Bank Capital and Lending: Evidence from Syndicated Loans

Abstract

Using within-loan estimations to remove the impact of the demand side factors, we find that capital levels of banks participating in the same syndicated loan are positively associated with the banks' contributions to the loan. Using TARP as a quasi-natural experiment, we find that banks increase their contributions to syndicated loans after receiving TARP funding. Capital levels of lead banks are also positively associated with their fund contributions across loans. Taken together, we provide new evidence on the importance and the causal effect of bank capital on lending for the syndicated loans market.

Keywords: Bank Capital, Lending, Syndicated Loans, TARP

JEL **Classification:** G21, G28, G32

1. Introduction

We study how bank capital affects credit supply in syndicated loans. Syndicated lending makes up a substantial portion of bank total loan provision. Ivashina and Scharfstein (2010) report that syndicated loans account for more than a quarter of total commercial and industrial (C&I) loan exposures on U.S. commercial banks' balance sheets in 2007. Syndicated loans are also an important financing source for U.S. companies. Sufi (2007) reports that, between 1994 and 2002, nearly 90% of the largest 500 nonfinancial firms in the Compustat universe used the syndicated loans market for financing. In 2014, U.S. companies raised $2.3 trillion in the syndicated loans market, compared to $253.9 billion in equity issuance and $2.7 trillion in bond offerings.[1] Despite the large amount of bank credit extended via the syndicated loans market, little empirical research has been done on whether and how bank capital affects syndicated lending.[2] Answering this question is useful for the understanding of how the bank lending channel of monetary policy works. It is also an important issue in light of debates over the potential economic consequences of the tightened bank capital requirements proposed in the aftermath of the 2008-2009 financial crisis. Using a unique bank-loan-borrower matched data set and a novel identification method, this paper provides comprehensive evidence on the causal effect of bank capital on lending in the syndicated loans market.

The literature has devoted many efforts to evaluating the impact of capital on lending, mostly at the aggregate level. It has proven to be difficult, however, to empirically identify the

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[1] The numbers are from *Syndicated Loans Review*, *Full Year 2014*, *Equity Capital Markets Review*, *Full Year 2014*, and *Debt Capital Markets Review*, *Full Year 2014* by Thomson Reuters. Note that these dollar numbers for syndicated loans, equities, and bonds do not necessarily reflect their percentage weights for new U.S. corporate financing because of their different effective maturities. For global markets, the new issuances in syndicated loans, equities, and debt are $4.7 trillion, $890.4 billion, and $5.7 trillion, respectively (all in U.S. dollars).

[2] Duchin and Sosyura (2014) use the TARP as a policy shock to assess the effect of capital injection on syndicated bank loan supply between 2006 and 2010. Santos (2011) shows that banks that incurred larger losses in the subprime crisis charge higher loan spreads.

causal effect of bank capital on lending (Jiménez, Ongena, Peydró, and Sarina (2012)). The main obstacle is to separate the effect of bank capital on lending from (often unobservable) demand side factors because changes in macroeconomic conditions/monetary policies that cause variations in bank capital levels often also affect the demand for loans (e.g., Bernanke and Gertler (1995)). Indeed this challenge is not limited to the relationship between bank capital and lending, as Strahan (2008) points out that "Sorting out the effects of loan demand from loan supply is a continuing challenge to all empirical research (in banking and elsewhere) (p126)."

In this paper, we use a novel approach to address the endogeneity problem arising from correlated loan demand. Our comprehensive dataset encompasses a large sample of U.S. syndicated loans (from Thomson Reuters DealScan) matched with banks' balance sheet data (from the Consolidated Report of Condition and Income or the "Call Report") and borrowers' financial information (from Compustat). Syndicated loans often have multiple banks as lenders. We take advantage of this unique feature to study how capital levels of banks that fund the *same* loan affect their contributions (or allocation shares) to the loan, which we call *within-loan* estimation. By focusing on the effect of capital levels of banks within the same loan, we effectively separate the effect of bank capital on lending from that of all demand side factors that are potentially correlated with bank capital but are otherwise unobservable. The within-loan estimation is also free from the impact of (potentially endogenous) loan characteristics such as pricing and covenants because they remain constant across all banks within the same loan. This paper complements the literature that uses one-time shocks to capital to disentangle the supply-demand effects (see, e.g., Peek and Rosengren (1997, 2000), Puri, Rocholl, and Steffen (2011), and Rice and Rose (2012)). While the use of one-time shocks to capital provides useful insights, such empirical designs may pick up some effects due to the shock but are not related to bank capital, i.e., the external validity of the shock-based results may be weak. We look at how capital determines banks' ownership decisions in each individual loan transaction across an extended sample period, which provides a different angle to disentangle the supply-demand effects.

Our identification strategy and hypothesis are motivated by the underwriting process of syndicated loans. In the syndicated loans market, the lead bank(s), also known as the arranger(s), originates a loan and then markets it to other participant lenders (Esty (2001) and Ivashina and Sun (2011)). Before the Russian debt crisis in 1998, the lead bank would simply structure a deal and determine its terms, and then the loan is syndicated to participant lenders. After 1998, a bookbuilding process, also called a "market flex" model by practitioners, is typically used, and this makes the loan syndication process, like that for initial public offerings (IPOs), more a capital market exercise. With the market flex model, the lead bank of a loan has the flexibilities to adjust the spreads and other loan terms if necessary to attract other banks and non-bank institutional investors to close the deal. A loan can be syndicated as an underwritten deal, for which the lead bank commits to fund the loan fully if other investors do not provide the desired level of funding, or a best-efforts deal, for which the full funding for the loan is not guaranteed by the lead bank.[3] For either an underwritten or a best-efforts deal, since the lead bank can adjust the loan terms during the syndication process, it has much control over its share of capital contributions to the loan. Even with the simple syndication process before 1998, the lead bank would still take into account its desired level of capital contributions when it structures the deal. The underwriting process also suggests that a non-lead, participant bank will also determine its contribution to a loan conditional on loan demand, since it can decide its participation after learning about the demand

[3] Some smaller loans (usually from $25 to $100 million, but can be as high as $150 million) are funded as "club deals". A club deal is pre-marketed to a group of relationship lenders and the lead is generally a first among equals. In this case, the lead bank's capital contribution is affected by the loan size and the number of relationship lenders.

side factors. In this paper, we use this feature of the syndicated loans market and examine the effect of bank capital on allocation shares to separate effectively the supply effect from that of the demand side factors.

We hypothesize that, within an individual loan, a bank with a higher capital ratio would contribute more to the loan. The positive effect of capital can be driven by either the regulation channel or the market channel. Under the regulation channel, a higher capital ratio allows a bank to make riskier loans since the bank has a greater capital buffer under the risk-based capital requirements (Berger and Udell (1994), Brinkman and Horvitz (1995), and Thakor (1996)). Under the market channel, a higher capital ratio implies a lower cost of funding (Flannery and Rangan (2008)), lower liquidity costs (Allen and Santomero (1997) and Allen and Gale (2004)), stronger incentive to monitor the borrower (Holmstrom and Tirole (1997) and Mehran and Thakor (2011)), and greater capacities to absorb risk (Bhattacharya and Thakor (1993), Repullo (2004), Von Thadden (2004), Coval and Thakor (2005), and Berger and Bouwman (2009)). Both the regulation and the market channels suggest that bank capital has a positive effect on allocation shares at the individual loan level.

Using a large sample of 2,044 (2,606) multiple-lender syndicated loan packages (facilities) made to U.S. firms between 1996 and 2012, we find that banks' allocation shares within syndicated loans are positively associated with the banks' capital ratios.[4] We show that this effect prevails for both lead and participant banks. For two non-lead, participant banks that participate in a loan package, one bank with a one percent higher capital ratio would contribute 0.51 percent, or half a million, more to the loan than the other bank, everything else being equal. The positive effect of

[4] Loans in the DealScan database are called deal packages. A deal package to a particular company can contain multiple facilities and each facility within a package can be of the same or different types of credit (e.g., credit lines, term loans, etc.). A bank can have a 50% share in one facility of a deal package but 0% in another facility of the same deal package. Our results hold at both the package and the facility levels.

bank capital on bank share remains intact if we further include bank fixed effects to control for unobserved time-invariant bank characteristics. The positive relation between capital and bank share is also robust to different measures of capital ratios. Overall, our results are consistent with the market and regulation channels which predict that bank capital positively affects credit supply.

To further address the potential endogeneity of bank capital, we exploit variation in bank capital levels generated from the funding from the Troubled Asset Relief Program (TARP). To deal with the potential endogeneity of TARP approval, we follow Duchin and Sosyura (2014) and Berger and Roman (2014) and use the membership of Congress financial subcommittees as an instrument for TARP approval. Combining the two-stage least squares regressions and within-loan estimations, we find that TARP recipient banks contribute more to syndicated loans after they receive TARP funding. This result confirms the robustness of the positive effect of bank capital on lending documented in our baseline within-loan regressions. The finding also sheds new light on the effectiveness of TARP. For the unprecedented capital injections for U.S. banks under TARP during the 2008-2009 financial crisis, one justification is that each dollar invested in capital for U.S. banks would generate an increase of \$8 to \$12 in lending capacity.[5] But many disagree with the projected positive effect of capital injection on lending, including the Office of the Special Inspector General for the Troubled Asset Relief Program (SIGTARP).[6] We provide new empirical evidence suggesting that TARP recipients are likely to increase their credit provisions.

We also look at how the capital level of a lead bank affects its contributions across different loans. In the syndicated loans market, lead banks play a pivotal role in originating individual loans

[5] See "Treasury Secretary Tim Geithner Opening Remarks – As Prepared for Delivery Congressional Oversight Panel" (TG-95, http://www.treasury.gov/press-center/press-releases/Pages/tg95.aspx), Treasure Department Press Release on April 21, 2009.

[6] See the audit report of the TARP program published by SIGTARP on October 5, 2009 (http://www.sigtarp.gov/Audit%20Reports/Emergency_Capital_Injections_Provided_to_Support_the_Viability_of_Bank_of_America.pdf), which suggests that TARP funding seems to have little impact on increase bank lending.

and helping close these deals. Moreover, lead banks tend to keep their loan holdings on the book after loan origination while participant banks may use the secondary loan trading market to unload their holdings afterwards (Bord and Santos (2012)). Therefore, we expect to find a similarly positive impact of lead bank' capital on lead bank share of a loan.[7] Using a sample of 4,356 loan packages that include both multiple- and single-lender loans, we find that a lead bank of a loan with a 2.5% higher total capital ratio (one standard deviation) would increase its bank share by 1.9% or $7.9 million for the loan. Note that we cannot fully control for unobservable loan and borrower characteristics that can affect loan demand and are potentially correlated with both bank capital levels for the cross-loan estimations. But we nevertheless take advantage of our individual loan level data and use extensive controls for observable loan and borrowing firm variables to separate out the demand side factors. The statistically significant positive association between lead bank capital and lending share is consistent with our within-loan estimations, suggesting that bank capital affects lending both within and across loans.

Overall, the novel identification strategies used in this paper allow us to make casual inference about the impact of bank capital on credit supply to U.S. companies at the individual loan level. The syndicated loans market plays an important role in the intermediation of bank credit to the real sector; our results therefore suggest that economic/monetary policies that affect bank capitalization could consequently affect the amount of credit banks are willing to supply to corporate borrowers in the syndicated loans market.

