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Abstract

This paper investigates the 'price-concentration' relationship in pricing syndicated loans. By measuring bank concentration at a state level in U.S, we show supporting evidence to market power hypothesis that syndicated loan prices are positively associated with the concentration of both borrower's and lead arranger's markets but not the concentration of participant lenders' markets. We also show that loan prices are more sensitively to lead arranger's market concentration than to borrower's and a borrower could reduce loan costs by borrowing from a less concentrated bank market. In sharp contrast, loan prices are negatively associated with bank concentration if a loan syndication is led by an investment bank or non-bank financial institution. Our findings are robust to a variety of bank concentration measures and model specification.

Key words: banking market; concentration; syndicated loan; market power

JEL code: G20; G21; G23; G32

1. Introduction

There has been ample empirical evidence on the 'price-concentration' relationship in banking and bilateral loans where on one hand, corporate loan rates are found to be positively associated with banking market concentration in U.S. (Cyrnak and Hannan 1999), Italy (Sapienza 2002) and Belgium (Degryse and Ongena 2005), supporting market power hypothesis. On the other hand, bank-efficiency model and information-based hypothesis conjecture a negative 'price-concentration' relationship (Demsetz 1973; Fungáčová et al. 2017). Compared with bilateral loans, syndicated loans carry a nature of 'three-party' game and in additional to lead arranger and borrower, participant lenders also play an important role in loan syndication. Hence, such a 'three party' game involves additional adverse selection and moral hazards problems (Ivashina 2009) and lenders from different bank markets may have different pricing mechanisms in loan syndication. Whereas, there has been little empirical evidence on the 'price-concentration' relationship in a syndicated loan setting, except for Lian (2017) and Hasan et al. (2017) which have investigated such a relationship in borrower's market only. To advance our understanding on such a relationship in syndicated loan, we consider the effects of bank competition from all three markets (lead arranger, participant lenders and borrower) on syndicated loan prices and in addition, we also investigate the moderating effects of lender types on such a 'price-concentration' relationship where non-commercial banks and non-bank institutions usually charge higher prices than commercial banks (Lim et al. 2014).

We test the 'price-concentration' relationship between syndicated loan prices and bank market concentration at a state level in U.S. which, first, is ideal for the scenario where a lead arranger headquarters in a different bank market from the borrower, enabling us to investigate the effects of the difference of bank concentration from two different markets on syndicated loan prices. We expect that the concentration of both borrower's and lead arranger's markets would affect loan prices and lenders of different types (e.g., banks vs. non-banks) would have different sensitivities to bank market concentration in pricing syndicated loans due to the heterogeneity of their liquidity, costs and lending portfolio risk. To this end, we identify

the location (state) and measure the bank market concentration where both the borrower and the lead arranger headquarter. Both of them may face the same market concentration if they headquarter in the same states (12% of our samples) and they may face different bank market structure where a lead arranger comes from a more competitive (39%) or a more concentrated bank market (49%) than the borrower's market. Second, we use share-weighted bank market concentration to capture the bank market power of participant lenders and finally, we identify the type of lead arranger (87% commercial banks and 13% investment banks or non banks) to examine the heterogeneity of the price sensitivity to banking market concentration.

Consistent with Lian (2017), our results show that the bank concentration in borrower's market increases syndicated loan prices, in terms of fees, spread and overlibor. By adding new evidence to literature, we also show that syndicated loan prices are more sensitive to the bank concentration of lender's market than that of borrower's market. Hence, borrowers will benefit from lower syndicated loan prices if they are located in a less concentrated bank market than the lead arranger's. This result is consistent with the 'auction' nature of loan syndication where loan prices charged in borrower's market reflect an equilibrium of lenders' markets (Lim et al. 2014). We find little evidence that the bank concentration of participant lenders have any impacts on syndicated loan prices.

In sharp contrast to commercial banks, investment bank and non-bank lead arrangers charge lower prices if they face a stronger bank concentration, supporting the structure-conduct-performance paradigm in bank markets. Our results are robust to various bank concentration measures (e.g. CR_k, HHI and number of branches), model specifications and endogeneity check. The effects of bank concentration on syndicated loan prices are economically significant and overall, for example, a standard deviation increase of bank concentration ratio in lead arranger's market (CR_{50}^{Lead}) would raise the *overlibor* of a typical syndicated loan ($366 million) by 4.15 base points, equivalent to around $152,000 additional costs for a corporate borrower.

The remainder of the paper is structured as follows. In Section 2, we review literature on the relationship between bank concentration and loan prices and develop hypotheses. We describe our data,

variables and baseline model specification in Section 3 and report the empirical results in Section 4. Finally, we conclude our findings with implications in Section 5.

2. Literature review and developing hypothesis

In recent years, syndicated credit continuously performs its crucial role in the global financial system, with a total volume of $4.7 trillion in 2015, compared with $3.02 trillion in the international bond market for non-financial companies. U.S dominates the global syndicated loan market with $938.6 billion in the first half of 2016 out of $1.8 trillion globally[1]. Syndicated loans provide corporate borrowers a large sum and stable funds at relatively lower interest rates than bilateral loans, bonds and equities (Altunbaş and Gadanecz 2004) and enable them to build and keep business relationships with multiple lenders. Moreover, syndicated loans provide lenders an efficient mechanism to diversify loan risk via dispersing portfolio into multiple lenders and to bypass regulations on the maximum size of a single loan[2].

There has been ample empirical evidence on the determination of syndicated loan prices in terms of the participation of non-bank lenders (Lim et al. 2014), foreign banks (Haselmann and Wachtel 2011), the roles played by ethical behavior (Kim et al. 2014), corporate social responsibility (Bae et al. 2018) and asymmetric information (Ivashina 2009). However, what is less understood is the effects of bank market concentration on syndicated loan prices. Such a 'price-concentration' relationship could be understood within three competing theoretical frameworks: structure-conduct-performance paradigm (SCP), structure-efficient hypothesis (SE) and information-based hypothesis (IB).

[1] The information is collected from Thomson Global Syndicated Loans Reviews and Bank for International Settlements (BIS).

[2] The lending limits as defined in FDIC law, §32.3, where the maximum size of loan to single borrower is 15% of the bank's or savings association's capital and surplus.

SCP, also known as market power hypothesis, proposes that banks with a greater market power would charge higher prices on loans for two reasons. First, due to their market power, banks maximize profits by charging higher rates on loans and paying lower interests on deposits, leading to credit rationing (e.g. Guzman 2000; Pagano 1993). Second, banks with a greater market power charge higher prices on loans because of their cost inefficiency (Ariss 2010; Delis and Tsionas 2009). In contrast, the structure-efficient model (SE) proposes that banks with a higher market share would charge lower prices on loans due to their improved productivity technology and efficient management, which have helped them reduce costs, gain higher profits and take over a bigger market share (Demsetz 1973). The information-based hypothesis (IB), instead, indicates that banks with a greater market power would have stronger incentives to acquire private information from borrowers and to improve credit availability, especially to those financially constrained borrowers. Hence, banks with monopoly power could help firms by providing loans at a relatively lower prices (Fungáčová et al. 2017; Jackson and Thomas 1995) and extract rent in the future from those who are eventually successful (Cetorelli and Gambera 2001; Petersen and Rajan 1995; Sharpe 1990; von Thadden 2004).

To examine the 'bank concentration – loan price' relationship, recent empirical studies have focused on the structure (HHI or Lerner Index) of borrower's bank market (e.g. Hasan et al. 2017; Lian 2017). Such an investigation has become increasingly important since the removal of interstate banking and branching restrictions by Interstate Banking and Branching Efficiency Act (IBBEA) in 1990s. Banking market deregulation, especially on interstate banking, has enabled banks to geographically diversify risk across state borders (Amore et al. 2013) so that distant banks (e.g. headquartered in another state) would compete against local banks and borrowers can borrow from 'distant' banks locally. The empirical evidence of (Lian 2017) is in favor of market power hypothesis (Cetorelli and Strahan 2006) where in borrower's market, bank competition drives up credit supply and therefore reduces loan prices. This is in sharp contrast to the conjecture of asymmetric information hypothesis (Petersen and Rajan 1995) that bank competition reduces relationship banking. We credit the originality of such an investigation to Lian (2017) which considers the

scenario where borrowers borrow locally from either local lenders or distant lenders which run branches in borrower's market. In addition, we also propose that borrower's market concentration matters for loan pricing even they borrow from distant markets. This is because distant lenders need to offer a more competitive price to compete with local lenders (Degryse and Ongena 2005) and to compensate borrower's additional costs incurred in accessing distant finance, such as transportation. Therefore, we hypothesize that

Hypothesis 1: Syndicated loan prices are positively associated with bank concentration in borrower's market.

Lian (2017) comprehensively examines how the bank concentration of borrower's market affects syndicated loan prices. We hypothesize that the bank concentration of lead arranger's market also matters in pricing loans and this applies to both scenarios where either distant banks enter borrower's market to compete with local lenders or borrowers reach out distant credit in distant location. In the former scenario, bank concentration of lead arranger's market matters for loan price because it determines the costs of capital for banks. It has been widely acknowledged that according to SCP, banks would have lower costs of deposits if they have a greater power in a deposit market (e.g. Guzman 2000; Pagano 1993) and for risk diversification reasons (Amore et al. 2013), distant banks who operate branches locally may channel deposits from their headquarter location to the new market they enter. In such a scenario, the syndicated loan price would be negatively related to lead arranger's bank market concentration if the lead arrangers have lower costs of capital. It is also possible that syndicated loan prices increase with lead arranger's bank market concentration if lead arrangers charge comparable price to both local and distant borrowers.

