The Rise of Shadow Banking: Evidence from Capital Regulation*

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Abstract

We investigate the connections between bank capital regulation and the prevalence of lightly regulated nonbanks (shadow banks) in the U.S. corporate loan market. For identification, we exploit a supervisory credit register of syndicated loans, loan-time fixed-effects, and shocks to capital requirements arising from surprise features of the U.S. implementation of Basel III. We find that less-capitalized banks reduce loan retention and nonbanks step in, particularly among loans with higher capital requirements and at times when capital is scarce. This reallocation has important spillovers: loans funded by nonbanks with fragile liabilities experience greater sales and price volatility during the 2008 crisis.

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The recent financial crisis has triggered a broad push toward increased regulation of the financial sector, and a vigorous debate about how to best implement this overhaul. At the heart of the debate is the issue of capital requirements. In particular, Admati et al. (2013) argue that banks should be subject to significantly higher capital requirements in order to mitigate risk-shifting incentives and increase financial stability (see also Thakor 2014). On the other hand, increased regulation of banks may push intermediation into unregulated entities (e.g., the "shadow banking" system), which may increase overall financial fragility and reduce welfare (Fahri and Tirole 2017; Martinez-Miera and Repullo 2018; Plantin 2014).[1] At the same time, there have been recent policy initiatives in Europe to enhance and even create new secondary markets that would allow banks to sell riskier loans (with higher capital requirements) to other financial intermediaries (ECB 2017).[2] Despite its importance for the design of prudential regulation (Freixas et al. 2015; Hanson et al. 2011), there is limited empirical evidence on the relation between bank capital and shadow banking, and precisely how a greater presence of shadow banks might exacerbate or propagate risks in the financial system.

In this paper, we make progress on these issues by documenting the association between bank regulatory capital and credit reallocation toward nonbanks in the U.S. market for syndicated corporate loans. Narrative evidence suggests an important link from strengthening bank capital regulation to the transfer of corporate credit risk out of the regulated sector, beginning in the early 2000s.[3] To shine a light on this potential credit reallocation, we analyze

[1]Tax benefits of debt, explicit and implicit public guarantees, and asymmetric information imply that equity finance may be more costly for banks than debt (Freixas and Rochet 2008). We use the terms "shadow bank" and "nonbank" interchangeably when referring to financial institutions that provide credit without issuing insured liabilities or having (guaranteed) access to central bank liquidity. This is consistent with the Federal Reserve's (or Financial Stability Board's) definition of shadow banking as nonbank credit intermediation. We also distinguish among shadow banks according to the fragility of their liabilities, a definition closer to Fahri and Tirole (2017).

[2]See also "Development of secondary markets for non-performing loans," European Commission, March 20, 2018 (`www.europarl.europa.eu/legislative-train`).

[3]For example, "Who's carrying the can?" *The Economist*, August 14, 2003 (see `www.economist.com/node/1989430`).

an administrative credit register of U.S. syndicated loan shares that contains comprehensive data on the dynamics of loan share ownership among banks and nonbanks from 1992 until 2015. Our empirical tests confirm a tight connection between banks' regulatory capital and loan sales and trading activity in the secondary loan market. We show how undercapitalized banks reallocate credit to nonbanks, and these effects are pronounced among loans with higher capital requirements and at times when bank capital is scarce. Further, we demonstrate a potentially adverse spillover of this risk transfer. Based on secondary market loan pricing data, we uncover greater price volatility among loans funded by nonbanks during times of marketwide stress, and we connect this effect to the fragility of the liabilities of these nonbanks.

We base our empirical tests on data from the Shared National Credit Program, which is a supervisory credit register administered by the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation, and the Office of the Comptroller of the Currency. This data set has a unique advantage as compared with credit registers from other countries: it has comprehensive information on the loan share ownership of both banks and nonbanks. Moreover, these ownership shares are tracked in the years following origination, which allows us to construct a complete picture of credit reallocation within loans, in response to bank balance sheet shocks. Accounting for these dynamics is crucial, as much of the reallocation from banks to nonbanks in the modern syndicated loan market occurs via secondary market trading.