The rest of the paper is organized as follows. We review the related literature and outline our hypotheses in Section 2. In Section 3, we describe the data and sample construction. We

[7] A participant bank's incentive to trade in the secondary market may weaken the association between capital and loan origination share. This biases against our main finding.

present the baseline within-loan estimation results in Section 4 and the results using TARP as quasi-natural experiment in Section 5. Robustness tests using alternative bank capital measures are presented in Section 6. We complete the loop by presenting the cross-loan estimation results in Section 7. Section 8 concludes.

2. Related Literature and Hypothesis Development

Our paper contributes to the large literature on how bank capital affects bank lending. Theories on the relationship between bank capital and lending can be viewed through the lenses of the classical Modigliani-Miller (M&M, 1958) theorem. The M&M theorem suggests that, in a frictionless world of full information and complete markets, a firm's capital structure would not affect its investment policies. Theories that study the effect of bank capital all begin with a set of imperfections that deviate from the M&M theorem assumptions. One such imperfection is the cost associated with financial distress. When a bank has more capital and lower leverage, the financial distress cost would be lower, which enables the bank to obtain funding at a lower cost (Flannery and Rangan (2008)). A lower funding cost will not necessarily imply cheaper loans in a competitive market; however, it does enable the bank to fund more loans because it can earn a profit at a lower yield spread over its funding cost.

In addition to lower funding costs, higher capital levels also enable banks to better absorb risk (Berger and Bouwman (2009)). When banks increase lending, they are exposed to greater credit risk and face an increased likelihood and severity of losses associated with disposing illiquid loans to meet customers' liquidity demands (Allen and Santomero (1997) and Allen and Gale (2004)). With a higher capital level, a bank can better absorb risk and increase its risk bearing capacity (Bhattacharya and Thakor (1993), Repullo (2004), Von Thadden (2004), and Coval and

Thakor (2005)). Consequently, higher capital level allows banks to lend more.

Higher capital levels can also provide stronger incentives for banks to monitor their borrowers because shareholders are the first to bear the loss from bank's insolvency (Holmstrom and Tirole (1997) and Mehran and Thakor (2011)). The enhanced bank monitoring improves the access to bank credit for borrowers. Together, lower funding costs, better risk absorption, and stronger monitoring suggest that bank capital would have a positive impact on lending. They are all based on market imperfections or market forces, and together we call them the market channel through which bank capital positively affects lending.

Another deviation from the MM theorem, or the second channel through which bank capital positively affects lending, is regulation, especially risk-based capital requirements. Under capital regulation, banks get punished when their capital levels fall below the risk-based capital requirements. The risk-based capital requirements may then encourage substitution out of risky assets, such as loans, into safe assets, such as Treasury securities when raising capital is costly (Berger and Udell (1994), Brinkman and Horvitz (1995), and Thakor (1996)). Therefore, banks with lower levels of capital have stronger incentives to cut lending because of the risk-based capital requirements. We call this the regulation channel. Both the market and the regulation channels suggest a positive relationship between bank capital and bank lending. We refer these two channels collectively as the risk-regulation hypothesis.

While the risk-regulation hypothesis predicts a positive effect of bank capital on lending, there exist theories suggesting that higher leverage (lower bank capital) disciplines banks and thereby promotes lending. Calomiris and Kahn (1991) note that demandable deposits and the associated premature-withdrawal threat are needed to discipline a bank so that the bank is able to raise financing needed to make loans. Diamond and Rajan (2000, 2001) argue that higher bank capital may reduce lending by making a bank's capital structure less fragile. A low level of bank capital encourages the bank to commit to monitor and collect repayments from its borrowers, and hence allows it to make more loans. Gorton and Winton (2014) suggest that higher regulatory capital requirements for banks can crowd out demand deposits, which in turn can reduce bank credit supply.[8] We refer these forces collectively as the fragility-crowding out hypothesis, which predicts that bank capital negatively affects lending.

Early empirical literature on the relationship between bank capital and lending has mostly focused on the causes and consequences of the "credit crunch" in the late 1980's and early 1990's and the U.S. adoption of the Basel Accord in the early 1990's. Most early literature finds a positive impact of bank capital on lending, consistent with the risk-regulation hypothesis (e.g., Bernanke, Lown, and Friedman (1991), Hancock and Wilcox (1993), and Brinkmann and Horvitz (1995)). One exception is Berger and Udell (1994), who find very limited effects of the risk-based capital ratio on loan growth rates using bank-level data from the Call Report.

More recent literature has devoted attention to separating the effect of bank capital on lending from that of the demand side factors. Most papers rely on exogenous shocks to capital levels for identification. For example, Peek and Rosengren (1997, 2000) use the dramatic decline of the Japanese stock market in the late 1980s and early 1990s, Puri, Rocholl, and Steffen (2011) use German banks' exposure to the U.S. subprime market, Rice and Rose (2012) use the bailout of the Government Sponsored Enterprises (GSEs, or specifically Fannie Mae and Freddie Mac), and Mora and Logan (2012) use losses on United Kingdom (UK) banks' loans to non-UK residents, as exogenous shocks to bank capital levels to identify the causal effect of bank capital on lending. Berrospide and Edge (2010) instead use dynamic vector auto-regression models to achieve

[8] The empirical evidence in Berger and Bouwman (2009) suggests that the link between monitoring or crowding effect of regulatory capital requirements and lending applies more to smaller banks.

identification. With the exception of Puri, Rocholl, and Steffen (2011), who use individual loan applications by retail customers of German banks, all other aforementioned papers rely on aggregate data or bank balance sheet data, and therefore are still unable to fully control for individual borrower characteristics that may affect loan demand.

In this paper, by focusing on the effect of bank capital on banks' allocation shares in the same syndicated loans, we also attempt to separate the effect of bank capital on lending from that of the demand side factors and thereby provide a clean test distinguishing the risk-regulation and the fragility-crowding out hypotheses. We study the relative movements conditional on loan demand with the within-loan estimation. Our main finding that a participant bank with more capital contributes more to a given loan provides a clean identification of the impact of bank capital on lending. Methodologically, our identification strategy shares some similarities with Jiménez *et al.* (2012), who use Spanish banks' loan application data to control for demand side factors. Specifically, they examine whether a bank with higher capital or liquidity is more likely to approve a loan application than other banks who received the same application, i.e., they use the loan application fixed effects to control for loan demand. The use of loan application fixed effects in Jiménez *et al*. (2012) is similar to the package/facility fixed effects that we use in our within-loan estimations, with the same purpose of controlling for loan demand.

Syndicated loans are an important source of corporate finance. Despite the increasing presence of institutional funds, banks remain the dominant fund providers of syndicated loans, in particular loan commitments (e.g., Cornett, McNutt, Strahan, and Tehranian (2011), Gatev and Strahan (2009), and Ivashina and Sun (2011)). A clear understanding of the supply side determinants of syndicated lending is therefore essential for understanding the transmission mechanism of the monetary policies (Bernanke and Blinder (1988) and Kashyap and Stein (2000)).

Our paper also fills this gap by linking the theories of bank capital and lending to the mechanisms of loan supplies by U.S. banks in the syndicated loans market.

3. Data and Descriptive Statistics

3.1 Sample Construction

Our sample construction starts with a sample of 222,991 unique loan facilities between January 1996 and December 2012 from the LPC DealScan database. We begin our sample in 1996 because only since then do banks report their risk-based capital ratios in the Call Report and does DealScan coverage become comprehensive. These 222,991 facilities belong to 155,345 unique deal packages. DealScan reports a bank's allocation share, which captures the bank's contribution of fund, in a loan. Since we use a bank's allocation share to measure ban lending at the individual loan level, we exclude loans with insufficient bank allocation share information. This reduces the sample to 65,969 facilities (53,713 deal packages).[9] Among these loans with valid bank share information, we focus on 44,248 facilities that involve credit lines, term loans, or both in subsequent analysis. We analyze credit lines and term loans because they are the dominant types of bank loans obtained by non-financial firms (see, e.g., Sufi (2009), Jiang, Li, and Shao (2010), Rauh and Sufi (2012), and Colla, Ippolito, and Li (2013)).[10]

Out of the 44,248 loan facilities, we are able to use the DealScan-Compustat link file provided by Chava and Roberts (2008, updated in August 2012) to identify the borrowing firms

[9] We will discuss in more details about the calculation of bank share in the next subsection. The large sample size reduction at this step is mainly due to the fact that the lender allocation information is entirely missing for about 72% of all facilities in the DealScan database (also see Ivashina (2009)). We exclude packages with facilities that have missing information on any lender shares. The only exception is when a package has only one lender and its allocation information is missing. In this case, we set the lender share to be 100%. We also exclude packages with incorrect lender share information (e.g., those packages in which the sum of all lender shares are more than 101%. we choose 101% to accommodate small rounding errors).

[10] Our results are robust if we include packages with infrequent credit types such as bridge loans, standby letters of credit, and leases.

from the Compustat Annual database for 25,410 facilities (20,438 deal packages). Note that all private borrowers are excluded in this step. We further exclude loans borrowed by firms in regulated and financial sectors (two-digit SIC code equals to 49 or is between 60 and 69) and loans made to non-U.S. firms. A borrower's financial statement data is obtained from the Compustat as of the fiscal year ending immediately prior to the DealScan deal activation date. We retain a loan in our sample if its borrower's key characteristics are non-missing. These above requirements lead to a sample of 10,633 facilities (8,365 packages).

For the 8,365 packages with valid bank share and borrowing firm information, we then match their lenders with banks from the Call Report. We use a text matching program to match bank names reported in DealScan with bank legal names in the Call Report. Wherever possible, we also use a bank's location information (city and/or state) reported in both databases to facilitate the matching. We manually check all automated matching results to ensure accuracy. We also rely on information provided by the National Information Center (NIC) and/or the FDIC institution search (http://www2.fdic.gov/idasp/main.asp) to identify DealScan lenders that are not matched by the text matching program.[11]

For banks that can be linked to Call Report, we obtain bank characteristics from the Call Report as of the filing in the calendar quarter immediately prior to the DealScan deal activation date. We only keep loan packages made by U.S. commercial banks and loans whose key lender information is available.[12] 4,356 unique loan packages meet these requirements.[13,14]

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[11] For all lenders in the DealScan universe, we are able to identify 1,269 unique U.S. financial institutions that have Call Report information.

[12] We exclude Thrifts/Savings & Loans institutions because they have different call reports.

[13] In unreported analysis, we entertain different samples to make sure that our findings are not sample specific. We find that the baseline within-loan results are qualitatively similar if we do not require non-missing Compustat variables or even do not require a loan to be matched to a Compustat firm to be included.

[14] The 4,356 packages involve 2,435 unique borrowing firms and 235 unique lead banks. Among these packages, 4,297 packages have only one lead bank, 56 packages have two lead banks, one package has three lead banks, and

To conduct the within-loan estimation, we further construct a sample of 2,044 loan packages/facilities with at least two banks as lenders out of the 4,356 loan packages.[15] These multi-bank packages correspond to 10,655 bank-share package level observations. At the facility level, the multi-bank sample consist of 2,606 facilities, which correspond to 13,806 bank-share facility level pairs. These multi-bank packages are taken out by 1,137 firms and involve 247 banks (both lead and non-lead banks).

We report the composition of the 4,356 packages (in Panel A) and the composition of the 2,044 multi-bank packages (in Panel B) according to loan types in Table 1. Notably, most loan packages (97.89% of the 2,044 packages) are credit line only ones. This observation is consistent with the existing literature suggesting that credit line is an instrumental component of corporate external finance (e.g., Sufi (2009) and Campello, Giambona, Graham, and Harvey (2011)).