The latter scenario proposes a possibility that borrowers reach out to raise funds from distant market directly because of the overlap between industrial and financial markets (Asker and Ljungqvist 2010) and the development of information technologies in financing businesses even distant banks do not have local branches in the market where borrower locates (Petersen and Rajan 2002). Theoretically, borrowers may

do so because of the indirect competition theory in banking sector (Osborne 1988) where the geographical span of the industrial markets in which borrowers operate affect their demand for credit in distant market (Bellón 2016). Therefore, a borrower would not be financially disadvantaged if its key competitor locates in a distant location. The spatial price discrimination theory (Degryse and Ongena 2005) also states that distance between lender and borrower and the distance between borrower and competing banks would mitigate the bank market concentration effects on loan prices. Recent literature has offered both theoretical justification (e.g. Bellón 2016) and empirical evidence (e.g. Tian and Han 2018), supporting the 'reach-out' scenario[3]. In such a scenario, the 'price-concentration' relationship would be positive and distant borrowers would be charged higher prices on loans if the lead arranger has a greater market power in its own market. Therefore, we hypothesize that

Hypothesis 2: Syndicated loan prices are associated with bank concentration in lead arranger's market.

Apart from borrower and lead arranger, participant lenders also play an important role in loan syndication. This is because first, in additional to the agency problem between lenders and borrowers, participant lenders may face further adverse selection and moral hazard problems when syndicating loans with lead arrangers (Ivashina 2009). Second, participant lenders have an information disadvantage against lead arrangers on the creditability of borrowers due to their weaker incentives to invest in costly private information collection[4]. Above mentioned theories may also apply to participant's market where loan prices could be associated with participant's market concentration. Another possibility is that loan prices would

[3] Our data and information from FDIC also provide empirical evidence to support such a possibility. For example, FDIC shows that only 2 banks headquartered in Arizona operate interstate banking and branching in another 4 states. These two banks, however, lead syndicated loans for borrowers from 26 states in total.

[4] A lead arranger may face a free-riding problem by participant lenders in information collection and monitoring (Lee and Mullineaux 2004) if participant lenders hold a small portion of loans (9.6% averagely for each participant in our data).

not be sensitive to participant's market concentration because in the syndication process, the prime loan terms (loan size, maturity, price, etc.) have been set before lead arrangers invite participant lenders (Dennis and Mullineaux 2000; Esty 2001). Even though, participant lenders can require the lead arranger to reset the loan terms especially when the loan is undersubscribed or the request is raised by all participant lenders. Hence, we hypothesize

Hypothesis 3: Syndicated loan prices are associated with the bank market concentration of participant lenders.

There has been ample empirical evidence on the determinant roles played by the type of lenders in pricing loans due to the heterogeneity of their liquidity, costs, and lending portfolio risk. Syndicated loans issued by non-commercial bank and non-bank lenders are usually charged higher prices than those issued by commercial banks only in loan syndication. This is especially prominent for loans issued by hedge funds and private equity investors, loans raised by financial constrained borrowers and when loans are less available from commercial banks (Lim et al. 2014). Higher loan prices are charged by non-bank lenders to compensate for their liquidity and usual fees charged on financial services. In addition, for asymmetric information reasons, non-bank institutional investors may charge a higher spread on syndicated loans when they have less information about the loan quality than the lead arranger who conducts borrower's due diligence. As a result, "adverse selection could delay the syndication process and make institutional investors demand a higher spread" (Ivashina and Sun 2011, p.501). Also due to the information disadvantages, loans with participating non-bank lenders are more difficult to be restructured in financial distress than bank loans (Demiroglu and James 2015). Empirical studies have suggested that non-bank institutions and investment banks participate in loan syndication especially when commercial banks lack of funds or borrowing firms are facing financial constraints (Lim et al. 2014). Therefore, non-bank financial institutions usually charge higher prices on syndicated loans because of their higher managing fee, less

special and sustainable funds to syndicate and being in favor of less profitable and high leveraged firms (Harjoto et al. 2006).

In addition to the above conjectured 'price-concentration' relationship, we propose that such a relationship may vary between loan issued by commercial banks and non-commercial bank financial institutions (e.g. investment banks and non banks). Based on SCP, commercial banks will pay lower interests on deposits and charge higher interests on loans issued to corporate borrowers (e.g. Guzman 2000; Pagano 1993). Thereofore, those non-commercial bank financial institutions will be able to obtain funds from commerical banks with lower costs (Ahmed et al. 2015) and to offer more competitve syndicated loan prices to borrowers (Gropp et al. 2014) in a more concentrated bank market. Hence, we hypothesize

Hypothesis 4: The 'price-concentration' relationship may vary over lender type.

3. Data and methodology

3.1. Data

We collect data on syndicated loans from DealScan and bank data from Federal Deposit Insurance Corporation (FDIC) between 1994 and 2012[5]. Firm-level information on borrowers is collected from Compustat and macroeconomic data are from Federal Reserve Bank of St. Louis. DealScan provides

[5] The information on bank market structure from FDIC covers a period since 1994 and the Compustat-DealScan table covers a period until 2012 (Chava and Roberts 2008).

detailed information on loan characteristics (e.g. spread, maturity, amount, and purpose), borrower's information (e.g. name, location, and industry) and lender's characteristics (e.g. name, location, share allocation, type, and lender role in syndication). We use Compustat-DealScan linking table (Chava and Roberts 2008) to match syndicated loans and borrowers' information. We match bank concentration to syndicated loan based on the location of the borrower and lenders (lead arranger and the participant lenders) at state level. We focus on syndicated loan samples so as we have a full set of information for borrowers, lenders, and local (state level) banking concentration. We exclude sample loans issued to foreign borrowers, those with missing location information and those raised by financial institutions and in total, we use 33,023 syndicated loan samples between 1994 and 2012 in the following empirical analysis.

3.2. Syndicated loan price and facility characteristics

We measure syndicated loan price by *fees*, *overlibor* and *spread*. Fees (commitment fee and annual fee) are used to price options[6], *overlibor* – rate over the London Interbank Offered Rate (LIBOR) - is to measure syndicated loan rate and *spread* (all-in-drawn spread) is the total of the annual fee and *overlibor* (Chan et al. 2015). To examine the effects of banking market concentration on syndicated loan prices, we follow (Lim et al. 2014) and control for loan facility characteristics, such as loan size, maturity, number of lenders, term loan, having covenants and performance price features. To further investigate the

[6] Fees are used to price cancellation and drawdown options and to screen borrowers who possess private information to exercise the fee options by which lenders could learn the likelihood of borrower's future credit line usage by the combination of loan spread options and commitment fee options (Berg et al. 2015). Commitment fee also enhances bank reputation by keeping its promise, prevents bank from extracting extra rents by intimidating to withhold credit, and weakens the effects of moral hazard. Borrowers have an option to draw on a line of credit and each line of credit provides the borrower with an option to draw at a pre-specified spread. Borrowers would be more likely to draw down their lines of credit when spot market spreads are high (Berg et al. 2015). With different combinations of fee and spread, lender can predict future behavior of borrower. For example, if borrowers choose contracts with low fee and high spread, they are more likely to draw down their credit lines.

heterogeneity of banking market concentration effects, we follow Lim et al. (2014) and control for the type of lead arranger as commercial banks and non-commercial bank lenders (investment bank and other non-bank financial institutions, e.g., hedge funds). We define the lead arranger as the key lender who plays a role as 'administrative agent', 'agent', 'arranger', 'bookrunner', 'lead arranger', 'lead bank', 'lead manager' or 'Mandated lead arranger' in loan syndication (Ivashina 2009; Taylor and Sansone 2007) and exclude loan samples (2% of total samples) with multiple lead arrangers by following (Ivashina and Scharfstein 2010).

3.3. Measuring banking market concentration

We follow Lian (2017) and use structural measures, such as concentration ratio (CR_k) and Herfindahl-Hirschman Index (HHI), at a state level in U.S to evaluate the concentration of local banking market where the borrower and the lead arranger located, respectively[7]. We calculate the state level market concentration of the participant lenders based on the loan shares they hold[8]. We use state-level bank concentration instead of bank level market power in the analysis because whether a lending bank exercises its market power is mainly dependent on local bank market structure (Hasan et al. 2017). CR_k has been widely used in measuring bank market concentration (Bikker and Haaf 2002) and in specific, we make a distinction

[7] We measure market concentration at a state level for three reasons. (1) Banks operating in multiple MSAs usually set uniform-prices which are independent from MSA market concentration (e.g. Heitfield and Prager 2004; Heitfield 1999; Radecki 1998). (2) States still have considerable leeway to decide the rules in governing entry by out-of-state banks since IBBEA (e.g. Johnson and Rice 2008; Rice and Strahan 2010). (3) Due to the size of syndicated loan (averaged at $366 m) and borrower (averaged asset value of $5.02 billion), it is highly likely that syndicated loans are raised 'distantly' across county and MSA. Therefore, defining the local market at county or metropolitan area is no longer evident and instead, state boundaries seem to be appropriate for bank market (e.g. Radecki 1998).

