	(23.28)	(23.22)
PUT	−0.0846	−0.1261	−0.271***	−0.2509***
	(−1.07)	(−1.61)	(−4.32)	(−4.00)**
SINK	−0.0327	−0.02	0.0528	0.0785
	(−0.60)	(−0.37)	(1.39)	(2.04)
SENIOR	−0.0331	−0.0313	−0.0927***	−0.0822***
	(−0.97)	(−0.92)	(−3.86)	(−3.43)
Year dummies	Yes	Yes	Yes	Yes
No. of obs	1458	1458	4041	4041
Adj. R^2	0.3571	0.3585	0.335	0.3322

Note: This table reports the OLS regression results explaining bond yield-spread. The dependant variable is bond yield-spread (the difference between bond yield and the yield of a matched treasury security with similar coupon rate and maturity). Firm-size is the log of (BV of total debt plus MV of equity). All other independent variables are as defined in Table 1. DummyBg and DummySm are two dummy variables that equal one if the BHCs total assets belong to the top and bottom quartile of the entire sample respectively, and zero otherwise. The coefficient for the middle part of the sample is reflected in DIV. Dummy variables of each calendar year are included to control for the time effects. *t*-Statistics are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

4.4. Robustness tests

As pointed out by Doukas and Pantzalis (2003), OLS regression of pooled time-series and cross-sectional data may suffer from bias due to autocorrelation of the residuals. To

remedy this problem, we follow Fama and MacBeth (1973), and estimate cross-sectional regressions for each sample year and then we average the coefficients over the time series. To adjust for heteroscedasticity and serial correlation, we compute the *t*-statistics associated with the coefficients following Newey and West (1987). A similar methodology is used by Klock et al. (2005) to address the panel data issue. Regression results are shown in Table 5. The coefficient estimates of geographic diversification (GeodivSt) and asset diversification (AHHI) remain negative and statistically significant. The coefficient estimates are also similar in magnitude to those from OLS in Tables 2 and 3. These findings suggest that the negative relationships between geographic and asset diversification and bond yield-spread are robust to the correction of serial correlation. After correcting for serial correlation, the activity diversification measure (ACTHHI) is found not to be significantly

Table 5
Fama-Macbeth regressions explaining bond yield-spread

	DIV = GeodivSt	DIV = AHHI	DIV = ACTHHHI
Intercept	1.8238**	2.5405	2.3407*
	(2.36)	(1.56)	(1.73)
Moody rating	−0.0208	0.0660***	0.0696***
	(−1.20)	(3.14)	(3.02)
DIV	−0.1483***	−0.1811**	0.3107
	(−3.66)	(−2.54)	(0.99)
Agency Proxy	0.0096	0.5124	0.3876
	(0.17)	(1.46)	(1.24)
Int'l DIV	−0.0253		
	(−0.50)		
Maturity	0.2112	0.0011	0.0012
	(0.76)	(0.26)	(0.30)
Issue-size	−0.3266	−0.0847**	−0.0896**
	(−0.52)	(−2.29)	(−2.23)
Bond Age	1.2126	−0.0459***	−0.0442***
	(1.23)	(−4.76)	(−4.50)
Firm-size	−0.0373**	−0.0121	−0.0120
	(−2.53)	(−0.82)	(−0.67)
Leverage	0.7764***	−0.8898	−0.9441
	(6.35)	(−0.46)	(−0.61)
Volatility	−0.2406*	5.0456	5.9199
	(−1.68)	(1.03)	(1.38)
CALL	0.2972***	0.6544***	0.6473***
	(3.97)	(6.28)	(5.83)
PUT	0.0423***	−0.3763***	−0.3249***
	(3.50)	(−3.93)	(−4.80)
SINK	−0.0011	0.1355	0.1510
	(−0.33)	(0.74)	(0.81)
SENIOR	−0.0792***	−0.0893	−0.0856
	(−3.15)	(−1.17)	(−1.07)
No. of obs	1458	4041	4041
Adj. R^2	0.3994	0.3800	0.3831