3.2 Measuring Bank Share and Bank Capital

The key dependent variable of our empirical analysis is a lender's allocation share (or ownership) of a loan, which is referred to as *Bank Share*. The DealScan database reports lender identities and their loan allocations at the facility level. Our unit of analysis is at both the facility and the deal package levels. To calculate a bank's allocation in a package, we first obtain the bank's allocations in all facilities within the package and then aggregate these allocations at the package level using individual facility amounts and the total package amount. For example, if a bank participates in two facilities in a deal package and the two facility amounts are 60% and 40%

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two packages have four lead banks. In later analyses, we implicitly assume that a lead bank can choose whether or not to structure a deal as a sole- or multi-lender loan.

[15] There are 3,516 syndicated packages (out of 4,356) with multiple lenders in our sample. But 1,472 of them have only one lender name (lead bank) recorded by DealScan. So for this analysis, we keep the 2,044 (3,516-1,472) syndicated packages with at least two lenders that can be identified.

of the total package amount, and if the bank contributes 30 percent in the first facility and 50 percent in the other facility, we calculate the bank's share in the entire deal package as: 60%× 30%+40%× 50% =38%.

We calculate bank shares for both lead and participant banks. The DealScan database reports the roles of lenders in each facility. We follow Ivashina (2009) to identify the lead bank(s) of a facility. If a lender is reported as the "administrative agent", it will be defined as the lead bank. If no lender is reported as the "administrative agent", we define a lender that acts as the "agent", "arranger", "book-runner", "lead arranger", "lead bank", or "lead manager" as the lead bank. A lead bank of any facility in the package will be regarded as the lead bank of the package.

The key independent variable of interest is a bank's capital ratio. Our main measure, *Total Capital Ratio*, is defined as total capital divided by bank total risk-weighted assets. One alternative capital measure is *Tier 1 Capital Ratio*, which is defined as tier 1 capital, the core capital, divided by bank total risk-weighted assets. Another measure is *Leverage Ratio*, which is defined as tier 1 capital divided by bank total (un-weighted) assets. The *Leverage Ratio* is a non-risk-based capital measure. We use *Leverage Ratio* to make sure that our results are not entirely driven by a bank's incentive to strategically manage its risk-based assets.

3.3 Control Variables

When applicable, we include a broad set of control variables in our regressions. The first set of control variables includes bank characteristics, such as bank size, liquidity, profitability, loan performance, and asset risk. Specifically, the variables are as follows. *Log (Bank Total Assets)* is defined as the natural logarithm of bank total assets ($thousand); *Bank Liquidity* is defined as the sum of cash and available-for-sale securities divided by bank total assets; *Bank ROA* is defined as bank operating income divided by total assets; *Loan Charge-offs* is defined as the total charge-offs on loans and leases divided by bank total assets; *Loan Loss Allowance* is defined as the total allowance for loan and lease losses divided by bank total assets; *Risk-Weighted Assets* is defined as total risk weighted assets divided by bank total assets; *Subordinated Debt* is defined as total subordinated debt divided by bank total assets; and *Deposits* is defined as total deposits divided by bank total assets. Finally, we also include an indicator variable, *BHC Dummy*, which equals one if a bank is controlled by a bank holding company and zero otherwise.

The second set of control variables is borrower characteristics. Although borrower characteristics are washed out in our within-loan estimation, we use them to control for demand for credit when we conduct the cross-loan analysis with the lead banks. These firm level controls can also capture the asymmetric information effect on lead banks share. Asymmetric information affects lead bank allocation share because higher lead bank allocation share can mitigate the potential moral hazard and adverse selection problems associated with syndicated lending (see, e.g., Sufi (2007) and Ivashina (2009)).

Specifically, we include the following control variables for borrower characteristics. *Log (Firm Total Assets)* is defined as the natural logarithm of total assets ($million); *Tobin's Q* is defined as the market value of assets divided by book value of assets; *Tangibility* is defined as total property, plant, and equipment divided by total assets; *R&D* is defined as R&D expenses divided by total assets; *Cash Flow Volatility* is defined as the standard deviation of quarterly cash flows calculated over the last three years; *Leverage* is defined as the total debt divided by total assets; *Profitability* is defined as the operating income before depreciation divided by total assets; *Cash Holdings* is defined as cash and marketable securities divided by total assets; and *Rated Dummy* equals one if the firm has an S&P long-term credit rating and zero otherwise.

3.4 Summary Statistics

We present the summary statistics for the key variables of the 2,044 multi-lender loan packages in Table 2. Panel A of Table 2 reports the descriptive statistics of loan characteristics at both the package and the facility levels. On average, a lead bank contributes 22.1% of the total package amount. And this number is 21.7% at the facility level. Each package has 1.03 lead banks on average. The average number of all lenders (both lead and participant banks) of a multi-bank package is about 6.70 and this number is very similar at the facility level (6.88). For participant banks, the average contribution is 8.8% (8.6%) at the package (facility) level. Packages in our sample have an average total amount of $1,047.20 million (in 2012 dollars). This implies that the average lead bank contribution at the package level is about $230.38 million (1,047.20 × 0.22).

Panel B of Table 2 reports the summary statistics for bank characteristics at the package level (the facility level results are similar). The key variable of interest is *Total Capital Ratio*, which is defined as total capital over risk-weighted assets. It has a mean of 11.7% and a median of 11.2% for lead banks. For non-lead (participant) banks, the mean and median of *Total Capital Ratio*, 12.3% and 11.3%, respectively, are slightly higher. For lead banks, the 25th percentile for *Total Capital Ratio* is 10.8% and the minimum value (not shown) is 9.1%, which indicates that lead banks are far from hitting the minimum capital requirements, which is 8%. The patterns in capital ratios for our sample are consistent with that in Flannery and Rangan (2008). As alternative capital measures, the average *Tier 1 Capital Ratio* for lead banks is 8.5%. The average *Leverage Ratio* is 6.5%. Leverage ratios are smaller than the *Tier 1 Capital Ratio*s because the denominator is bank total assets without weighting by risk. The mean (median) value of lead bank total assets in our sample is $549.88 ($426.55) billion. For participant banks, the mean (median) value of bank total assets is $232.32 ($80.52) billion. Bank assets are much larger for our sample than the average size of commercial banks in the whole Call Report universe because larger banks are more active in the syndicated loan market.[16]

The summary statistics of borrower characteristics are reported in Panel C of Table 2. The firms in our sample are larger, more profitable, and more likely to have S&P long term credit ratings than average Compustat firms.

Note that we also report the summary statistics of the natural logarithms for both lead and participant bank shares in percentages (*Log(Lead Bank Share×100)* and *Log(Participant Bank Share×100)*) in Panel A of Table 2. For presentation purposes, we use the logged percentage bank shares as dependent variables in our regressions, while the key independent variable for bank capital ratios is in decimals.

4. Baseline Within-Loan Estimation Results: The Effect of Bank Capital on Bank Share

We first present the baseline results of within-loan estimations. Empirically, we estimate the following model:

$$Log(Bank\ Share)_{ijkt} = \alpha_k + \beta_1 Bank\ Capital_{jt-1} + \gamma_2 Y_{jt-1} + \epsilon_{ijkt} \quad (1)$$

where subscript k indexes packages/facilities, and α_k is the package/facility fixed effects. Y is a vector of control variables for bank characteristics. Note that once the package/facility fixed effects are included, both borrower and loan characteristics drop out. In other words, by including the package or facility fixed effects, we remove any effect due to confounding borrower characteristics that are otherwise unobservable. The within-loan estimation is also free from any confounding effects due to endogenously determined loan characteristics.[17] Therefore, any remaining

[16] In the multi-bank loan sample, the average loan package is over $1 billion. A lead bank's average contribution to a package is about 0.19% of the bank's total asset and about 0.25% of a bank's total risk weighted assets.

[17] For papers that use a similar approach for other empirical research purposes, see, e.g., Ivashina and Sun (2011) and Lim, Minton, and Weisbach (2014).

differences in the relative loan shares between different lenders within a package/facility are likely to be a function of bank-level factors. Estimating Equation (1) with the package or facility fixed effects effectively disentangles the effect of bank capital from any demand side factors that are potentially correlated with bank capital.

At the package level, we use the 2,044 packages that have at least two lenders between 1996 and 2012. At the facility level, we use the corresponding 2,606 facilities with at least two lenders. We present the package level within-loan estimation results in Panel A of Table 3. In Column (1), we estimate the within-loan model with all banks (both lead and non-lead banks). To account for possible inherent differences between lead and non-lead (participant) banks, we also add a lead bank dummy in the regression, which equals one if a bank is the lead bank in the package, and zero otherwise. In Column (2), we include only participant (non-lead) banks. In this subsample, all non-lead banks are homogenous in terms of their roles in a package so we can rule out any confounding effects resulted from unobservable differences between lead and non-lead banks during the loan underwriting process. The coefficients on *Total Capital Ratio* in both columns are positive and statistically significant at the one percent level. This result suggests that, within the same loan package, a bank with a higher capital level contributes more to the entire package.

Although the within-loan estimations are able to mitigate the concern that bank capital may be correlated with demand side factors, they do not address the potential problem that bank capital may be correlated with some unobserved bank characteristics. As a first step to address this problem, we include bank fixed effects in the regression to control for the correlation between bank capital and unobserved time invariant bank characteristics. The results are presented in Columns (3) and (4) of Panel A of Table 3. The coefficients on *Total Capital Ratio* are still positive but with reduced statistical significance. Because the magnitudes of the coefficient estimates do not drop, the decrease in statistical significance is likely a power problem. We re-estimate the models with the facility level data, and the results are presented in Panel B of Table 3. The coefficients on *Total Capital Ratio* are all positive and statistically significant at the one or five percent levels. The results are consistent with those shown in Panel A of Table 3.

Other control variables in the regressions generally carry expected signs. For example, large, more liquid, or more profitable banks contribute more, but banks with higher charge-offs contribute less to syndicated loans.

Economically, taking the coefficient of 0.51 on *Total Capital Ratio* for both lead and participant banks at the package level as reported in Column (1) of Panel A of Table 3, a bank with a one percent higher capital ratio would increase the contribution by 0.51% (0.51×0.01) from its mean, if we evaluate all variables at the mean levels. In dollar terms, an increase of 0.51% from the mean contribution for a lead bank is about $1.18 million ($1,047.20 million (average package amount)×0.221 (average lead bank share) ×0.51%). For a participant bank, a lender with a one percent higher capital ratio from the mean level would increase its contribution from the mean for about $0.47 million ($1,047.20×0.088 (average participant bank)×0.51%). At the facility level, if we use the coefficient of 0.59 in Column (1) of Panel B of Table 3, the resulted increase in dollar contributions for a lead (participant) bank would be $1.09 (0.43) million. These dollar numbers are modest compared with the overall loan or bank asset sizes. But we do want to point out that these measures for economic impact of bank capital should only be viewed as indicators, since the within-loan comparison only captures the impact of bank capital at the intensive margin. It is possible that a bank with a strong capital position is more likely to work with other banks with strong capital positions. It is also possible that a bank with a weak capital position may just not participate in a loan at all. So an increase of $1 million for a bank with a stronger capital positon does suggest that bank capital has an impact on credit supply for corporate borrowers.