[8] We do not have information on foreign banks and only consider U.S banks in participating loan syndication, accounting for 70% of total participant lenders in U.S syndicated loan markets.

between the banking market where a borrower locates ($CR_k^{Borrower}$) and that where the lead arranger headquarters (CR_k^{Leader}). If both borrower and lenders are in the same state, they will face the same banking market structure. We use CR_{50} in the main tests and HHI, CR_{20}, CR_{10} and other concentration ratios in robustness tests to fully capture the bank market concentration effects on syndicated loan prices. In addition, we use deposit CR_k and HHI at state branch level in our main tests and deposit HHI at state bank level and MSA (Metropolitan Statistical Area) branch level (Lian 2017) in robustness tests.

3.4 Control variables and baseline model specification

In the following empirical analysis, we follow Ivashina (2009) and control for borrower's characteristics by assets, tangibility, profitability and credit risk by S&P credit rating. We also control for macroeconomic conditions at state level, such as annual personal income and state gross domestic product (Gelos et al. 2011; Schuermann 2004). We report the definition and source of each variable used in Appendix. To examine the effects of banking market concentration on syndicated loan price, we have the baseline model specification (Eq.1) as follows:

$$Syndicated\ loan\ price_t = \partial + \beta \times banking\ market\ concentration_{t-1} + \gamma \times Loan\ characteristics_t + \theta \times Other\ controls_{t-1} + \varepsilon \cdots\cdots \quad (1)$$

where syndicated loan price is measured by *fees*, *spread* and *overlibor*, banking market concentration is measured by CR_k and HHI at branch level and control variables are the characteristics of loan facility (e.g. loan size, maturity, number of lenders, term loan indicator, covenants indicator, performance pricing indicator), borrower chateratersitics (e.g. assets, tangibility, profitability and S&P rating indicator) and macroeconomic condition (personal income and GDP at state level), where we match firm financial data from the fiscal year (t-1) prior to the loan issue year (t). Definition of control variables is presented by

Appendix. In addition, we also control for the aggregate trends in year, loan type and lender type to eliminate the effects driven by such factors.

4. Empirical results

4.1 Descriptive statistics and correlation

Table 1 presents the descriptive statistics for all variables used in the empirical analysis and on average, a syndicated loan is charged for fees at 30 base points (bps), overlibor at 174 bps and spread at 189 bps. In the state where the borrower (lead arranger) locates, top 50 bank branches own 31% (37%) market share of deposits. Averagely, a state in U.S has branch (bank) deposit HHI of 0.01 (0.11), indicating that first, there is a big variation between the branch concentration and bank concentration in a specific state. Second, banking market is concentrated in U.S. Table 1 also shows that overall, syndicated loans are more likely to be raised from more concentrated bank markets ($CR_{50}^{Difference} = CR_{50}^{Borrower} - CR_{50}^{Lead} < 0$). Averagely, there are about 3,300 branches per state, equivalent to 0.3 per 1,000 population and 0.03 per km^2.

An average syndicated loan size is $366 million with 46 months maturity and 9 lenders participating in the loan syndication. A quarter of our loan samples are term loans, 62% have covenants and 48% have performance pricing features. In terms of the characteristics of syndicated loan borrowers, an average borrower has an asset value of $5 billion and its tangible assets account for 32% of total assets with a profitability (net income/total assets) of -1% and 54% of facilities have a S&P credit rating between AAA and BBB. Table 2 reports Pearson's correlation matrix between the key variables and it shows that overall, syndicated loan price is positively correlated with banking market concentration measures for both lead arranger's and borrower's bank market.

Table 1: Descriptive statistics

Samples collected are between 1994 and 2012 with 33,023 observations. Syndicated loan price is measured by *spread*, *fees* and *overlibor*. Banking market concentration is measured by concentration ratio (top 50, 20 and 10) in the state where borrower, lead arranger and participant lenders located, respectively and HHI on deposit at branch and bank level respectively.

	Mean	Std. Dev	Median
Syndicated loan Price			
Fees (base points)	30.49	24.09	25
Overlibor (base points)	174.34	112.24	175
Spread (base points)	189.26	115.84	175
Bank market concentration			
$CR_{50}^{Borrower}$	0.31	0.12	0.28
CR_{50}^{Lead}	0.37	0.12	0.36
$CR_{50}^{Participant}$	0.31	0.12	0.33
$CR_{50}^{Difference}$	-0.07	0.14	-0.07
$CR_{20}^{Borrower}$	0.25	0.12	0.22
$CR_{10}^{Borrower}$	0.21	0.12	0.18
HHI (Branch) ^{Borrower}	0.01	0.03	0.01
HHI (Bank) ^{Borrower}	0.11	0.11	0.08
Number_Branch ^{Borrower}	3297	2314	3150
Branch density by population (1,000) ^{Borrower}	0.3	0.27	0.24
Branch density by km^{2} ^{Borrower}	0.03	0.04	0.02
HHI(MSA, Branch)^{Borrower}	0.13	0.07	0.12
Facility Characteristics			
Loan size (USD$ m)	366	793	150
Loan maturity (months)	46.19	24.46	48
Total number of lenders	8.52	9.03	6
Term loan (0,1)	0.26	0.44	0
Secured indicator (0,1)	0.72	0.45	1
Covenant indicator (0,1)	0.62	0.48	1
Performance pricing feature (0,1)	0.48	0.50	0
Borrower Firm Characteristics			
Asset (USD$ m)	5026.32	8464.28	1382.82
Tangibility	0.32	0.25	0.26
Profitability	-0.01	0.54	0.03
S&P Rating (0,1)	0.54	0.50	1
Macroeconomic Factors			
State personal yearly income (USD$ 000)	33.28	7.53	32.78
State Gross Domestic Product (USD$ b)	539	448	392

Table 2: Correlation Table

Samples collected are between 1994 and 2012 with 33,023 observations. Syndicated loan price is measured by *spread*, *fees* and *overlibor*. Banking market concentration is measured by concentration ratio (top 50, 20 and 10) in the state where borrower, lead arranger and participant lenders located, respectively and HHI on deposit at branch and bank level respectively* denotes statistical significance level of 5%.

	Spread	*Fees*	Overlibor	$CR_{50}^{Borrower}$	CR_{50}^{Lead}	$CR_{50}^{Participant}$	$CR_{50}^{Difference}$	$CR_{20}^{Borrower}$	$CR_{10}^{Borrower}$	$HHI(Branch)^{Borrower}$
Spread	1									
Fees	0.7186*	1								
Overlibor	0.9061*	0.7250*	1							
$CR_{50}^{Borrower}$	0.0620*	0.0342*	0.0305*	1						
CR_{50}^{Lead}	0.0272*	0.0135	0.0700*	0.2701*	1					
$CR_{50}^{Participant}$	-0.1145*	-0.1264*	-0.0699*	0.2611*	0.2999*	1				
$CR_{50}^{Difference}$	0.0155*	0.0090	-0.0359*	0.6166*	-0.5915*	-0.0394*	1			
$CR_{20}^{Borrower}$	0.0675*	0.0325*	0.0372*	0.9778*	0.2854*	0.2768*	0.5847*	1		
$CR_{10}^{Borrower}$	0.0670*	0.0295*	0.0373*	0.9525*	0.2818*	0.2753*	0.5656*	0.9942*	1	
$HHI(Branch)^{Borrower}$	0.0444*	0.0444*	0.0244*	0.0186*	0.6393*	0.1511*	001517*	0.6528*	0.6478*	1
$HHI(Bank)^{Borrower}$	0.0595*	0.0176*	0.0223*	0.4289*	0.1285*	0.1288*	0.2541*	0.4282*	0.4337*	0.2967*

4.2 Baseline results

We employ the baseline model (Eq. 1) to investigate the effects of banking market concentration on syndicated loan price and the results are reported in Table 3. In specific, Models 1-3 consider the effects of bank concentration of borrower's market (**H1**) and Models 4-6 consider the effects of lead arranger's market (**H2**) where the lead arranger is possibly from a different state with different bank concentration from that of the borrower. Overall, Table 3 shows that after controlling for a rich set of variables and fixed effects, syndicated loan borrowers would pay a higher cost, in terms of fees, spread and overlibor, in a more concentrated banking market with higher CR_{50}, supporting *market power hypothesis*. In particular, borrowers would be charged higher prices, such as fees (commitment fee and annual fee) and overlibor, if they locate in a more concentrated bank market, supporting both **H1** and **H2**. Specifically, a standard deviation increase in borrower's market bank concentration ($CR_{50}^{Borrower}$) would increase *fees* by 3%, consisting with Lian (2017) and Hasan et al. (2017). A standard deviation (0.12) increase in CR_{50}^{Lead} would raise the *overlibor* of a typical syndicated loan by 4.15 base points, equivalent to around $152,000 additional costs for a borrower with an average size of syndicated loan ($366 million).

Table 3: Baseline results: banking market concentration and syndicated loan price

Samples collected are between 1994 and 2012 with 33,023 observations. Syndicated loan price is measured by *spread*, *fees* and *overlibor*. Banking market concentration is measured by concentration ratio (top 50) in the state where borrower and lead arranger located, respectively. '*Performance pricing indicator*' is defined as a dummy and coded as 1 if overlibor spread of a sample loan is based on borrower's subsequent performance; therefore, we do not consider it in *overlibor* models (3 and 6). We also control for the fixed effects of loan type, lender type and year. Standard errors are clustered at lender-firm year level and reported in parentheses. ***, **, and * denotes statistical significance level of 1%, 5% and 10% respectively.