Note: Following Fama and MacBeth (1973), we estimate cross-sectional regressions every calendar year. Then we average the coefficients over the time series, and compute their associated *t*-statistics following Newey and West (1987) to adjust for heteroscedasticity and serial correlation. Dummy variables of each calendar year are included to control for the time effects. Newey and West adjusted *t*-statistics are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

related to the bond yield-spread. Therefore, the positive relationship between activity diversification (ACTHHI) and bond yield-spread in the OLS regressions might have been driven by serial correlation.

As additional robustness check, we estimate our models using Rogers standard errors to account for both cross-sectional and serial correlation, and our results still stand. In addition, we estimate a model that relates the changes (rather than the levels) of the yield-spread to the changes (rather than the levels) of diversification. In this model, the coefficient for the change of geographic diversification remains negative and significant, the coefficient of the change of asset diversification becomes insignificant, and the coefficient of the change of activity diversification, which was not significant, becomes significant (these results are available upon request).

4.5. Endogeneity of diversification

Our results are consistent with the hypothesis that geographic and asset diversifications reduce the cost of debt financing of BHCs. However, diversification itself might be an endogenous choice, and some of the observed association between geographic, asset diversification and bond yield-spread could be due to the reason that safer firms with a lower yield-spread choose to diversify more across geographic regions and assets. To address this endogeneity issue, following Bhojraj and Sengupta (2003), we employ a simultaneous equation model with bond yield-spread and diversification measure both treated as endogenous variables. The model is described by Eqs. (5A) and (5B) and it is estimated using the three-stage least squares (3SLS) procedure:

$$\begin{aligned}\text{Yield Spread} = {} & \alpha_0 + \gamma_1 \text{Credit Rating} + \gamma_2 \text{DIV} + \gamma_3 \text{Agency Proxy} + \gamma_4 \text{Int'l DIV} \\ & + \gamma_5 \text{Maturity} + \gamma_6 \text{Issue Size} + \gamma_7 \text{Bond Age} + \gamma_8 \text{Firm Size} \\ & + \gamma_9 \text{Leverge} + \gamma_{10} \text{Volatility} + \gamma_{11} \text{CALL} + \gamma_{12} \text{PUT} \\ & + \gamma_{13} \text{SINK} + \gamma_{14} \text{SENIOR} + \gamma_{15} \text{YearDummy}, \end{aligned} \tag{5A}$$

$$\begin{aligned}\text{DIV} = {} & \alpha_0 + \beta_1 \text{Yield Spread} + \beta_2 \text{ROA} + \beta_3 \text{Agency Proxy} + \beta_4 \text{Firm Size} \\ & + \beta_5 \text{Liquidity} + \beta_6 \text{Volatility} + \beta_7 \text{Trend}. \end{aligned} \tag{5B}$$

Following Campa and Kedia (2002), we include profitability (ROA), firm-size (log of total market value of equity plus book value of debt), liquidity (total loans/total assets), firm risk (stock return volatility), and a time trend in the diversification equation (5B). Moreover, Jensen (1986), Shilerfer and Vishny (1989), Amihud and Lev (1981), and Denis et al. (1997) suggest that agency problems may prompt firms to diversity. Thus, we include the agency proxy (MB) in the model as well. The results are presented in Table 6. The coefficients for diversification measures in the yield-spread regressions (5A) are all negative and significant, indicating that the bond market does recognize and incorporate the effect of geographic, assets, and activity diversification on bond yields. The effect of yield-spread on diversification (Eq. (5B)) is not uniform; increased yield-spread is associated with increased asset and activity diversifications but with reduced deposit dispersion.