Overall, the positive and statistically significant coefficients on *Total Capital Ratio* suggest that bank capital has a positive and causal effect on the bank's loan ownership decision, which supports the risk-regulation hypothesis. Our empirical methods deal with the common difficulty in the empirical literature on the bank lending channel that the link between bank capital levels and lending can be driven by demand side factors. Compared with prior studies based on aggregate or bank level lending data (e.g., Bernanke *et al*. (1991), Berger and Udell (1994), and Peek and Rosengren (1997)), our loan-level data and the institutional feature of syndicated loans offer the possibility of achieving a cleaner identification.

5. Using TARP as a Quasi-Natural Experiment

In this section, we provide additional evidence on the causal effect of bank capital on lending by exploiting plausibly exogenous variation in bank capital levels generated by funding injections under the Troubled Asset Relief Program (TARP). TARP was established in October 2008 in pursuant to the 2008 Emergency Economic Stabilization Act (EESA). The major component of TARP, the Capital Purchase Program (CPP), authorized the U.S. Treasury Department to invest up to $250 billion in preferred stocks and equity warrants of selected financial institutions to boost their capital adequacy (see, e.g., Li (2013), Duchin and Sosyura (2014), and Berger and Roman (2014)). From the fourth quarter of 2008 to the fourth quarter of 2009, about $205 billion was infused into 709 banking organizations under TARP (Berger and Roman (2014)). The amount that each banking organization received ranged from one percent to three percent of its risk-weighted assets or $25 billion, whichever was smaller. If bank capital positively affects lending as suggested by the risk-regulation hypothesis, the TARP capital injection would increase a recipient bank's contribution to syndicated loans.

We estimate the impact of TARP capital injection on bank share in the within-loan setting. The model specification is as follows:

$$
\begin{aligned}
&Log(Bank\ Share)_{ijkt} \\
&\quad = \alpha_k + \theta TARP\ Recipient_j + \delta After\ TARP_{jt} \times TARP\ Recipient_j \qquad (2) \\
&\quad + \beta_1 Bank\ Capital_{jt-1} + \gamma_2 Y_{jt-1} + \epsilon_{ijkt}
\end{aligned}
$$

In the model, *i*, *j*, *k*, and *t* index the borrowing firm, the bank, the loan package/facility, and time, respectively. *TARP Recipient* is a dummy variable that equals one if the bank is one of the CPP recipients under TARP and zero otherwise, regardless of the timing of its TARP funding. This variable is used to capture the difference between TARP recipient and non-TARP recipient banks. The variable *After TARP* is a dummy variable that equals one if the loan activation date is after a TARP recipient bank's TARP receiving date and zero otherwise. The interaction term *After TARP*×*TARP Recipient* therefore equals one for a bank who has received TARP funding by the time of loan activation and zero otherwise. *Bank Capital* is *Total Capital Ratio* and *Y* is a vector of other bank characteristics. The above model specification is similar to a difference-in-differences (DID) framework with the addition of package/facility fixed effects (α_k). Because the equation is estimated with the within-loan framework, the time fixed effects drop out. Note that if the risk-regulation hypothesis dominates and the TARP capital injection has a positive impact on lending, the coefficient on *After TARP*×*TARP Recipient*, δ, would be positive.

In Equation (2), the *TARP Recipient* variable is likely to be endogenous. For example, TARP capital might be provided to more viable and healthier banks (Berger and Roman (2014)), which are more likely to take larger loan shares. We address this endogeneity issue by using an instrumental variable (IV) approach. Following Duchin and Sosyura (2014), we use the information on whether a bank is located in an election district of a House member who served on the Financial Institutions Subcommittee or the Capital Market Subcommittee of the House Financial Services Committee. Specifically, we define our instrumental variable as an indicator, *Subcommittee*, which equals one if the bank is headquartered in a district of a House member who served on either of the two key subcommittees in 2008 or 2009. We use this indicator variable as the instrument for the *TARP Recipient* variable.

As suggested by Duchin and Sosyura (2014), the instrumental variable, *Subcommittee,* is likely to satisfy both the relevance condition and the exclusion condition. The Financial Institutions Subcommittee or the Capital Market Subcommittee of the House Financial Services Committee played a direct role in the development of the EESA, which created TARP. Duchin and Sosyura (2012) show that members of these subcommittees arrange meetings between banks and the Treasury Department, write letters to banking regulators, and even write provisions into the EESA aimed at helping particular banks. It is therefore expected that *Subcommittee* would be positively correlated with TARP approval, i.e., the instrument satisfies the relevance condition. On the other hand, *Subcommittee* is unlikely to directly affect a bank's lending decisions, i.e., the instrument also satisfies the exclusion condition.

Because the *TARP Recipient* variable is binary, we follow Wooldridge (2010) to estimate a dummy endogenous variable model (also see Berger and Roman (2014)). Specifically, we first estimate a Probit model in which the *TARP Recipient* dummy is regressed on the instrumental variable, *Subcommittee*, along with all other control variables in Equation (2). We then use the fitted probability from the Probit model as an instrument for the *TARP Recipient* dummy and estimate the model via a two stage least square (2SLS) method. Because the fitted probability is a generated variable, we compute standard errors in the 2SLS regressions using bootstrap.

The results for the Probit and the IV regressions are reported in Table 4. We report the package level results in Panel A and the facility level results in Panel B. The package and facility level samples are subsamples (between 2007 and 2012) of those used in Table 3. We focus on the sample period between 2007 and 2012 as TARP was largely implemented in 2008 and 2009. The Probit regression in Column (1) of Panel A shows that a bank's location in an election district is positively associated with the probability of receiving TARP capital injections. To save space, we do not report the coefficients on the control variables in both Panels A and B of Table 4.[18]

Column (2) of Panel A reports the second stage of the IV regression results involving both lead and participant banks. The coefficient on the interaction variable, *After TARP×TARP Recipient*, is positive and statistically significant at the five percent level. This indicates that TARP recipient banks, after receiving TARP funding, significantly increase their contributions to a syndicated loan relative to banks without such capital injections. The economic magnitude of the coefficient on this interaction variable is also large. Note that the dependent variable for the second stage regression is the logged percentage bank share. The coefficient of 0.70 on *After TARP×TARP Recipient* thus suggests that, all else being equal, a bank's share in a syndicated loan after it receives TARP increases by 70% relative to a bank without such TARP capital injections. The F-statistic of the first stage regression is 13.30 and is above the Stock-Yogo critical values, confirming the strength of the instrument. In Column (3), we report the estimation results using

[18] The coefficients on the control variables have expected signs. For example, for the Probit regression in Column (1) of Panel A, *Total Capital Ratio*, *Log (Bank Total Assets)*, and *Bank ROA* are all positively related to the *TARP Recipient* dummy, suggesting that better capitalized, larger, and more efficient banks are indeed more likely to receive TARP money.

participant banks only. The coefficient on the treatment variable, *After TARP×TARP Recipient*, is again positive and statistically significant at the five percent level. Compared with other participant banks within a loan syndicate, a participate bank that receives TARP funding increases its capital contribution by 80%, all else being equal. The regressions results at the facility level as reported in Panel B of Table 4 are similar to those at the package level, and the magnitudes of the coefficient estimates on *After TARP×TARP Recipient*, 0.86 (86%) for all banks (lead and participant banks are pooled) and 1.09 (109%) for participant banks only, are slightly larger.

Overall, the results suggest that capital injections via TARP significantly increase bank lending, which is consistent with the risk-regulation hypothesis that bank capital has a positive and causal effect on credit supply. This result also adds to the findings of several recent studies on TARP. For example, Li (2013) shows that TARP investments increased loan supply for banks with low tier 1 capital ratios. Duchin and Sosyura (2014) show that CPP-approved banks increased credit supplied to riskier borrowers.[19] Berger and Roman (2014) find that TARP recipients gained competitive advantages and market shares. Our results add to this stream of literature by providing loan level evidence on the positive effect of TARP on lending.

6. Alternative Measures of Bank Capital

In our baseline results, we show that a bank's contribution to a loan is positively associated with its *Total Capital Ratio*. Several alternative measures of bank capital adequacy are also often used by practitioners and regulators. In this subsection, we show that our results are robust with

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[19] Our results differ from Duchin and Sosyura (2014) in three aspects. First, we are using the within-loan estimation while they do not control for loan fixed effects. Second, the loan ownerships used in our sample are actually reported by DealScan while Duchin and Sosyura (2014) impute missing loan ownerships in their sample. Third, we estimate IV regressions that account for the endogeneity of TARP approval. Nevertheless, our results still share general similarity with theirs in that the both papers find that TARP has some positive impact on bank credit provision.

these alternative capital adequacy measures including *Tier 1 Capital Ratio*, defined as tier 1 capital divided by total risk-weighted assets, and *Leverage Ratio*, defined as tier 1 capital divided the total assets. *Leverage Ratio*, in particular, as argued by commentaries, can be an effective backstop to the risk-based capital measures because it is less subjective to banks' own discretion in manipulating their risk-weighted assets.[20] Besides these two measures, we also construct an *Average Total Capital Ratio*, which is the average of *Total Capital Ratio*s over the four quarters prior to a loan. The *Average Total Capital Ratio* eliminates the possible effect of short-term fluctuations in the capital ratios on lending. It instead captures how a bank's lending responds to its relatively long-term capital ratio trend. Using the *Average Total Capital Ratio* also mitigates the concern that banks may actively manage their long-run target capital ratios.

We report the within-loan estimation results using these alternative bank capital measures in Table 5. We only report the results at the package level as the facility level results are similar. We also suppress all other control variables to save space. In Panel A we show the results using loan package fixed effects and in Panel B we add bank fixed effects. In Column (1) of Panel A, the coefficient on *Tier 1 Capital Ratio* is 0.50 and is statistically significant at the one percent level, suggesting that *Tier 1 Capital Ratio* has a similarly positive effect on a bank's contribution to a loan. The results remain robust if we look at participant banks only as shown in Column (4) of Panel A or if we add bank fixed effects as shown in Column (1) of Panel B. Estimations using *Leverage Ratio* are reported in Columns (2) (all banks) and (5) (participant banks only) in Panels A and B. *Leverage Ratio* also exhibits a significantly positive impact on the bank share. Moreover, even the model with both package and bank fixed effects return strong statistical significance. Table 5 also shows that, as reported in Columns (3) and (6) in Panels A and B, the *Average Total*

[20] See "Banks Get a Break on Leverage-Ratio Rules", the *Wall Street Journal*, 01/12/2014.

Capital Ratio still has a significantly positive effect on a bank's loan allocation as well. Overall, the results using alternative bank capital measures suggest that our baseline results are not driven by one particular bank capital measure.

7. Cross-Loan Estimation Results: Lead Bank Capital and Lead Bank Share

The summary statistics in Table 2 show that a lead bank holds a much larger share of a loan than other participant banks. Furthermore, it is the lead bank that first originates a loan and then markets it to other potential lenders. The capital level of the lead bank and its lending capacity can have a much greater impact on the loan size through the lead bank share. Therefore, in this section, we examine separately the impact of lead bank capital on its share allocation across loans. For the cross-loan analysis, we cannot fully mitigate the possible endogeneity concerns due to the correlations between bank capital and bank/borrowing firm characteristics. Nevertheless, we do our best to control for a variety of borrower-level and bank-level variables and use the bank fixed effects/state-year fixed effects estimations to control for demand side factors.