	Model 1 Spread	**Model 2** Fees	**Model 3** Overlibor	**Model 4** Spread	**Model 5** Fees	**Model 6** Overlibor
Banking Market concentration						
$CRK_{50}^{Borrower}$	22.67***	7.10***	14.57*			
	(6.13)	(1.79)	(8.27)			
CRK_{50}^{Lender}				21.64***	10.90***	34.61***
				(7.37)	(1.87)	(9.50)
Loan facility						
Log (Loan size)	-13.52***	-3.26***	-14.41***	-14.64***	-3.50***	-14.35***
	(0.69)	(0.25)	(1.02)	(0.78)	(0.28)	(1.09)
Loan maturity	0.28***	0.17***	0.64***	0.25***	0.15***	0.60***
	(0.03)	(0.01)	(0.05)	(0.04)	(0.01)	(0.05)
Total number of lenders	0.03	0.06**	0.01	0.14*	0.10***	0.12
	(0.07)	(0.03)	(0.10)	(0.10)	(0.03)	(0.11)
Term loan dummy	52.80***	13.01***	34.87***	52.10***	11.73**	34.39***
	(1.34)	(4.07)	(1.83)	(1.54)	(5.22)	(2.00)
Secured indicator	91.31***	17.97***	102.85***	91.32***	17.70***	100.30***
	(6.67)	(0.39)	(1.87)	(1.81)	(0.41)	(2.05)
Covenants indicator	18.34***	3.84***	0.73	20.68***	3.46***	0.85
	(1.68)	(0.50)	(3.01)	(1.91)	(0.55)	(3.33)
Performance pricing indicator	-35.21***	-3.29***		-35.92***	-3.09***	
	(1.48)	(0.49)		(1.68)	(0.55)	
Borrower's characteristics						
Log (Asset)	-12.80***	-1.30***	-21.84***	-12.52***	-1.36***	-22.27***
	(0.62)	(0.23)	(0.97)	(0.70)	(0.26)	(1.00)
Tangibility	0.09	3.25***	-6.07*	-0.94	2.184***	-8.41**
	(2.50)	(0.65)	(3.29)	(2.82)	(0.72)	(3.65)
Profitability	-8.05**	-2.84***	-4.89	-8.09**	-2.73***	-4.15
	(3.57)	(0.78)	(3.33)	(3.77)	(0.66)	(2.60)
S&P Rating	-19.49***	-4.022***	-15.47***	-19.23***	-4.232***	-14.17***
	(1.46)	(0.42)	(1.91)	(1.64)	(0.46)	(2.12)
State macroeconomics factors						
State personal income	-0.84***	-0.10**	-1.30***	-0.77***	-0.10**	-1.42***
	(0.14)	(0.04)	(0.19)	(0.16)	(0.05)	(0.21)
Log (GDP)	1.73**	0.49**	3.27***	1.39*	0.08	1.84*
	(0.78)	(0.25)	(1.03)	(0.80)	(0.25)	(1.07)
Constant	589.8	71.86	694.7***	782.1***	109.7***	615.9***
	(538,656)	(16,244)	(32.15)	(27.25)	(24.96)	(34.61)
Observations	28,198	18,225	14,470	21,963	14,563	11,320
R-squared	0.516	0.325	0.520	0.525	0.327	0.533
Year FE	YES	YES	YES	YES	YES	YES
Purpose FE	YES	YES	YES	YES	YES	YES
LenderType FE	YES	YES	YES	YES	YES	YES

4.2.1 Bank concentration: borrower's market vs. lead arranger's market

With the development of new information and communication technologies, banks have become able to lend to borrowers locating farther away from them (Felici and Pagnini 2008). Even though, the geographic distance between them would cause high costs for banks to *ex ante* screen and *ex post* monitor borrowers and therefore, syndicated loans are more likely to be led by domestic banks which are geographically close to borrowers (Lin et al. 2012). However, it is not intuitively straightforward to predict the sensitivity of syndicated loan price to banking market concentration. Because of the cost efficiency for lenders to monitor borrowers in the same state, one possibility could be that loan prices would be less sensitive to banking market concentration where borrowers could share the cost savings for lenders by paying lower prices (Degryse and Ongena 2005). In contrast, market power hypothesis suggests that same-state lenders would create rents from geographic proximity by charging higher prices from local borrowers who would have to undertake greater costs (e.g. transportation) to approach alternative lenders farther away from them (Degryse and Ongena 2005). Rent creation would be possibly associated with the market share of local lenders and therefore, syndicated loan prices could be more sensitive to banking market concentration.

To address this issue, we categorize our samples into two groups and re-run Eq. (1). We report the results in Table 4 where we consider same-state lending relations (borrower and lead arranger locating in the same state) in Models 1-3 and different state relations in Models 4-6[9]. Table 4 shows that, first, our key result still holds that banking market concentration raises syndicated loan price in terms of fees, spread and overlibor. Second, if the borrower and lender locate in the same state, syndicated loan price would be more sensitive to banking market concentration than in different states, supporting above market power

[9] We also use endogenous switching regression model corresponding to the possible endogenous selection between same-state lead arranger and out-state lead arranger. The results are consistent with Table 4 and available on request from authors.

hypothesis. In specific, with a same-state lending relationship, a syndicated loan borrower would pay 5 more bps on spread, 2 more bps on fees and 6 more bps on overlibor with a standard deviation increase (0.12) in CR_{50} (Models 1-3). This is equivalent to additional costs of $186,000 on spread, $66,000 on fees and $234,000 on overlibor for an average loan.

Table 4: Banking market concentration and syndicated loan price: borrowing from same-state or out-of-state lead arrangers

Samples collected are between 1994 and 2012 with 33,023 observations. Syndicated loan price is measured by *spread*, *fees* and *overlibor*. Banking market concentration is measured by concentration ratio (top 50) in the state where borrower and lead arranger located, respectively. We also control for the fixed effects of loan type, lender type and year and the results for control variables are not reported but available on request from the authors. In the 'same state' group, we consider sample syndicated loans if the borrower and lead arranger locate in the same state and therefore, both borrower and lender face the same banking market concentration measured by $CR_{50}^{Borrower}$. In the 'different states' group, we consider samples if the borrower and lead arranger locate in different states and therefore, we examine the effects of banking market concentration in borrower's market and lender's market respectively. Standard errors are clustered at lender-firm year level and reported in parentheses. ***, **, and * denotes statistical significance level of 1%, 5% and 10% respectively.

	Same state			Different states		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	Spread	Fees	Overlibor	Spread	Fees	Overlibor
$CRK_{50}^{Borrower}$	42.31*	14.95**	53.28*	16.17**	5.67***	12.21
	(23.46)	(7.19)	(30.56)	(7.61)	(2.18)	(10.39)
CRK_{50}^{Lender}				17.27**	10.04***	25.28**
				(7.96)	(1.99)	(10.35)
Constant	330.1***	17.26	782.5***	390.6	72.55***	390.6***
	(97.46)	(28.22)	(119.4)	(270,730)	(11.52)	(39.13)
Other Controls	YES	YES	YES	YES	YES	YES
Observations	3,233	2,186	1,664	18,730	12,377	9,656
R-squared	0.502	0.295	0.511	0.536	0.345	0.546
Year FE	YES	YES	YES	YES	YES	YES
Purpose FE	YES	YES	YES	YES	YES	YES
LenderType FE	YES	YES	YES	YES	YES	YES

Table 4 also shows that when a borrower raises syndicated loans led by a lead arranger from a different states, loan prices are associated with the concentration of both lender's and borrower's market but slightly more sensitive to the concentration of lead arranger's banking market. For example, controlling for lender's

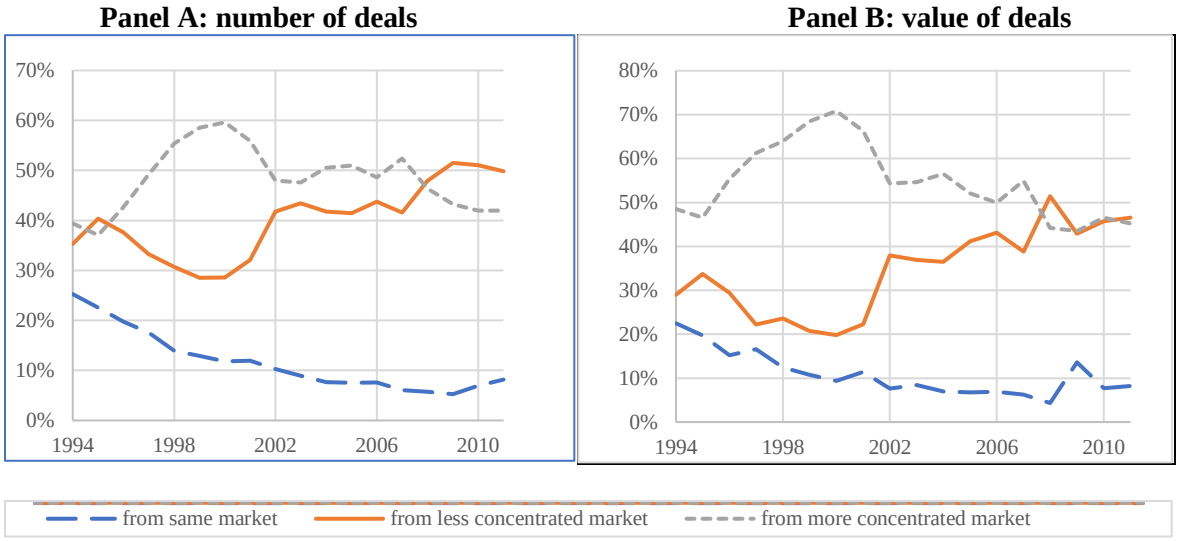
market concentration (CR_{50}^{Lead}), a standard deviation (0.12) increase of borrower's banking market concentration ($CR_{50}^{Borrower}$) would raise the spread, fees and overlibor by 1.9, 0.68 and 1.5 bps respectively (Models 1-3), supporting **H1**. In contrast, holding $CR_{50}^{Borrower}$ at constant, a standard deviation increase of CR_{50}^{Lead} would raise the spread by 2.0 bps, fees by 1.2 bps and overlibor by 3.0 bps (Models 4-6), supporting **H2**.