Two results are of particular interest. First, the negative and significant coefficient estimate for Yield Spread in the GeodivSt model suggests that, as we suspected, some of the observed association between geographic diversification and bond-yield in the OLS regressions is due to the effect from bond-yield on diversification. Second, the result on activity diversification (ACTHHI) based on the system model differs from that produced in the

Table 6
Simultaneous equation results on bond yield-spread

Dependent variable = Yield-spread (Eq. (5A))				Dependent variable = DIV (Eq. (5B))			
Variable	GeodivSt	AHHI	ACTHHI	Variable	GeodivSt	AHHI	ACTHHI
Intercept	−0.3297	0.7844***	0.4487*	Intercept	3.9031***	0.0070	−2.1164***
	(−0.24)	(3.41)	(1.65)		(7.59)	(0.06)	(−18.86)
Moody rating	0.0446***	0.0643***	0.0182*	Yield-Spread	−0.1421***	0.0101**	0.0358***
	(3.78)	(9.3)	(1.75)		(−6.71)	(1.97)	(6.95)
DIV	−0.9022**	−0.6976**	−3.7650***	ROA	0.1303	−5.5413***	−3.8448***
	(−2.08)	(−1.97)	(−3.43)		(0.05)	(−14.48)	(−11.01)
Agency Proxy	−1.2106	0.0726***	0.2756***	Agency Proxy	−0.7235***	−0.0032	−0.0311***
	(−1.04)	(3.46)	(6.52)		(−6.36)	(−1.6)	(−15.34)
Int'l DIV	−0.1025			Firm-size	0.0842***	0.0489***	0.0287***
	(−0.23)				(14.23)	(34.6)	(20.09)
Maturity	−0.0009	0.0023	−0.0023	Liquidity	−4.3513***	−0.1365	2.3764***
	(−0.43)	(1.45)	(−1.39)		(−8.14)	(−1.1)	(18.93)
Issue-size	−0.0736***	−0.0896***	−0.1378***	Volatility	−1.4847***	−3.7217***	−3.0064***
	(−3.74)	(−5.39)	(−6.99)		(−4.84)	(−9.6)	(−7.69)
Bond Age	−0.035***	−0.0438***	−0.0363***	Time Trend	0.0416***	−0.0092***	0.0046***
	(−6.29)	(−11.06)	(−9.72)		(5.53)	(−6.04)	(2.99)
Firm-size	0.0812	0.0210	0.0192				
	(1.09)	(1.44)	(0.97)				
Leverage	1.0018**	0.8979***	4.6455***				
	(2.34)	(4.31)	(5.1)				
Volatility	−0.6266	5.5990**	2.6808				
	(−0.85)	(2.44)	(0.92)				
CALL	0.7278***	0.6893***	0.8374***				
	(15.43)	(23.84)	(18.5)				
PUT	−0.0962	−0.3059***	−0.5120***				
	(−1.22)	(−4.6)	(−6.93)				
SINK	0.0336	0.0509	−0.3325***				
	(0.54)	(1.11)	(−3.91)				
SENIOR.	0.0059	−0.1005***	−0.1520***				
	(0.15)	(−3.76)	(−5.81)				
Year dummies	Yes	Yes	Yes	Year dummies	Yes	Yes	Yes
No. of obs	1458	4041	4041	No. of obs	1458	4041	4041
System R^2	0.3442	0.3329	0.3787	System R^2	0.3442	0.3329	0.3787

Note: This table reports the simultaneous equation results (3sls) relating to effect of diversification on bond yield and the effect of bond yield on diversification. The two simultaneous equations are specified in Eqs. (5A) and (5B). ROA is defined as total income divided by total assets; Liquidity is defined as total loans divided by total assets. All other variables are as defined in Table 1. Dummy variables of each calendar year are included to control for the time effects. *t*-Statistics are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

single-equation framework. In the OLS regression, we observed a positive relationship between ACTHHI and yield-spread. However, once we control for endogeneity of diversification in the simultaneous equation system model, the sign of the effect gets reversed. In other words, in the latter model we find that higher levels of ACTHHI do indeed lead to lower bond yield-spreads. The implication of these findings is that the positive association between activity diversification and yield-spread in the OLS model is completely driven by the fact that BHCs with higher yield-spread (riskier BHCs) tend to choose to diversify more extensively in non-traditional activities.