To estimate the effect of a lead bank's capital on its loan contribution, we rely on the sample of 4,356 loan packages that have non-missing loan, bank, and borrower variables.[21] We report the package level summary statistics of loan, lead bank, and borrower characteristics in Panel A of Table 6 for this larger sample. The average lead bank share of a loan is 60.7%. The lead bank share is much higher than those reported in Table 2 because of the inclusion of single lender loans in the sample. Average lead bank size (assets), average loan package amount, and average borrower size

[21] This sample consists of the 2,044 multi-lender loans and the 2,312 loans with one bank lender. We no longer require a loan to have multiple lenders given the fact that a lead bank can also choose to keep the entire loan to itself if it has a strong capital position. We previously focused on the multi-lender loans simply for econometric purposes. In unreported results, the effect of lead bank capital on lead bank share is robust if we restrict to a smaller subsample of syndicated, single- and multi-bank loans.

are smaller. Other variables are generally similar to the multi-lender sample we used previously in the within-loan analysis.

We regress the natural logarithms of *Lead Bank Share* (in percentage points) on bank capital ratios along with other control variables as follows:

$$\begin{aligned} Log(Lead\ Bank\ Share)_{ijkt} \\ &= \alpha + \beta_1 Bank\ Capital_{jt-1} + \gamma_1 X_{it-1} + \gamma_2 Y_{jt-1} + \gamma_3 Z_{ijkt} \\ &+ Bank, Year, Industry, Loan\ Purpose, and/or\ State \\ &\times Year\ Fixed\ Effects + \epsilon_{ijkt} \end{aligned} \tag{3}$$

where subscripts *i*, *j*, *k*, and *t* index the borrowing firm, the lead bank, the loan package/facility, and time, respectively. The key variable of interest is *Bank Capital*, which is *Total Capital Ratio*. *X* is a vector of borrower characteristics and *Y* is a vector of lead bank characteristics other than *Bank Capital*, which are all measured at the fiscal year/quarter immediately prior to the loan activation date. *Z* is a vector of loan characteristics.

In all regressions, we include loan origination year dummies to capture changes in the macroeconomic environment of bank credit demand and supply. We also include borrower industry dummies defined according to the two-digit SIC codes to control for industry specific effects on lead bank allocations. Package purpose dummies are also included to account for the possibility that banks with higher capital may prefer to involving in loans with specific purposes. We cluster the standard errors at the lead bank level to account for the correlation between multiple loans made by the same bank.

The results of estimating Equation (3) are presented in Panel B of Table 6. To save space, we only report the package level results as the facility level results are qualitatively the same. In Column (1) of Panel B, the OLS estimated coefficient on *Total Capital Ratio* is positive and statistically significant at the one percent level. In Column (2), we add the numbers of financial and non-financial covenants as additional controls for loan characteristics. The results are similar to those in Column (1). Rajan and Winton (1995) suggest that a lead bank can use loan covenants instead of its capital contribution to show its commitment for monitoring the borrower. We thus do not include the numbers of financial and non-financial covenants as control variables in Column (1) to make sure that the potential endogeneity of these two variables does not bias our results. The positive coefficients on *Total Capital Ratio* suggest that a lead bank with higher capital contributes more to a loan package.

Economically, if we use the coefficient in Column (1), a one standard deviation increase of *Total Capital Ratio* (2.5%) is associated with an increase of the lead bank capital contribution by 1.26 × 2.5%=3.15%. Since the dependent variable is in logarithm, this implies that the lead bank would increase its bank share by 1.9% (60.7% (average lead bank share) × 3.15%) if we increase bank capital by one standard deviation from the sample mean. In dollar terms, a one standard deviation increase in a lead bank's *Total Capital Ratio* is associated with an increase of $7.86 million ($411.215 × 1.9%) capital contribution to a package on average. A $7.86 million increase in funding is modest, but as we pointed out in Section 4 for the within loan estimations, these effects should be viewed as indicators, as banks can decide not to participate in a loan at all.

We then include bank fixed effects in the regressions to control for the correlation between bank capital and unobserved time invariant bank characteristics. The results with the bank fixed effects are presented in Columns (3) and (4) of Panel B of Table 6. In both columns, the coefficient estimates on *Total Capital Ratio* remain positive and are statistically significant. The magnitudes of the effect of *Total Capital Ratio* in fact increase relative to the OLS estimates.

To further alleviate the concern that demand side factors may simultaneously drive bank capital and lead bank share, we include instead *State×Year* fixed effects. The *State×Year* fixed effects can absorb confounding time-varying state level economic conditions that can simultaneously affect bank capital and loan demand but are otherwise unobservable.[22] The results are presented in Columns (5) and (6) of Panel B of Table 6. In both columns, the coefficients on *Total Capital Ratio* remain positive and statistically significant, which suggests that the positive effects of bank capital on lead bank share are unlikely to be driven by local economic conditions.

Other control variables in the regressions generally carry expected signs. For example, large, more liquid, or more profitable banks contribute more, but banks with higher charge-offs contribute less to syndicated loans. On the borrower side, lead banks contribute less to a loan made to a rated firm, which is consistent with Sufi (2007) that a firms with credit rating has less information asymmetry so that the lead bank does not have to retain a large fraction.

Taken together, the results in Table 6 suggest that a lead bank with a higher capital level is more likely to provide more credit in a syndicated loan. These results echo our baseline results of the within-loan estimations and are consistent with the risk-regulation hypothesis but not the fragility-crowding out hypothesis. These results also suggest that the impact of bank capital on credit supply exists not only within but also across loans.

A proper interpretation of the results presented above may warrant some further discussions. Gertler and Gilchrist (1994) contend that firms affected more by monetary and economic conditions may choose to borrow more from affected banks. Our multi-lender loan setting is less likely to be subject to this selection bias because borrowers do not choose participant banks in loan syndicates. Instead, banks themselves decide which loan and how much to invest.

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[22] Gilje, Loutskina, and Strahan (2013) show that regional oil and natural gas shale discoveries can affect both deposits and mortgage lending of local banks.

To the extent that banks with weaker balance sheets may opt to participate in fewer loan syndicates and reduce their ownerships conditional on participation, the documented positive relation between capital ratio and bank share may only understate the overall effect of bank capital on corporate loan supply. Alternatively, it is possible that banks with weaker balance sheets diversify their loan ownership by increasing the number of loans that they participate in and reducing their ownership of each loan. To at least partially rule out this prospect, we attempt to estimate the impact of capital ratio on broader C&I loan provision at the bank-quarter frequency and present these results in Table A1. We include all lead banks as long as they appear in the 4,356 packages sample we use in the cross-loan estimation. These estimation results show that, at the aggregate level, higher capital ratio is still associated with greater overall C&I loan growth rate and greater bank total asset growth rate. We acknowledge that these estimations may not suggest a causal effect; however, they still indicate an overall positive correlation between bank capital and lending.

8. Conclusion

This paper provides robust evidence on how a bank's capital levels affect its lending behavior at the individual loan level in the syndicated loans market. More specifically, we use a matched sample between syndicated loans from DealScan, the Call Report, and Compustat to identify a causal effect of bank capital on lending. We find that, after controlling for loan demand (through package or facility fixed effects) and other bank characteristics, a bank with a one percentage point higher *Total Capital Ratio* would contribute 0.5% more funding to a loan than another bank participating in the same loan.

Exploiting exogenous variations in bank capital generated by the TARP program, we show that a bank with capital injections under the TARP program increases its funding contributions to a particular loan by 70% compared to another bank participating in the same loan that does not receive TARP at the loan activation date. This result suggests that exogenous capital increases such as those under the TARP program can have a significantly positive impact on bank lending if we properly control for demand-side factors.

In addition to the within-loan analysis, we also show that bank capital has a statistically significant impact on lending across loans. A lead bank with a one standard deviation (2.5%) higher *Total Capital Ratio* would contribute 1.9%, or $7.86 million, more funding to a loan that it originates. Overall, our results suggest that bank capital has a positive causal effect on lending due to both risk and regulation reasons. An increase in capital adequacy for a bank can provide more funding for U.S. manufacturing firms in the syndicated loans market.

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Table 1
Sample Compositions

This table reports the compositions of the sample of 4,356 deal packages (in Panel A) and the sample of 2,044 multi-bank deal packages (in Panel B) between 1996 and 2012. A DealScan loan is often called a deal package. A deal package to a particular borrowing company often contains multiple loan facilities. Some of the loan contract terms such as covenants are at the package level, while some loan features such as credit type are at the facility level. Short-Term Credit Line denotes facilities with the type of either "364-Day Facility" or "Revolver/Line < 1 Yr.". Long-Term Credit Line denotes facilities with the type of "Revolver/Line ⩾ 1 Yr.". Credit Line (CL) Only Package denotes packages with only credit lines. Term A Loan denotes facilities with the type of either "Term Loan" or "Term Loan A". Term B Loan denotes facilities with the type of "Term Loan B". Term Loan Only Package denotes packages with only term loans. Credit Line and Term Loan Package denotes packages with both credit lines and term loans. A loan package is classified as being leveraged or syndicated if all its facilities are leveraged or syndicated. A loan facility is leveraged if the facility is labeled as "Highly Leveraged", or "Leveraged", or "Non-Investment Grade". A loan facility is classified as being syndicated if the distribution method of the facility is syndication.

Panel A

	Total	Leveraged	% Leveraged	Syndicated	% Syndicated
Whole Sample	4,356	2,715	62.30%	3,516	80.70%
Credit Line (CL) Only Package	3,460	1,980	57.20%	2,864	82.80%
Short-Term Credit Line Only	772	356	46.10%	626	81.10%
Long-Term Credit Line Only	2,501	1,585	63.40%	2,055	82.25%
Short and Long-Term Credit Lines	187	39	20.90%	183	97.90%
Term Loan Only Package	266	201	75.60%	174	65.40%
Term A Loan Only	240	175	72.90%	152	63.30%
Term B Loan Only	19	19	100.00%	19	100.00%
Term A and Term B Loan	7	7	100.00%	3	42.90%
Credit Line and Term Loan Package	630	534	84.80%	478	75.90%
Term Loan and Short-Term CL	66	60	90.90%	37	56.10%
Term Loan and Long-Term CL	555	468	84.30%	432	77.80%
Term Loan and Both CL	9	6	66.70%	9	100.00%

Panel B

	Total	% of Total
Within-Loan Analysis Sample	2,044	
Credit Line (CL) Only Package	1,800	88.06%
Short-Term Credit Line Only	299	14.63%
Long-Term Credit Line Only	1,331	65.12%
Short and Long-Term Credit Lines	170	8.32%
Term Loan Only Package	43	2.10%
Term A Loan Only	40	1.96%
Term B Loan Only	3	0.15%
Term A and Term B Loan	0	0.00%
Credit Line and Term Loan Package	201	9.83%
Term Loan and Short-Term CL	3	0.15%
Term Loan and Long-Term CL	193	9.44%
Term Loan and Both CL	5	0.24%

Table 2
Summary Statistics

This table reports summary statistics of the sample of 2,044 multi-bank packages and the corresponding 2,606 facilities between 1996 and 2012. Due to multiple lead or participant banks per package/facility, there are 10,655 observations (2,104 lead bank-loan pairs plus 8,551 participant bank-loan pairs) at the package level and 13,806 observations (2,670 lead bank-loan pairs plus 11,136 participant bank-loan pairs) at the facility level. Panel A reports loan characteristics at both the package and facility levels. Panel B reports bank characteristics (both lead and participant banks) at the package level. Panel C reports borrower characteristics at the package level. The number of observations (N) indicates the sample (lead bank-loan pair, participant bank-loan pair, or both) for which the summary statistics are based on. We use a bank-loan pair as an observation for calculating the summary statistics since it is the basis for the regressions in latter tables for within-loan analysis. *Lead Bank Share* for a lead bank and *Participant Bank Share* for a participant bank is the dollar amount of a loan contributed by the bank over the total loan amount for a loan package or facility (in decimals). *Total Capital Ratio* for a bank is defined as total capital over risk-weighted assets, *Tier 1 Capital Ratio* is defined as tier 1 capital over risk-weighted assets, and *Leverage Ratio* is defined as tier 1 capital over total assets. All three capital ratios are in decimals. See detailed information for the definitions of other variables in Appendix A1. Note that Log(X) denotes the natural logarithm of variable X. All dollar values are adjusted using CPI to the December 2012 value.