4.2.2 Is it beneficial to borrow from out-of-state lenders with lower bank concentration?

Since banking market deregulation in the U.S (e.g. IBBEA) in 1990s, the proportion of syndicated loan deals with both lead arranger and borrower locating in the same state decreases from 25% in 1994 to 8% in 2011. During the same period, deals led by arrangers from less concentrated banking market ($CR_{50}^{Difference} = CR_{50}^{Borrower} - CR_{50}^{Lead} > 0$) increase from 35% to 50% and in 2011, 42% of deals were raised from lead arrangers headquartered in more concentrated market ($CR_{50}^{Difference} < 0$; Panel A Figure 1). The value of deals of syndicated loan has also changed in a similar pattern where the total volume of deals raised in the same state has reduced and a greater volume of deals was raised from less concentrated banking markets (Panel B Figure 1).

Figure 1: Borrowing from banks headquartering in the same state?

Figure 1 shows the % of deals in numbers (Panel A) and value (Panel B) raised from banks headquartering in the same state as the borrower ($CR_{50}^{Difference}=0$), in other states with more concentrated market ($CR_{50}^{Difference}<0$) or in other states with less concentrated market ($CR_{50}^{Difference}>0$) between 1994 and 2011.



In this section, we further investigate the 'price-concentration' relationship be considering the effects of the difference of bank concentration between borrower's and lead arranger's markets, $CR_{50}^{Difference}$. We start with descriptive statistics and Table 5 shows that borrowers may access out-of-state lead arranger for loan availability reasons when loan size is particularly big. For example, 18% of loans in first size quartile were raised from home-state leader arrangers and the proportion reduces to 7.7% for loans in the 4th size quartile. In addition, borrowers may also borrow from out-of-state lead arrangers for price reasons, especially when lead arrangers are non-banks. For example, Table 5 shows that out-of-state non-bank lead arrangers charge lower spread (by 46bps), fees (by 12bps) and overlibor (by 43bps).

Table 5: Borrowing from home state lender vs. out-of-state lender

Samples collected are between 1994 and 2012 with 33,023 observations. We consider three possible scenarios – borrowing from local (home state) lead arranger, borrowing from out-of-state lead arrangers with less concentrated banking market ($CR_{50}^{Difference}>0$) and borrowing from out-of-state lead arrangers with more concentrated banking market ($CR_{50}^{Difference}<0$).

	Mean	Same state	Out of state	Less concentrated market ($CR_{50}^{Difference}>0$)	More concentrated market ($CR_{50}^{Difference}<0$)
Loan size quartile ($m and % of deals)					
1st quartile	$26	17.92%	82.08%	41.98%	40.11%
2nd quartile	$103	11.76%	88.24%	39.75%	48.49%
3rd quartile	$251	8.37%	91.63%	38.07%	53.56%
4th quartile	$1,110	7.66%	92.34%	36.52%	55.82%
Spread (bps)					
Non-bank	246.33	291.16	245.02	237.21	275.83
Bank	178.81	173.46	179.62	188.38	174.58
Commercial bank	174.32	171.02	174.82	187.21	167.26
Investment bank	258.70	235.74	261.01	248.53	262.79
Fees (bps)					
Non-bank	40.08	51.46	39.76	38.87	43.42
Bank	29.10	27.72	29.31	30.94	28.40
Commercial bank	28.49	27.56	28.63	20.70	27.44
Investment bank	46.96	33.92	48.45	48.18	48.49
Overlibor (bps)					
Non-bank	216.82	259.24	215.79	204.29	257.87
Bank	168.32	164.93	168.82	172.66	166.42
Commercial bank	165.12	162.98	165.44	172.42	160.82
Investment bank	233.66	214.55	235.90	188.93	242.04

Table 6 reports the results that we regress loan prices on borrower's market concentration ($CRK_{50}^{Borrower}$) and its difference with lead arranger's market concentration ($CR_{50}^{Difference}$) by controlling for the same set of control variables used in the baseline model (Eq. 1). First, our baseline result still holds where loan prices increase with borrower's bank market concentration, supporting **H1**. Second, it supports above predication that borrowers borrow from less concentrated bank market to reduce loan prices. For example, holding $CR_{50}^{Borrower}$ constant, if the lead arranger headquarters in a state with a less concentrated banking market by one standard deviation (0.14), a typical borrower with an average loan size of $366 million would have cost savings of $88,000 on spread, $51,000 on fees and $130,000 on overlibor, compared with those borrowers who borrower locally in the same state, supporting **H2**.

Table 6: Borrowing from out-of-state lenders

Samples collected are between 1994 and 2012 with 33,023 observations. Syndicated loan price is measured by *spread*, *fees* and *overlibor*. Banking market concentration is measured by concentration ratio (top 50) in the state where borrower and lead arranger located, respectively. $CR_{50}^{Difference}$ is defined as the difference of CR_{50} between borrower and lead arranger's market, i.e. $CR_{50}^{Difference} = CR_{50}^{Borrower} - CR_{50}^{Lead}$. Therefore, $CR_{50}^{Difference} > 0$ (<0) suggests that a borrower borrows from a less (more) concentrated banking market. In our data, there are no two markets have the same CR_{50} and therefore a borrower borrows from the same state if $CR_{50}^{Difference} = 0$. We also control for the fixed effects of loan type, lender type and year and the results for control variables are not reported but available on request from the authors. Standard errors are clustered at lender-firm year level and reported in parentheses. ***, **, and * denotes statistical significant level of 1%, 5% and 10% respectively.

	Model 1 Spread	**Model 2** Fees	**Model 3** Overlibor
$CRK_{50}^{Borrower}$	33.44***	15.72***	37.50***
	(11.25)	(2.81)	(14.73)
$CRK_{50}^{Difference}$	-17.27**	-10.04***	-25.28**
	(7.96)	(1.99)	(10.35)
Constant	665.4***	75.22***	390.6***
	(29.65)	(11.52)	(39.13)
Other Controls	YES	YES	YES
Observations	18,730	12,377	9,656
R-squared	0.536	0.345	0.546
Year FE	YES	YES	YES
Purpose FE	YES	YES	YES
LenderType FE	YES	YES	YES

4.3 Does the participant's market power determine syndicated loan price?

To test **H3**, we regress loan prices on weighted participant's market concentration ($CRK50^{Participant}$) and lead arranger's market concentration ($CRK50^{Lead}$) by controlling for the same set of control variables used in the baseline model (Eq.1). Rejecting **H3**, Table 7 shows little evidence on the impacts of bank concentration on syndicated loan prices. Therefore, our empirical results so far suggest that syndicated loan prices are sensitive to bank concentration of both borrower's market (**H1**) (e.g. Hasan et al. 2017; Lian 2017) and lead arranger's market (**H2**) but not participant lenders' market (**H3**).

Table 7: Participants market power

Samples collected are between 1994 and 2012 with 33,023 observations. Syndicated loan price is measured by *spread*, *fees* and *overlibor*. Banking market concentration is measured by concentration ratio (CR_{50}) in the borrower's market and the weighted participant bank market respectively. We control for the fixed effects of loan type, lender type and year. Results for control variables are not reported but available from the authors on request. Standard errors are clustered at lender-firm year level and reported in parentheses. ***, **, and * denotes statistical significant level of 1%, 5% and 10% respectively.

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	Spread	Fees	Overlibor	Spread	Fees	Overlibor
$CRK50^{Lead}$				46.24***	9.20***	37.31***
				(11.44)	(2.84)	(13.04)
$CRK50^{Participant}$	-6.85	-6.95	-5.72	-1.96	-7.40	-2.87
	(10.78)	(8.28)	(12.82)	(10.97)	(8.71)	(12.98)
Constant	1,037.47***	86.63***	774.49***	765.21***	125.83***	428.67***
	(43.67)	(13.34)	(81.66)	(47.69)	(12.67)	(63.08)
Observations	8,088	6,445	6,025	7,230	5,738	5,350
R-squared	0.540	0.345	0.586	0.545	0.352	0.590
Year FE	YES	YES	YES	YES	YES	YES
Loan Purpose FE	YES	YES	YES	YES	YES	YES
Lender Type FE	YES	YES	YES	YES	YES	YES

4.4 Robustness tests

Overall, our earlier empirical results support both **H1** and **H2** that bank concentration of both borrower's and lender's market have an impact on syndicated loan prices and loan prices are not sensitive to participant lender's market concentration (**H3**). We run a rich set of additional tests to examine the robustness of our results. First, we use alternative bank concentration measures, such as $CR_{20}^{Borrower}$ (Model 1), $CR_{10}^{Borrower}$ (Model 2), HHI Branch deposit (Model 3), HHI Bank deposit (Model 4), Log(number of Branches) (Model 5), branch density by state size (Model 6) and HHI MSA (Model 7), and our results still hold. Second, we exclude samples in the financial crisis period, i.e. 2007-2009 (Model 8) and third, we consider sample loans with a type of revolver only (Model 9). Again, our earlier results are still robust[10].