The finding that a higher yield-spread boosts diversification in loans and off balance-sheet activities is not surprising. The rationale is that the increase in the bond yield-spread prompts the BHC managers to counter it through increased diversification in both traditional lending and non-traditional banking activities. A question may arise, however, as to why wider yield-spreads are associated with a lower level of geographic diversification in deposits (lower deposit dispersion). One possible explanation is that widened bond yield-spreads may signal a deterioration of the BHC default risk to the deposit markets, and curtail deposit supply, especially by depositors in more distant markets who are less certain about obtaining new information on the BHC quickly and, thus, more reluctant to trust their funds with it. This limits the extent of deposit diversification.

As to the other regressors in the diversification model (5B), asset and activity diversification are negatively related to profitability while geographic diversification is unaffected by it. These results are consistent with Campa and Kedia (2002) and Graham et al. (2002) who find that poorly performing firms tend to diversify (be acquired). The diversification decision is negatively related to the Agency proxy (MB) in all three categories. The reason might be that our agency measure also serves as a proxy for growth opportunities, as suggested by Barclay and Smith (1995), and growth opportunities are negatively associated with firm's decision to diversify. Firms with poor growth opportunities in their current industry tend to diversify more in search of more profitable business activities, as documented by Hyland and Diltz (2002), which indicates that diversified firms have relatively fewer growth opportunities than their stand-alone counterparts even before they diversify. Bank size is associated with higher diversification in all three categories. This finding is consistent with Demsetz and Stranhan (1997) and is contributed to by the fact that larger size banks can overcome the indivisibilities in the market more easily and achieve diversification at a lower cost.

Increased bank illiquidity (higher total loans/total assets) is found to limit geographic diversification, to increase off balance sheet activity diversification, and to have no significant effect on asset diversification. Banks with higher outstanding loans, relative to total assets, are less likely to be able to expand their deposit base geographically or to broaden their asset diversity. The increase in off balance sheet diversification is likely to reflect an attempt on the part of the bank to hedge risk. Similarly, increased volatility leads to a lesser degree of diversification, with a possible rationale that increased riskiness generally subjects banks to more intensive supervision from the federal and state regulatory agencies, and stiffens the conditions for obtaining approval for expansion and diversification.[18]

5. Conclusion

In this study, we assess the association of various dimensions of diversification with the cost of debt financing in the banking industry. We find that domestic geographic diversification of deposits and diversification of assets lead to a lower bond yield-spread. The results continue to hold when we control for serial correlation and the endogeneity of diversification. Activity diversification is negatively associated with yield-spread only when we estimate yield-spread and activity diversification in a simultaneous equation

[18] Our findings on the effect of diversification on the cost of debt and the role of TBTF continue to hold in the simultaneous equation system framework (results available upon request).

framework. In addition, we find that, consistent with the too-big-to-fail (TBTF) effects, medium-sized BHCs experience a greater reduction in the bond yield-spread than small-sized and large-sized BHCs. We also document that the association between diversification and yield-spread is indeed bidirectional, with increased yield-spread resulting in an increase in asset and activity diversification and a reduction in geographic deposit dispersion.

These results have several implications. First, all three types of diversification are priced in the corporate bond market. Second, medium-sized banks would benefit more from geographic and asset diversification in cutting the cost of debt financing. Hence, the recent wave of super large M&As in the banking industry (cases of mega-mergers), may or may not be beneficial in reducing bond risk premia. This is consistent with Penas and Unal (2004) who document that big acquirers do not achieve a lower cost of debt financing after the merger. Third, consistent with Winton (1999), different dimensions of diversification entail different impacts on the cost of debt and demonstrate different tradeoffs between the benefits and the costs associated with diversification.

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