Panel A: Loan Characteristics

VARIABLES	N	Mean	Median	Std.	P25	P75
Package Level						
Lead Bank Share/Package	2,104	0.221	0.167	0.157	0.105	0.286
*Log (Lead Bank Share*100)*	2,104	2.868	2.813	0.680	2.351	3.352
Participant Bank Share/Package	8,551	0.088	0.068	0.075	0.040	0.111
*Log (Participant Bank Share*100)*	8,551	1.862	1.917	0.833	1.386	2.407
No. of Lead Banks/Package	10,655	1.034	1.000	0.210	1.000	1.000
No. of All Lenders/Package	10,655	6.704	6.000	3.350	4.000	8.000
Package Amount ($million)	10,655	1,047.195	499.987	1,672.367	239.994	1,243.817
Log(Package Amount $million)	10,655	20.080	20.030	1.180	19.296	20.941
No. of Financial Covenants	10,655	2.005	2.000	1.255	1.000	3.000
No. of Non-Financial Covenants	10,655	2.108	1.000	2.336	0.000	5.000
Leveraged Package Dummy	10,655	0.408	0.000	0.491	0.000	1.000
Facility Level						
Lead Bank Share/Facility	2,670	0.217	0.162	0.155	0.100	0.280
*Log (Lead Bank Share*100)*	2,670	2.847	2.784	0.685	2.303	3.332
Participant Bank Share/Facility	11,136	0.086	0.067	0.075	0.038	0.107
*Log (Participant Bank Share*100)*	11,136	1.825	1.897	0.848	1.328	2.367
No. of Lead Banks/Facility	13,806	1.032	1.000	0.201	1.000	1.000
No. of All Lenders/Facility	13,806	6.881	6.000	3.492	4.000	8.000
Facility Amount ($million)	13,806	851.566	421.333	1,397.630	191.435	972.341
Log(Facility Amount $million)	13,806	19.841	19.859	1.239	19.070	20.695
Secured Facility Dummy	13,806	0.314	0.000	0.464	0.000	1.000
Performance Pricing Dummy	13,806	0.840	1.000	0.366	1.000	1.000
Leveraged Facility Dummy	13,806	0.427	0.000	0.495	0.000	1.000

Panel B: Bank Characteristics

VARIABLES	N	Mean	Median	Std.	P25	P75
Lead Bank						
Total Capital Ratio	2,104	0.117	0.112	0.022	0.108	0.120
Tier1 Capital Ratio	2,104	0.085	0.082	0.023	0.078	0.087
Leverage Ratio	2,104	0.065	0.062	0.018	0.058	0.068
Bank Total Assets ($billion)	2,104	549.875	426.547	486.319	92.916	804.804
Log (Bank Total Assets $thousand)	2,104	19.431	19.871	1.503	18.347	20.506
Bank Liquidity	2,104	0.197	0.189	0.074	0.147	0.244
Bank ROA	2,104	0.006	0.005	0.004	0.003	0.008
Loan Charge-Offs	2,104	0.002	0.001	0.003	0.001	0.003
Loan Loss Allowance	2,104	0.009	0.009	0.008	0.006	0.011
Risk Weighted Assets	2,104	0.776	0.758	0.119	0.706	0.831
Subordinated Debt	2,104	0.018	0.018	0.008	0.013	0.021
Deposits	2,104	0.607	0.620	0.116	0.535	0.680
BHC Dummy	2,104	1.000	1.000	0.000	1.000	1.000
Participant Bank						
Total Capital Ratio	8,551	0.123	0.113	0.088	0.108	0.121
Tier1 Capital Ratio	8,551	0.092	0.083	0.087	0.076	0.094
Leverage Ratio	8,551	0.077	0.068	0.048	0.062	0.077
Bank Total Assets ($billion)	8,551	232.323	80.524	351.803	38.524	250.515
Log (Bank Total Assets $thousand)	8,551	18.243	18.204	1.579	17.467	19.339
Bank Liquidity	8,551	0.226	0.202	0.117	0.150	0.269
Bank ROA	8,551	0.007	0.006	0.005	0.003	0.010
Loan Charge-Offs	8,551	0.002	0.001	0.004	0.001	0.003
Loan Loss Allowance	8,551	0.010	0.009	0.011	0.006	0.012
Risk Weighted Assets	8,551	0.842	0.821	0.187	0.736	0.918
Subordinated Debt	8,551	0.020	0.019	0.017	0.012	0.026
Deposits	8,551	0.651	0.662	0.130	0.592	0.730
BHC Dummy	8,551	0.971	1.000	0.167	1.000	1.000

Panel C: Borrower Characteristics

VARIABLES	N	Mean	Median	Std.	P25	P75
Log (Firm Total Assets $million)	10,655	7.945	7.820	1.629	6.773	9.115
Tobin's Q	10,655	1.462	1.201	0.972	0.886	1.728
Profitability	10,655	0.154	0.146	0.077	0.109	0.189
Tangibility	10,655	0.344	0.283	0.233	0.160	0.499
Cash Holdings	10,655	0.065	0.032	0.083	0.012	0.087
Leverage	10,655	0.278	0.265	0.169	0.166	0.368
Rated Dummy	10,655	0.655	1.000	0.475	0.000	1.000
R&D	10,655	0.015	0.000	0.044	0.000	0.014
Cash Flow Volatility	10,655	0.080	0.028	0.699	0.015	0.057

Table 3
Bank Capital and Lending: Within-Loan Analysis

This table reports the within-package/within-facility tests for the effect of bank capital on bank share. We include package dummies for all the regressions in Panel A to difference out the impacts of loan- and borrower-related factors at the package level, which we call the within-package estimations. Panel B reports the within-facility estimations using facility dummies. The dependent variable in all regressions is the natural logarithm of the bank share in percentages of a lead or a participant bank at the package (Panel A) or the facility (Panel B) level. The key independent variable in all regressions is the *Total Capital Ratio*, which is defined as the ratio of a bank's total capital over its risk-weighted assets (in decimals). The sample used in Columns (1) and (3) of Panel A consists of 2,044 packages (10,655 bank-loan pairs) between 1996 and 2012 for which there exist at least two lenders and package-level share information of all lenders is available. The sample used in Columns (2) and (4) of Panel A consists of 1,668 packages (8,192 participant bank-loan pairs, this number is smaller than 8,551 in Table 2 because we require a loan to have more than one participant banks) between 1996 and 2012 for which there exist at least two participant (non-lead) lenders and package-level share information of all participant lenders is available. Note that lead banks are excluded in Columns (2) and (4) of Panel A. Similarly, the sample used in Columns (1) and (3) of Panel B consists of 2,606 facilities (13,806 bank-loan pairs) between 1996 and 2012 with at least two lenders, and the sample used on Columns (2) and (4) of Panel B consists of 2,124 facilities (10,670 participant bank-loan pairs, this number is smaller than in Table 2 for the same reason) between 1996 and 2012 with at least two participant lenders (lead banks are excluded). The number of observations for each regression is the number of bank-package or bank-facility pairs used in that particular regression. The t-statistics in the parentheses below the coefficient estimates are calculated using robust standard errors clustered at the package/facility level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Package Level

	Package FE		Package and Bank FE	
	(1)	(2)	(3)	(4)
Total Capital Ratio	0.51***	0.53***	0.55	0.63*
	(3.86)	(3.31)	(1.63)	(1.72)
Log(Bank Total Assets)	0.16***	0.18***	0.10***	0.12***
	(23.60)	(23.57)	(5.77)	(6.33)
Bank Liquidity	-0.09	-0.11	-0.13	-0.15
	(-1.34)	(-1.46)	(-1.28)	(-1.34)
Bank ROA	-4.94***	-5.33***	2.23	3.41
	(-2.70)	(-2.60)	(1.16)	(1.55)
Loan Charge-Offs	4.63**	3.72	5.61**	5.77**
	(2.23)	(1.61)	(2.42)	(2.25)
Loan Loss Allowance	1.52*	1.57*	0.02	0.43
	(1.92)	(1.76)	(0.02)	(0.37)
Risk Weigthed Assets	0.33***	0.29***	0.15	0.18*
	(5.87)	(4.60)	(1.52)	(1.67)
Subordinated Debt	-1.63***	-1.72***	-1.64**	-1.38
	(-3.13)	(-2.99)	(-1.99)	(-1.54)
Deposits	-0.17***	-0.32***	0.04	0.04
	(-3.53)	(-5.29)	(0.36)	(0.34)
BHC Dummy	-0.31***	-0.37***	0.06	0.11
	(-6.34)	(-7.27)	(0.36)	(0.60)
Lead Bank Dummy	0.45***		0.41***	
	(39.21)		(34.77)	
Constant	-0.84***	-1.11***	-0.14	-0.67
	(-5.22)	(-5.94)	(-0.35)	(-1.56)
Observations	10,655	8,192	10,655	8,192
Adj. R-squared	0.76	0.68	0.79	0.72

Panel B: Facility Level

	Facility FE		Facility and Bank FE	
	(1)	(2)	(3)	(4)
Total Capital Ratio	0.59***	0.58***	0.80**	0.69**
	(3.92)	(3.59)	(2.54)	(2.14)
Log(Bank Total Assets)	0.17***	0.18***	0.10***	0.12***
	(22.94)	(23.38)	(5.86)	(6.59)
Bank Liquidity	-0.10	-0.11	-0.20*	-0.23**
	(-1.53)	(-1.46)	(-1.96)	(-2.09)
Bank ROA	-5.63***	-5.96***	2.00	3.31
	(-3.39)	(-3.24)	(1.09)	(1.63)
Loan Charge-Offs	4.94**	3.38	4.98**	4.82**
	(2.38)	(1.47)	(2.20)	(1.98)
Loan Loss Allowance	1.40*	1.62*	-0.82	0.15
	(1.82)	(1.95)	(-0.76)	(0.13)
Risk Weigthed Assets	0.34***	0.30***	0.20**	0.18*
	(5.79)	(4.57)	(2.09)	(1.77)
Subordinated Debt	-1.75***	-1.86***	-2.24***	-1.79**
	(-3.22)	(-3.14)	(-2.70)	(-2.04)
Deposits	-0.21***	-0.36***	-0.03	-0.04
	(-3.77)	(-5.49)	(-0.28)	(-0.33)
BHC Dummy	-0.29***	-0.37***	0.12	0.13
	(-5.69)	(-6.81)	(0.78)	(0.77)
Lead Bank Dummy	0.45***		0.41***	
	(37.10)		(33.02)	
Constant	-0.99***	-1.24***	-0.28	-0.74*
	(-5.87)	(-6.56)	(-0.76)	(-1.83)
Observations	13,806	10,670	13,806	10,670
Adj. R-squared	0.76	0.69	0.80	0.74

Table 4
TARP and Bank Lending

This table reports the within-loan estimations using the instrumental variable (IV) approach over the effect of TARP on bank share. The within-package regressions in Panel A include package dummies to difference out the impacts of loan- and borrower-related factors at the package level. Panel B reports the within-facility estimations using facility dummies. The dependent variable for the first-stage regressions, labelled as "Probit Model" in both panels, is *TARP Recipient*, which equals to one if a bank is a TARP recipient (regardless of timing) and zero otherwise. The dependent variable in all the second-stage regressions, labelled as "IV Regression", is the natural logarithm of the bank share in percentages of a lead or a participant bank at the package (Panel A) or the facility (Panel B) level. We use the interaction term *After TARP*TARP Recipient*, which equals one for a bank who has received TARP funding by the time of loan activation and zero otherwise, to capture the effect of TARP capital injection on lending.