[10] The robustness tests for the participant's bank market are also available from the authors on request.

Table 8: Robustness test: alternative measures of banking market concentration

This table reports the results of 8 robustness tests by using alternative measures of bank concentration (Models 1-7), samples excluding financial crisis period (Model 8) and sample loans with a type of revolver only (Model 9). We only report the estimate of the key variables and results for all other results are available from the authors on request. Standard errors are clustered at lender-firm year level and reported in parentheses. ***, **, and * denotes statistical significant level of 1%, 5% and 10% respectively.

		Borrower's market			*Lead Arranger's market*			*Difference*		
Models		*Spread*	*Fees*	*Overlibor*	*Spread*	*Fees*	*Overlibor*	*Spread*	*Fees*	*Overlibor*
1	CR_{20}	21.77***	5.96***	10.07	20.79***	11.16***	33.92***	-20.31***	-11.00***	-33.85***
		(6.11)	(1.78)	(8.35)	(7.38)	(1.94)	(9.68)	(7.38)	(1.45)	(9.69)
2	CR_{10}	21.74***	5.43***	7.69	15.38**	10.29***	29.29***	-14.98**	-10.17***	-29.35***
		(6.17)	(1.81)	(8.32)	(7.28)	(1.90)	(9.53)	(7.28)	(1.91)	(9.54)
3	*HHI Branch deposit*	87.65***	21.82***	59.49	259.69***	65.73***	138.21**	-252.54***	-64.38***	-131.29*
		(26.09)	(7.01)	(37.21)	(57.50)	(19.45)	(69.31)	(57.92)	(19.64)	(69.74)
4	*HHI Bank deposit*	14.08**	1.30	3.61	12.94***	0.50	4.15	-10.36**	-0.65	-2.27
		(6.06)	(1.76)	(7.78)	(4.96)	(1.29)	(6.13)	(4.14)	(0.96)	(5.10)
5	*Log(number of Branches)*	-5.53**	-1.08	-10.84***	-1.63	-0.93***	-2.01	1.56	0.92***	1.83
		(2.46)	(0.67)	(3.03)	(1.06)	(0.24)	(1.29)	(1.06)	(0.24)	(1.29)
6	*Density by size* (number of branches per km^2)	-10.31	-9.28**	-68.87***	-35.19**	3.63	-4.67	35.12**	-3.99	2.61
		(19.93)	(4.69)	(24.90)	(31.85)	(3.72)	(18.93)	(16.34)	(3.73)	(19.07)
7	*HHI (MSA)*	125.24***	7.90*	141.89***	108.43***	4.02	135.76***	-104.20***	-4.38	-116.13***
		(17.22)	(4.53)	(21.44)	(18.79)	(3.98)	(21.28)	(20.16)	(4.36)	(22.54)
8	$CR_{50}^{Borrower}$ (excluding samples from 2007-09 financial crisis)	23.58***	7.71***	12.40	28.38***	12.39***	39.05***	-27.48***	-12.14***	-38.88***
		(6.59)	(1.83)	(9.05)	(7.86)	(1.92)	(10.07)	(7.85)	(1.93)	(10.09)
9	$CR_{50}^{Borrower}$ (loan type: revolver only)	23.86***	6.93***	22.16**	17.47**	10.18***	38.66***	-16.73**	-9.95***	-37.83***
		(6.73)	(1.76)	(9.01)	(7.50)	(1.90)	(9.74)	(7.51)	(1.91)	(9.76)

4.5 Does lender type matter to the 'price-concentration' relationship?

We group sample loans according to the lead arranger's types, commercial banks vs. non-commercial banks (investment banks and non-banks). Our data (Table 9) shows that about 4.25% of our sample deals are led by investment banks and 15.8% by non-bank lenders. The univariate test results show that compared with commercial bank lenders, investment banks and non-bank lenders are more likely to charge higher loan prices and issue term loans and loans with longer maturity.

To test **H4**, we regress loan prices on borrower's market concentration ($CRK_{50}^{Borrower}$), leader arranger's market concentration (CRK_{50}^{Lead}) and the difference between them, $CR_{50}^{Difference}$ (= $CRK_{50}^{Borrower}$ - CRK_{50}^{Lead}), by controlling for the same set of control variables used in the baseline model (Eq. 1). We report the results in Table 10[11]. Our results on loans led by commercial banks are consistent with our earlier findings where loan prices increase with bank concentration in both borrower's and lead arranger's markets, and loans raised in less concentrated out-of-state markets ($CR_{50}^{Difference}>0$) are charged lower prices. In sharp contrast, the prices (spread and overlibor) of syndicated loans led by non-commercial banks, such as investment banks and non-bank lenders, decrease with bank market concentration (Models 2 and 6). Such a result could be driven by the structure-conduct-performance (SCP) model where in a more concentrated bank market, it will decrease the cost of funds for investment banks and non-banks. This is because financial institutions obtain funds from commercial banks with lower prices than corporate borrowers (Ahmed et al. 2015) and with a greater market power, commercial banks pay lower interest rate to depositors and charge higher prices on loans, according to SCP. Hence, financial institutions could raise cheaper funds and offer more competitive prices to borrowers (Gropp et al. 2014) when banking market is concentrated. Results in

[11] We also perform endogenous switching regression model to control for the selection basis arising from choices between commercial lead arranger and non-commercial lead arranger. The results are consistent with Table 10 and are available from the authors on request.

Panel B support this finding where non-commercial banks would have higher costs in less concentrated markets ($CR_{50}^{Difference}>0$) and hence charge higher prices on loans (Model 8).

Table 9: Does lender type matter? Evidence from univariate analysis

In this table, we compare the characteristics of loans across types of lead arrangers and identify the type of lenders by following (Lim et al. 2014). We run univariate tests (commercial vs. investment banks; banks vs. non-banks) and ***, **, and * denotes statistical significant level of 1%, 5% and 10% respectively.

	All Lenders	*Bank lenders*	*Commercial Bank lenders*	*Investment bank lenders*	*Non-bank lenders*
Number of observations	33023	27736	26268	1468	5287
Spread	186.56	178.81	174.32	258.70***	246.33***
Fees	29.87	29.10	28.49	46.96***	40.08***
Overlibor	172.73	168.32	165.12	233.66***	216.82***
Loan size (USD$ m)	378	374	373	406	320***
Loan maturity (months)	46.19	46.32	45.69	57.79***	49.88***
Total number of lenders	8.46	8.89	8.95	7.89***	6.60***
Term loan (0,1)	0.25	0.24	0.23	0.48***	0.36***
Covenant indicator (0,1)	0.61	0.63	0.62	0.68***	0.61**
Performance pricing feature (0,1)	0.47	0.50	0.51	0.44***	0.38***

Table 10: Does lender type matter?

Samples collected are between 1994 and 2012 with a total number of observations of 33,023. Dependent variable is syndicated loan price measured by *spread*, *fees* and *overlibor*. According to the type of lead arranger, we group sample loans into 'commercial bank' loans and 'non-commercial bank' loans and non-commercial banks include both investment banks and non-bank lenders (e.g. hedge funds). In Panel A, banking market concentration is measured by concentration ratio ($CR_{50}^{Borrower}$ and CR_{50}^{Lead}) in the borrower's and lender's market. In Panel B, banking market concentration is measured by concentration ratio ($CR_{50}^{Borrower}$) in the borrower's market. $CR_{50}^{Difference}$ is defined as the difference of CR_{50} between borrower and lead arranger's market, i.e. $CR_{50}^{Difference} = CR_{50}^{Borrower} - CR_{50}^{Lead}$. Therefore, $CR_{50}^{Difference} > 0$ (or <0) suggests that a borrower borrows from a less (or more) concentrated banking market. In our data, there are no two markets have the same CR_{50} and therefore a borrower borrows from the same state if $CR_{50}^{Difference}=0$. We also control for the fixed effects of loan type and year and the results for control variables are not reported but available on request from the authors. Standard errors are clustered at lender-firm year level and reported in parentheses. ***, **, and * denotes statistical significant level of 1%, 5% and 10% respectively.

	Spread		**Fees**		**Overlibor**	
	Commercial Banks	Non-Commercial Banks	Commercial Banks	Non-Commercial Banks	Commercial Banks	Non-Commercial Banks
Panel A	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
$CR_{50}^{Borrower}$	15.59**	-38.26**	3.30*	11.05	18.41*	-87.07***
	(7.62)	(18.94)	(1.98)	(9.48)	(10.27)	(28.98)
CR_{50}^{Lead}	34.11***	-131.1***	12.17***	4.81	38.06***	-63.85
	(7.57)	(24.16)	(1.79)	(13.19)	(9.65)	(43.47)
Constant	492.3***	654.0***	92.72***	88.23**	528.8***	729.8***
	(28.02)	(70.08)	(10.45)	(36.94)	(37.92)	(116.7)
Other Controls	YES	YES	YES	YES	YES	YES
Observations	19,169	2,794	13,243	1,320	10,141	1,179
R-squared	0.493	0.427	0.321	0.207	0.523	0.402
Year FE	YES	YES	YES	YES	YES	YES
Loan Purpose FE	YES	YES	YES	YES	YES	YES
Lender Type FE	NO	NO	NO	NO	NO	NO
Panel B	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
$CR_{50}^{Borrower}$	49.70***	-171.4***	15.27***	15.86	56.47***	-150.9***
	(10.47)	(31.62)	(2.49)	(17.12)	(13.45)	(53.22)
$CR_{50}^{Difference}$	-34.11***	133.1***	-12.17***	-4.81	-38.06***	63.85
	(7.57)	(24.16)	(1.79)	(13.19)	(9.65)	(43.47)
Constant	492.3***	654.0***	92.72***	88.23**	528.8***	729.8***
	(28.02)	(70.08)	(10.45)	(36.49)	(37.92)	(116.7)
Other Controls	YES	YES	YES	YES	YES	YES
Observations	19,169	2,794	13,243	1,320	10,141	1,179
R-squared	0.493	0.427	0.321	0.207	0.523	0.402
Year FE	YES	YES	YES	YES	YES	YES
Loan Purpose FE	YES	YES	YES	YES	YES	YES
Lender Type FE	NO	NO	NO	NO	NO	NO

4.6 Endogeneity

An endogeneity issue may exist in our analysis and there is a particular concern on the 'reverse causality' effect where states differ in their syndicated loan prices and such differences may trigger the change of bank market concentration in a specific state[12]. This effect could be more pronounced when we consider 'same-state' lending relationships. Hence, we employ Eq. 2 to test if there is a reverse causality between bank market structure and syndicated loan prices:

$$Banking\ market\ concentration_t = \beta_0 + \beta_1 \times Banking\ market\ concentration_{t-1} + \beta_2 \times Syndicated\ loan\ prices_t + \beta_3 \times State\ control_{t-1} + \varepsilon \quad \cdots\cdots\cdots\cdots \text{Eq.(2)}$$

The results reported in Panel A Table 11 show little evidence on the existence of the reverse causality issue where syndicated loan prices do not affect banking market concentration at a statistically significant level[13]. The other possible reason for endogeneity is the 'omitted variables' effects. For example, unobservable state-level factors varying across states may influence the timing of deregulation and have further impacts on bank market structure in different states. To address this issue, we follow Cornaggia et al. (2015) to perform a placebo test to investigate if our results are driven by those unobservable and omitted state specific factors. We run the placebo test by randomly reordering banking market concentration within same state where a syndicated loan is raised. We replace $CR_{50}^{Borrower}$ by a $fake\text{-}CR_{50}^{Borrower}$ and re-run the baseline model (Eq. 1). Panel B (Table 11) shows that the coefficients of $fake\text{-}CR_{50}^{Borrower}$ are statistically insignificant in all loan price models. Therefore, our earlier results are robust and not subject to endogeneity.

[12] In Eq(1), we use one-year lagged concentration to overcome the possible reverse causality issue.

[13] We also consider loan prices (e.g. spread, overlibor) at time t-1 and our results still hold.

Table 11: Tests of endogeneity

Samples collected are between 1994 and 2012 with a total number of observations of 33,023. In Panel A, the dependent variable is $CR_{50}^{Borrower}$ when loan was raised in year t. $CR_{50,t-1}^{Borrower}$ is borrower's market concentration in year t-1. In Panel B, dependent variable is syndicated loan price measured by *spread*, *fees* and *overlibor*. We use a fake concentration measure (fake-$CR_{50}^{Borrower}$) and run a placebo test. We also control for the fixed effects of loan type and year and the results for control variables are not reported but available on request from the authors. Standard errors are clustered at lender-firm year level and reported in parentheses. ***, **, and * denotes statistical significant level of 1%, 5% and 10% respectively.

Panel A	**Model 1**	**Model 2**	**Model 3**
	$CR_{50,t}^{Borrower}$	$CR_{50,t}^{Borrower}$	$CR_{50,t}^{Borrower}$
$CR_{50,\ t-1}^{Borrower}$	1.01***	1.01***	1.02***
	(0.00)	(0.00)	(0.00)
Spread	-8.61e-07		
	(0.00)		
Fee		6.99e-07	
		(0.00)	
Overlibor			-2.44e-06
			(0.00)
Constant	-0.07***	-0.08***	-0.09***
	(0.01)	(0.01)	(0.01)
State controls	YES	YES	YES
Observations	30,389	19,036	15,174
R-squared	0.957	0.957	0.957
Year FE	YES	YES	YES
Loan purpose FE	YES	YES	YES
Lender type FE	YES	YES	YES
Panel B	**Model 4**	**Model 5**	**Model 6**
	Spread	Fees	Overlibor
fake-$CR_{50}^{Borrower}$	0.63	-1.41	0.52
	(3.46)	(0.92)	(4.58)
Constant	521.2	160.1***	636.2***
	(102209.3)	(7.85)	(30.46)
Other controls	YES	YES	YES
Observations	28,198	18,225	14,470
R-squared	0.516	0.325	0.520
Year FE	YES	YES	YES
Loan purpose FE	YES	YES	YES
Lender type FE	YES	YES	YES

5. Summary and conclusion

There have been both theoretical and empirical studies on the 'price-concentration' relationship in existing literature on both banking (e.g. bilateral loan) and product markets. However, there has been little evidence on such a relationship in a syndicated loan setting. Focusing on borrower's bank market concentration, recent evidence (e.g. Hasan et al. 2017; Lian 2017) shows a positive relationship between bank market concentration and syndicated loan prices. What is little known, however, is how bank concentration of lead arranger's market, participant lenders' market and lender type moderate such a 'price-concentration' relationship. To fill in this gap, this paper empirically investigates how syndicated loan prices, in terms of spread, fees and overlibor, react to bank concentration of the markets where borrower (H1), lead arranger (H2) and participant lenders (H3) locate. We show supporting evidence to market power hypothesis where syndicated loan prices are positively associated with bank concentration of both borrower's and lead arranger's markets but not participant lenders' markets. Our results also show that if a borrower raises syndicated loan led by a lead arranger from a different state, loan prices are more sensitive to the bank concentration of lender's market than to that of borrower's market. In addition, we show borrowers could reduce loan prices by borrowing from less concentrated bank markets.

In sharp contrast, syndicated loan prices are negatively associated with bank market concentration if the lead arranger is a non-commercial bank (H4). Our empirical findings imply that corporate borrowers could pay lower loan prices if they borrow from commercial banks in a less concentrated bank market. If they face a concentrated bank market, it would be beneficial to borrow from non-commercial banks.

Appendix: Definition and source of variables

Variables	Definition	Sources
Bank market concentration		
$CR_{50}^{Borrower}$	Top 50 branch deposit concentration ratio in borrower's bank market at state level.	FDIC
CR_{50}^{Lead}	Top 50 branch deposit concentration ratio in lender's bank market at state level.	FDIC
$CR_{50}^{Participant}$	Share weighted average of participants' bank market concentration, based on top 50 branch deposit concentration ratio at state level.	FDIC
$CR_{50}^{Difference}$	$CR_{50}^{Difference} = CR_{50}^{Borrower} - CR_{50}^{Lead}$	FDIC
CR_{20}	Top 20 branch deposit concentration ratio in bank market at state level.	FDIC
CR_{10}	Top 10 branch deposit concentration ratio in bank market at state level.	FDIC
HHI Branch	Herfindahl-Hirschman Index of branch deposit at state level.	FDIC
HHI Bank	Herfindahl-Hirschman Index of bank deposit at state level.	FDIC
HHI MSA	Herfindahl-Hirschman Index of branch deposit at MSA level.	FDIC
Number of Branches	The total number of deposit branches at state level.	FDIC
Branch density by population	Number of branches per 1000 population.	Federal Reserve Bank of ST. Louis
Branch density by state size	Number of branches per km^2.	FDIC
Syndication Price		
Spread	All-in-drawn-spread: basis point spread over LIBOR plus the annual fee and the up-front	DealScan
Fees	All-in-undrawn-spread: commitment fee plus annual fee, i.e., the amount a borrower pays for each dollar available under a commitment.	DealScan
Overlibor	Basis point over LIBOR for the first run of loan.	DealScan
Facility Characteristics		
Log(Loan size)	Natural Log of loan amount in $m	DealScan
Log(Loan maturity)	Natural Log of loan maturity in months	DealScan
Total number of lenders	Number of participating lenders in the facility syndicate	DealScan
Term loan dummy	= 1 if the facility type is term loan facility (including term loan A, term loan B….), and 0 otherwise	DealScan
Secured indicator	=1 if the loan has collateral	DealScan
Convents indicator	= 1 if the loan has convents, and 0 otherwise	DealScan
Performance pricing dummy	= 1 if the loan has performance pricing features, and 0 otherwise	DealScan
Borrower Firm Characteristics		
Log(Asset)	Natural Log of the total asset in £m of the borrower at the end of fiscal year prior to the loan originated.	Compustat
Tangibility	The sum of net property, equipment and pant, divided by total asset	Compustat
Profitability	Net income/total asset	Compustat
S&P rating	=1 if the company has a S&P rating from "AAA" to "BBB".	Compustat
Macroeconomic Factors		
State personal annual income($000)	The average personal annual income in state.	Federal Reserve Bank of ST. Louis
State Gross Domestic Product ($bn)	The annual gross domestic product by state	Bureau of Economic