The instrument for *TARP Recipient* in the first-stage Probit regressions is *Subcommittee*, which equals one if a bank is headquartered in a district of a Congress House member who served on two key subcommittees of the House Financial Services Committee that oversaw the implementations of TARP. The sample used in Columns (1) and (2) of Panel A consists of a subsample of packages between 2007 and 2012 for which there exist at least two lenders and package-level share information of all lenders is available. The sample used in Column (3) of Panel A consists of a subsample of packages between 2007 and 2012 for which there exist at least two non-lead lenders and package-level share information of all non-lead lenders is available. Note that lead banks are excluded in Column (3) of Panel A. Similarly, the sample used in Columns (1) and (2) of Panel B consists of a subsample of facilities between 2007 and 2012 with at least two lenders, and the sample used in Column (3) of Panel B consists of a subsample of facilities between 2007 and 2012 with at least two non-lead lenders (lead banks are excluded). The number of observations reported for each regression is the number of bank-package or bank-facility pairs for a particular regression. For brevity, only coefficients and z-statistics on the key independent variables are reported. The Bootstrap z-statistics in the parentheses below the coefficient estimates are calculated using bootstrap standard errors clustered at the package/facility level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Package Level

	Probit Model (1)	IV Regression (All Banks) (2)	IV Regression (Participant Banks) (3)
Subcomittee	0.49**		
	(2.14)		
TARP Recipient		-1.48***	-1.56***
		(-3.10)	(-2.71)
*After TARP * TARP Recipient*		0.70**	0.80**
		(2.26)	(1.96)
Bank Characteristics Controls	Yes	Yes	Yes
Observations	1,533	1,533	1,201
Pseudo. R-squared	0.40		
Cragg-Donald Wald F statistic		13.30	

Panel B: Facility Level

	Probit Model (1)	IV Regression (All Banks) (2)	IV Regression (Participant Banks) (3)
Subcomittee	0.38**		
	(2.05)		
TARP Recipient		-1.75***	-2.02**
		(-4.51)	(-2.04)
*After TARP * TARP Recipient*		0.86***	1.09*
		(3.11)	(1.65)
Bank Characteristics Controls	Yes	Yes	Yes
Observations	1,965	1,965	1,544
Pseudo. R-squared	0.38		
Cragg-Donald Wald F statistic		10.22	

Table 5
Alternative Measures of Bank Capital

This table reports the within-package tests for the effect of capital on bank share under alternative measures of bank capital. The dependent variable in all regressions is the natural logarithm of the bank share in percentages of a lead or a participant bank at the package level. The sample used in Columns (1), (2), and (3) of Panels A and B consists of 2,044 packages between 1996 and 2012 for which there exist at least two lenders and package-level share information of all lenders is available. The sample used in Columns (4), (5), and (6) of Panels A and B consists of 1,668 packages between 1996 and 2012 for which there exist at least two participant (non-lead) lenders and package-level share information of all participant lenders is available. The alternative measures of bank capital are the *Tier 1 Capital Ratio*, the *Leverage Ratio*, and the *Avg. Total Capital Ratio*. *Tier 1 Capital Ratio* is defined as the ratio of a bank's tier 1 capital over its risk-weighted assets, and *Leverage Ratio* is defined as the ratio of a bank's tier 1 capital over its total assets. *Avg. Total Capital Ratio* is defined as the average of the *Total Capital Ratio* over the four quarters before a loan package activation date. All ratios are in decimals. The number of observations for each regression is the number of bank-package pairs used in that particular regression. For brevity, only coefficients and t-statistics on the key independent variables are reported. The t-statistics in the parentheses below the coefficient estimates are calculated using robust standard errors clustered at the package level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Package Fixed Effects

	All Banks			Participant Banks		
	(1)	(2)	(3)	(4)	(5)	(6)
Tier 1 Capital Ratio	0.50***			0.52***		
	(3.92)			(3.33)		
Leverage Ratio		1.43***			1.56***	
		(6.77)			(7.08)	
Avg. Total Capital Ratio			0.47***			0.48***
			(3.75)			(3.11)
Bank Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,655	10,655	9,397	8,192	8,192	7,221
Adj. R-squared	0.76	0.76	0.75	0.68	0.68	0.66

Panel B: Package and Bank Fixed Effects

	All Banks			Participant Banks		
	(1)	(2)	(3)	(4)	(5)	(6)
Tier 1 Capital Ratio	0.62*			0.70*		
	(1.84)			(1.87)		
Leverage Ratio		0.96***			1.02***	
		(2.70)			(2.71)	
Avg. Total Capital Ratio			0.56*			0.76**
			(1.70)			(2.06)
Bank Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,655	10,655	9,397	8,192	8,192	7,221
Adj. R-squared	0.79	0.79	0.78	0.72	0.72	0.71

Table 6
Bank Capital and Lending: Cross-Loan Analysis with Lead Bank Share

Panel A reports the summary statistics, and Panel B reports the regression results for the effect of bank capital on lead bank share using OLS, bank fixed effects, and state-year fixed effects models. The sample consists of 4,356 deal packages (4,420 package-lead bank observations due to multiple lead banks for some packages) between 1996 and 2012 for which lead bank share information is available. The dependent variable for the regressions in Panel B is the natural logarithm of lead bank share in percentages in a package. The key independent variable in all regressions is the *Total Capital Ratio*, which is defined as the ratio of a bank's total capital over its risk-weighted assets. See detailed information for the definitions of other variables in Appendix A1. Note that Log(X) denotes the natural logarithm of variable X. All dollar values are adjusted using CPI to the December 2012 value.

The OLS and bank fixed effects regressions in Panel B also control for year, industry (two-digit SIC code), and package/facility purpose fixed effects. The state-year fixed effects regressions also control for industry (two-digit SIC code) and package purpose fixed effects. Note that for the state-year fixed effects model, each unique state-year combination has its own fixed effect, so 50 states over 17 years would have 850 fixed effects instead of 67 fixed effects. The t-statistics in the parentheses below the coefficient estimates are calculated using robust standard errors clustered at the lead bank level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Summary Statistics

VARIABLES	N	Mean	Median	Std.	P25	P75
Loan Characteristics						
Lead Bank Share/Package	4,420	0.607	0.634	0.400	0.175	1.000
*Log (Lead Bank Share*100)*	4,420	3.742	4.150	0.977	2.862	4.605
Participant Bank Share/Package	8,580	0.088	0.068	0.075	0.040	0.111
*Log (Participant Bank Share*100)*	8,580	1.862	1.916	0.833	1.386	2.407
No. of Lead Banks/Package	4,420	1.032	1.000	0.208	1.000	1.000
No. of All Lenders/Package	4,420	6.201	2.000	8.036	1.000	9.000
Package Amount ($million)	4,420	411.215	105.641	1,062.688	24.309	366.026
Log(Package Amount $million)	4,420	4.543	4.660	1.843	3.191	5.903
No. of Financial Covenants	4,420	2.016	2.000	1.466	1.000	3.000
No. of Non-Financial Covenants	4,420	1.659	1.000	2.143	0.000	2.000
Leveraged Package Dummy	4,420	0.621	1.000	0.485	0.000	1.000
Syndicated Package Dummy	4,420	0.813	1.000	0.388	1.000	1.000
Lead Bank Characteristics						
Total Capital Ratio	4,420	0.118	0.112	0.025	0.108	0.120
Tier1 Capital Ratio	4,420	0.088	0.082	0.027	0.077	0.090
Leverage Ratio	4,420	0.069	0.064	0.022	0.059	0.072
Bank Total Assets ($billion)	4,420	400.825	217.187	456.517	43.505	690.878
Log (Bank Total Assets $thousand)	4,420	18.708	19.196	1.933	17.588	20.354
Bank Liquidity	4,420	0.209	0.194	0.088	0.147	0.252
Bank ROA	4,420	0.006	0.006	0.005	0.003	0.009
Loan Charge-Offs	4,420	0.003	0.002	0.004	0.001	0.003
Loan Loss Allowance	4,420	0.010	0.009	0.009	0.007	0.012
Risk Weighted Assets	4,420	0.792	0.777	0.126	0.713	0.852
Subordinated Debt	4,420	0.017	0.017	0.010	0.012	0.021
Deposits	4,420	0.644	0.643	0.131	0.567	0.719
Borrower Characteristics						
BHC Dummy	4,420	0.996	1.000	0.060	1.000	1.000
Log (Firm Total Assets $million)	4,420	6.266	6.135	2.048	4.763	7.650
Tobin's Q	4,420	1.581	1.177	1.652	0.830	1.811
Profitability	4,420	0.115	0.131	0.156	0.077	0.182
Tangibility	4,420	0.304	0.241	0.23	0.121	0.438
Cash Holdings	4,420	0.105	0.048	0.137	0.015	0.142
Leverage	4,420	0.249	0.225	0.208	0.096	0.354
Rated Dummy	4,420	0.341	0.000	0.474	0.000	1.000
R&D	4,420	0.046	0.000	0.139	0.000	0.027
Cash Flow Volatility	4,420	0.230	0.042	0.087	0.020	0.107