Reference:

Ahmed JI, Anderson C, Zarutskie RE (2015) Are the borrowing costs of large financial firms unusual? FEDS. doi:http://dx.doi.org/10.17016/FEDS.2015.024

Altunbaş Y, Gadanecz B (2004) Developing country economic structure and the pricing of syndicated credits. J Devel Stud 68540:143-173 doi:https://doi.org/10.1080/0022038042000218170

Amore MD, Schneider C, Žaldokas A (2013) Credit supply and corporate innovation. J Finan Econ 159109:835-855 doi:https://10.1016/j.jfineco.2013.04.006

Ariss RT (2010) On the implications of market power in banking: Evidence from developing countries. J Banking Finance 121734:765-775 doi:https://doi.org/10.1016/j.jbankfin.2009.09.004

Asker J, Ljungqvist A (2010) Competition and the structure of vertical relationships in capital markets. J Political Econ 2724118:599-647

Bae SC, Chang K, Yi H-C (2018) Corporate social responsibility, credit rating, and private debt contracting: new evidence from syndicated loan market. Rev Quant Finance Acc 273350:261-299 doi:http://doi.org/10.1007/s11156-017-0630-4

Bellón C (2016) How local is a local banking market? Bank competition, borrower competition and interest rates. SSRN 2706 doi:http://dx.doi.org/10.2139/ssrn.2665173

Berg T, Saunders A, Steffen S (2015) The total cost of corporate borrowing in the loan market: Don't ignore the fees. J Finance 705 doi:https://doi.org/10.1111/jofi.12281

Bikker JA, Haaf K (2002) Competition, concentration and their relationship: An empirical analysis of the banking industry. J Banking Finance 74526:2191-2214 doi:https://doi.org/10.1016/s0378-4266(02)00205-4

Cetorelli N, Gambera M (2001) Banking market structure, financial dependence and growth: International evidence from industry data. J Finance 1056:617-648 doi:https://10.1111/0022-1082.00339

Cetorelli N, Strahan PE (2006) Finance as a barrier to entry: Bank competition and industry structure in local US markets. J Finance 16161:437-461

Chan ALC, Hsieh YT, Lee E, Yueh ML (2015) Does financial statement information affect cross-border lending by foreign banks in the syndicated loan market? Evidence from a natural experiment. J Account Public Policy 68634:520-547 doi:https://doi.org/10.1016/j.jaccpubpol.2015.05.005

Chava S, Roberts MR (2008) How does financing impact investment? The role of debt covenants. J Finance 97763:2085-2121 doi:https://doi.org/10.1111/j.1540-6261.2008.01391.x

Cornaggia J, Mao Y, Tian X, Wolfe B (2015) Does banking competition affect innovation? J Finan Econ 153115:189-209

Cyrnak AW, Hannan TH (1999) Is the cluster still valid in defining banking markets? Evidence from a new data source. Antitrust Bull 68744:313

Degryse H, Ongena S (2005) Distance, Lending Relationships, and Competition. J Finance 74260:231-266 doi:https://doi.org/10.1111/j.1540-6261.2005.00729.x

Delis MD, Tsionas EG (2009) The joint estimation of bank-level market power and efficiency. J Banking Finance 70233:1842-1850 doi:https://doi.org/10.1016/j.jbankfin.2009.04.006

Demiroglu C, James C (2015) Bank loans and troubled debt restructurings. J Finan Econ 699118:192-210 doi:https://doi.org/10.1016/j.jfineco.2015.01.005

Demsetz H (1973) Industry structure, market rivalry, and public policy. J Law Econ 70616:1-9 doi:https://doi.org/10.1086/466752

Dennis SA, Mullineaux DJ (2000) Syndicated Loans. J Finan Intermediation 459:404-426 doi:https://doi.org/10.1006/jfin.2000.0298

Esty BC (2001) Structure loan syndicates: A case study of the Hong Kong Disneyland project loan. J Appl Corp Finance 74314:80-95 doi:https://doi.org/10.1111/j.1745-6622.2001.tb00440.x

Felici R, Pagnini M (2008) Distance, bank heterogeneity and entry in local banking markets. J Ind Econ 69156:500-534 doi:https://doi.org/10.1111/j.1467-6451.2008.00357.x

Fungáčová Z, Shamshur A, Weill L (2017) Does bank competition reduce cost of credit? Cross-country evidence from Europe. J Banking Finance 251583:104-120 doi:https://doi.org/10.1016/j.jbankfin.2017.06.014

Gelos RG, Sahay R, Sandleris G (2011) Sovereign borrowing by developing countries: What determines market access? J Int Econ 69383:243-254 doi:https://doi.org/10.1016/j.jinteco.2010.11.007

Guzman MG (2000) Bank structure, capital accumulation and growth: a simple macroeconomic model. Econ Theory 69716:421-455 doi:https://doi.org/10.1007/PL00004091

Harjoto M, Mullineaux DJ, Yi H-C (2006) A Comparison of Syndicated Loan Pricing at Investment and Commercial Banks. Financ Manage 48935:49-70 doi:https://doi.org/10.1111/j.1755-053X.2006.tb00159.x

Hasan I, Liu L, Wang H, Zhen X (2017) Bank market power and loan contracts: Empirical evidence. Econ Notes 250946:649-676

Haselmann R, Wachtel P (2011) Foreign banks in syndicated loan markets. J Banking Finance 113435:2679-2689 doi:https://doi.org/10.1016/j.jbankfin.2011.02.023

Heitfield E, Prager RA (2004) The geographic scope of retail deposit markets. J Financ Serv Res 271925:37-55 doi:https://doi.org/10.1023/B:FINA.0000008664.47740.a5

Heitfield EA (1999) What do interest rate data say about the geography of retail banking markets? Antitrust Bull 271744:p. 333-348

Ivashina V (2009) Asymmetric information effects on loan spreads. J Finan Econ 75692:300-319 doi:https://doi.org/10.1016/j.jfineco.2008.06.003

Ivashina V, Scharfstein D (2010) Bank lending during the financial crisis of 2008. J Finan Econ 189597:319-338 doi:https://doi.org/10.1016/j.jfineco.2009.12.001

Ivashina V, Sun Z (2011) Institutional demand pressure and the cost of corporate loans. J Finan Econ 75599:500-522 doi:https://doi.org/10.1016/j.jfineco.2010.10.009

Jackson JE, Thomas AR (1995) Bank structure and new business creation lessons from an earlier time. Reg Sci Urban Econ 35625:323-353 doi:https://doi.org/10.1016/0166-0462(94)02069-s

Johnson CA, Rice T (2008) Assessing a decade of interstate bank branching. SSRN 164 doi:http://dx.doi.org/10.2139/ssrn.981214

Kim M, Surroca J, Tribo JA (2014) Impact of ethical behavior on syndicated loan rates. J Banking Finance 69038:122-144 doi:https://doi.org/10.1016/j.jbankfin.2013.10.006

Lee SW, Mullineaux DJ (2004) The size and composition of commercial lending syndicates. SSRN 744 doi:https://doi.org/10.2139/ssrn.292874

Lian Y (2017) Bank competition and the cost of bank loans. Rev Quant Finance Acc 2514 doi:https://doi.org/10.1007/s11156-017-0670-9

Lim J, Minton BA, Weisbach MS (2014) Syndicated loan spreads and the composition of the syndicate. J Finan Econ 696111:45-69 doi:https://doi.org/10.1016/j.jfineco.2013.08.001

Lin C, Ma Y, Malatesta P, Xuan Y (2012) Corporate ownership structure and bank loan syndicate structure. J Finan Econ 1902104:1-22 doi:https://doi.org/10.1016/j.jfineco.2011.10.006

Osborne DK (1988) Competition and geographical integration in commercial bank lending. J Banking Finance 270712:85-103 doi:https://doi.org/10.1016/0378-4266(88)90052-0

Pagano M (1993) Financial markets and growth. Europ Econ Rev 69837:613-622 doi:https://doi.org/10.1016/0014-2921(93)90051-B

Petersen MA, Rajan RG (1995) The effect of credit market competition on lending relationships. Q J Econ 695110:407-443 doi:https://doi.org/10.2307/2118445

Petersen MA, Rajan RG (2002) Does distance still matter? The information revolution in small business lending. J Finance 193657:2533-2570 doi:https://doi.org/10.1111/1540-6261.00505

Radecki L (1998) The expanding geographic reach of retail banking markets. Econ Pol Rev 2716

Rice T, Strahan PE (2010) Does credit competition affect small- firm finance? J Finance 16065:861-889

Sapienza P (2002) The effects of banking mergers on loan contracts. J Finance 70457:329-367 doi:https://doi.org/10.1111/1540-6261.00424

Schuermann T (2004) Why were banks better off in the 2001 recession? SSRN 676 doi:https://ssrn.com/abstract=601145

Sharpe SA (1990) Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Customer Relationships 95145:1069 doi:10.2307/2328715

Taylor A, Sansone A (2007) The handbook of loan syndications and trading. McGraw-Hill, New York

Tian L, Han L (2018) How local is local? Evidence from bank competition and corporate innovation in US. Rev Quant Finance Acc 2720:1-36

von Thadden E-L (2004) Asymmetric information, bank lending and implicit contracts: the winner's curse. Financ Res Lett 4851:11-23 doi:https://doi.org/10.1016/s1544-6123(03)00006-0