Panel B: Regression Results

	OLS		Bank FE		State-Year FE	
	(1)	(2)	(3)	(4)	(5)	(6)
Total Capital Ratio	1.26***	1.38**	1.71***	1.68**	1.56***	1.58**
	(2.86)	(2.56)	(2.79)	(2.44)	(2.87)	(2.41)
Log(Bank Total Assets)	0.05***	0.05***	-0.00	0.00	0.05***	0.05***
	(4.09)	(4.00)	(-0.01)	(0.03)	(3.71)	(3.46)
Bank Liquidity	0.58**	0.56**	0.66*	0.53*	0.59***	0.57***
	(2.46)	(2.36)	(1.92)	(1.67)	(2.74)	(2.65)
Bank ROA	6.26***	6.42***	1.53	2.05	6.13***	6.29***
	(2.97)	(2.80)	(0.70)	(1.00)	(3.13)	(3.03)
Loan Charge-Offs	-7.98*	-8.01*	-5.28	-5.50	-7.10*	-7.27
	(-1.83)	(-1.76)	(-0.93)	(-0.94)	(-1.78)	(-1.53)
Loan Loss Allowance	1.23	0.79	-3.22	-2.45	0.15	-0.09
	(0.53)	(0.37)	(-1.46)	(-1.07)	(0.06)	(-0.04)
Risk Weigthed Assets	0.66***	0.71***	0.81***	0.75***	0.66***	0.71***
	(4.36)	(4.33)	(3.81)	(3.94)	(4.15)	(4.17)
Subordinated Debt	-0.37	-0.63	0.52	0.05	0.25	-0.02
	(-0.18)	(-0.32)	(0.28)	(0.03)	(0.13)	(-0.01)
Deposits	0.04	-0.01	-0.20	-0.13	-0.01	-0.07
	(0.21)	(-0.07)	(-1.03)	(-0.68)	(-0.04)	(-0.47)
BHC Dummy	-0.17	-0.08			-0.17	-0.09
	(-1.03)	(-0.55)			(-0.90)	(-0.55)
Log (Firm Total Assets)	0.00	-0.03*	0.01	-0.03	0.01	-0.03*
	(0.24)	(-1.84)	(0.76)	(-1.52)	(0.39)	(-1.86)
Tobin's Q	-0.01	-0.01	-0.01	-0.01*	-0.01	-0.01
	(-1.31)	(-1.25)	(-1.36)	(-1.74)	(-1.10)	(-1.31)
Profitability	0.08	0.10	0.01	0.02	0.11	0.13*
	(1.16)	(1.47)	(0.15)	(0.29)	(1.55)	(1.80)
Tangibility	-0.01	-0.03	-0.00	-0.03	0.01	-0.01
	(-0.09)	(-0.38)	(-0.04)	(-0.43)	(0.11)	(-0.13)
Cash Holdings	0.29***	0.28***	0.27***	0.25***	0.27***	0.26***
	(4.87)	(5.08)	(3.88)	(4.18)	(3.97)	(4.25)
Leverage	0.13***	0.16***	0.13***	0.16***	0.11***	0.16***
	(3.30)	(3.53)	(3.02)	(3.07)	(3.02)	(3.74)
Rated Dummy	-0.21***	-0.25***	-0.19***	-0.22***	-0.22***	-0.26***
	(-5.03)	(-5.98)	(-4.40)	(-5.09)	(-5.32)	(-6.12)
R&D	-0.04	-0.07	-0.07	-0.10	-0.04	-0.07
	(-0.57)	(-0.93)	(-0.99)	(-1.25)	(-0.52)	(-0.86)
Cash Flow Volatility	0.01	0.00	0.02	0.01	0.01	-0.01
	(1.11)	(0.10)	(1.48)	(0.75)	(0.45)	(-0.45)
Log (Package Amount)	-0.38***	-0.34***	-0.38***	-0.34***	-0.38***	-0.33***
	(-21.27)	(-24.67)	(-19.88)	(-22.99)	(-18.02)	(-20.11)
No. of Fin. Covenants		-0.06**		-0.07***		-0.06**
		(-2.21)		(-2.71)		(-2.51)
No. of Non-Fin. Covenants		-0.04***		-0.04***		-0.05***
		(-5.52)		(-4.78)		(-5.78)
Constant	3.59***	3.75***	4.78***	5.07***	3.31***	3.47***
	(8.28)	(9.35)	(5.11)	(5.62)	(8.60)	(9.24)
Observations	4,420	4,420	4,420	4,420	4,420	4,420
Adj. R-squared	0.62	0.64	0.63	0.65	0.63	0.65

Appendix A1: Variable Definitions

This appendix contains the detailed definition of our regression variables. Note that for some of the variables in this appendix, their natural logarithms are used in the regressions.

Variable Name	Detailed Definition
Bank Share/Lead Bank Share	A lender's share of the dollar amount of the loan package/facility in decimals. This variable is referred to as *Lead Bank Share* if the lender is the lead bank of the loan package/facility. We set *Lead Bank Share* to 1 if *No. of All Lenders* equals one.
No. of Lead Banks	The total number of lead banks in the syndicate of a loan package/facility.
No. of All Lenders	The total number of all banks (both lead and participant) in the syndicate of a loan package/facility.
Package Amount ($ million)	The amount of a loan package committed by the package's lender pool, in millions of dollars of the December 2012 purchasing power.
Facility Amount ($ million)	The amount of a loan facility committed by the facility's lender pool, in millions of dollars of the December 2012 purchasing power.
No. of Financial Covenants	The total number of covenants based on financial ratios at the package level (see Appendix A2 for details). We first create a dummy variable that equals one if a financial ratio covenant exists and equals zero otherwise. Note that to avoid losing too many observations, we set the dummy variable to zero if there is no covenant based on a financial ratio or information about it is missing. We then add up the dummy variables to obtain the total number of financial covenants.
No. of Non-Financial Covenants	The total number of non-financial covenants at the package level (see Appendix A2 for details). This variable is constructed in the same way as *No. of Financial Covenants* based on non-financial ratio covenants.
Secured Facility Dummy	A dummy variable that equals one if a loan facility is secured, and equals zero otherwise.
Performance Pricing Dummy	A dummy variable that equals one if there is a grid displaying different pricing levels based, and equals zero otherwise.

Leveraged Package/Facility Dummy	A dummy variable that equals one if the market segment of a loan facility belongs to "Highly Leveraged", or "Leveraged", or "Non-Investment Grade". A package is leveraged if all facilities within the package are leveraged.
Syndicated Package/Facility Dummy	A dummy variable that equals one if the distribution method of a loan facility is syndication. A package is syndicated if all facilities within the package are syndicated.
Facility Purpose Dummy	At the facility level, it includes (1) Acquisition Dummy, (2) General Corporate Purpose Dummy, (3) LBO Dummy, (4) Recapitalization Dummy, and (5) Miscellaneous Dummy. The omitted group includes Other Purposes. The group definition follows Drucker and Puri (2009).
Package Purpose Dummy	At the package level, it includes (1) Acquisition Dummy, (2) General Corporate Purpose Dummy, (3) LBO Dummy, (4) Recapitalization Dummy, and (5) Miscellaneous Dummy. The omitted group includes Other Purposes. The group definition follows Drucker and Puri (2009).
Total Capital Ratio	Total Capital/Risk-Weighted Assets: (RCFD8274+RCFD8275)/RCFD223
Tier 1 Capital Ratio	Tier 1 Capital/Risk-Weighted Assets: RCFD8274/RCFD223
Leverage Ratio	Tier 1 Capital/Bank Total Assets: RCFD8274/RCFD2170
Bank Total Assets ($ billion)	Bank Total Assets in billions of dollars of the December 2012 purchasing power: RCFD2170 (after adjusted for CPI)/1,000,000
Bank Liquidity	(Cash+Available-for-sale Securities)/Bank Total Assets: (RCFD0010+RCFD1773)/RCFD2170
Bank ROA	Net Income/Bank Total Assets: RIAD4340/RCFD2170
Loan Charge-Offs	Total Loan Charge-Offs/Bank Total Assets: RIAD4635/RCFD2170
Loan Loss Allowance	Loan Loss Allowance/Bank Total Assets: RCFD3123/RCFD2170
Risk-Weighted Assets	Risk-Weighted Assets/Bank Total Assets: RCFD223/RCFD2170
Subordinated Debt	Subordinated Debt/Bank Total Assets: RCFD3200/RCFD2170
Deposits	Total Deposits/Bank Total Assets: RCFD2200/RCFD2170
BHC Dummy	Bank Holding Company Dummy. A dummy variable that equals one if the bank is held by a bank holding company, and equals zero otherwise.

TARP Recipient	A dummy variable that equals one if a bank is a TARP funding recipient, and equals zero otherwise.
Firm Total Assets ($ million)	Book Value of Total Assets in millions of dollars of the December 2012 purchasing power: AT (after adjusted for CPI). Note that this and the variables below are for borrowing firms.
Tobin's Q	Market Value of Total Assets/Book Value of Total Assets, where Market Value of Total Assets=PRCC_F*CSHO+(DLC+DLTT)+PSTKL-TXDITC. TXDITC is set to zero if missing.
Profitability	Operating Income Before Depreciation/Book Value of Total Assets: OIBDP/AT
Tangibility	Total Property, Plant, and Equipment/Book Value of Total Assets: PPENT/AT
Cash Holdings	Cash and Short-Term Investments/Book Value of Total Assets: CHE/AT
Leverage	(Total Debt in Current Liabilities+Total Long Term Debt)/Book Value of Total Assets: (DLC+DLTT)/AT
Rated Dummy	A dummy variable that equals one if a borrower has an S&P long term credit rating in the fiscal year before the loan activation date.
R&D	Research and Development Expense/Book Value of Total Assets: XRD/AT. XRD is set to zero if missing
Cash Flow Volatility	Standard deviation of previous 12 quarterly cash flows, where cash flow=(IBQ+DPQ)/SALEQ. DPQ is set to zero if missing. We only keep the computed cash flow volatility if cash flows are non-missing for at least 8 quarters out of previous 12 quarters.

Appendix A2: List of Bank Loan Covenants

Financial Covenants:

Max. Capex, Max. Debt to EBITDA, Max. Debt to Equity, Max. Debt to Tangible Net Worth, Max. Leverage Ratio, Max. Loan to Value, Max. Long-Term Investment to Net Worth, Max. Net Debt to Assets, Max. Senior Debt to EBITDA, Max. Senior Leverage, Max. Total Debt (including Contingent Liabilities) to Tangible Net Worth, Min. Cash Interest Coverage, Min. Current Ratio, Min. Debt Service Coverage, Min. EBITDA, Min. Equity to Asset Ratio, Min. Fixed Charge Coverage, Min. Interest Coverage, Min. Net Worth to Total Asset, Min. Quick Ratio, Other Ratio, Net Worth, Tangible Net Worth.

Non-Financial Covenants:

Insurance Proceeds Sweep, Dividend Restriction, Equity Issuance Sweep, Debt Issuance Sweep, Asset Sales Sweep, Excess Cash Flow Sweep, Percentage of Net Income, Percentage of Excess Cash Flow.

Table A1
Bank Capital and Overall Credit Provision

This table reports the bank fixed effects results on how bank capital affects overall credit provision. The sample contains bank-quarter observations of all lead banks that made loans in the 4,356 packages between 1996 and 2012 for which lead bank share information is available. The dependent variable in Column (1) is the C&I loan growth rate over the previous quarter. The dependent variable in Column (2) is the bank total asset growth rate over the previous quarter. The dependent variable in Column (3) is the C&I loan growth over the previous quarter divided by bank total asset. The dependent variable in Column (4) is the C&I loan growth over the previous quarter divided by bank total risk-weighted asset. The dependent variable in Column (5) is the C&I loan amount divided by total mortgage lending. The dependent variable in Column (6) is the C&I loan amount divided by total loan amount. The key independent variable in all regressions is the *Total Capital Ratio*, which is defined as the ratio of a bank's total capital over its risk-weighted assets, of the lead bank in the original loan package/facility that is used to identify the matched loan package/facility whose lead bank share is used as the dependent variable. The bank fixed effects regressions also control for year fixed effects. For brevity, only coefficients and t-statistics on bank characteristics are reported. The t-statistics in the parentheses below the coefficient estimates are calculated using robust standard errors corrected for heteroskedasticity and clustered at the bank level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in a two-tailed test.

	C& Loan Growth Rate (1)	Bank Total Asset Growth Rate (2)	C&I Loan Growth Over Total Asset (3)	C&I Loan Growth Over Total Risk-Weigthed Asset (4)	C&I Loan Over Mortgage (5)	C&I Loan Over Total Loan (6)
Total Capital Ratio	0.33***	0.13*	0.04*	0.12***	-0.07	-0.03
	(7.79)	(1.76)	(1.82)	(3.07)	(-0.21)	(-0.61)
Bank Characteristics Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,065	8,197	8,197	8,197	8,063	8,197
Adj. R-squared	0.10	0.04	0.08	0.10	0.79	0.87