We merge the loan funding data to bank balance sheets and estimate the effects of bank regulatory capital for credit reallocation to nonbanks. In the spirit of Khwaja and Mian (2008) and Irani and Meisenzahl (2017), we use a loan-year fixed effects approach that exploits the fact that loan syndicates in our sample always feature multiple banks, in conjunction with our panel on loan share holdings. This empirical approach boils down to comparing secondary market loan sale decisions across banks as a function of their regulatory capital positions within loan syndicates at a given point in time. It is attractive from an identification standpoint, as it accounts for changes in loan quality that could correlate with bank balance sheet shocks and risk management responses.

Our main results are as follows. We first establish the importance of regulatory capital for loan retention. We find that banks experiencing a weakening of their regulatory capital position are more likely to reduce loan retention. Our tests show how this is achieved by secondary market trading activity, that is, by selling loan shares in the years following origination. To buttress this key result, we show the negative relation between capital and loan sales is stronger during times of market wide uncertainty, when banks face limited access to external capital and profitability is low. We also examine the cross-section of loans and find that low-capital banks are most likely to sell distressed loans, which have higher risk weights for capital requirements.

We then provide the connection between bank capital and nonbank entry. We first present novel graphical evidence documenting aggregate trends in nonbank entry into the syndicated term loan market, which accelerated in the early 2000s—in terms of both loan retention and trading activity—particularly among collateralized loan obligations (CLOs) and investment funds.[4] We then aggregate our loan share-lender-year panel to the loan-year level and regress the fraction of loan funding from nonbanks on average syndicate member bank characteristics, including regulatory capital. Our regression evidence confirms that an important component of nonbank entry at the loan level reflects bank capital constraints. Specifically, our estimates indicate that a one-standard-deviation decrease in bank capital translates into a 3.25 percentage point increase in nonbank share (14.1% of the mean). Moreover, in line with our evidence on bank selling behavior, we find that these effects are pronounced in times when capital is scarce and for loans with high capital requirements.

[4]Throughout the paper, we aggregate our data to the bank holding company level, that is, all lenders assigned to the same ultimate parent are treated as a single entity. Notably, this includes any CLOs and other nonbanks that are affiliated with traditional banking organizations.

While our loan-year fixed effects model sweeps out all borrower- and loan-specific factors, potential time-varying omitted bank-level variables could compromise the internal validity of our estimates.[5] To improve identification, we use plausibly exogenous variation in bank capital arising from the Basel III capital reforms. While the timing and content of the internationally agreed version of the regulation was well understood, there were quirks in the precise implementation of the U.S. rule (Berrospide and Edge 2016). This created unexpected shortfalls in regulatory capital for some banks, which are unrelated to banks' commercial lending activity, including risk within the syndicated loan portfolio. Using two complementary shocks related to this rule for exogenous variation, we continue to find that relatively low-capital banks use loan sales to reduce risk-weighted assets and enhance regulatory capital ratios in the wake of this reform.[6] Furthermore, we show that nonbanks fill the funding gaps created by these loan sales.

In the final section of the paper, we investigate an important potentially adverse consequence of this nonbank entry for secondary market loan prices. We collect daily secondary market pricing data for traded loans from the Loan Syndication and Trading Association and link this to our information from the credit register on syndicate composition at the onset of the 2008 financial crisis. Our key finding is that syndicated loans with greater funding by nonbanks experience greater sales activity and downward pressure on secondary market prices during the crisis. We estimate that a one-standard-deviation higher pre-crisis nonbank share accounts for 19.2% of the mean fall in loan prices through 2008. Importantly, we show that these adverse effects are pronounced among loans funded by nonbanks with relatively liquid liabilities—broker-dealers, hedge funds, and other investment funds. We also examine secondary loan share purchases and show that well-capitalized banks and nonbanks with

[5] Though our point estimates are very similar if we exclude bank fixed effects, which indicates (following Altonji et al. 2005, among others) that our main result is orthogonal to unobserved lender characteristics.

[6] In this case, our point estimates are again very similar when we exclude loan fixed effects, which implies that our main result is orthogonal to unobserved borrower (and loan) characteristics.

relatively stable funding were able to act as liquidity providers during the 2008, but did not smooth out the shock. These findings suggest that there may be negative spillovers to market prices arising from the fragile funding of nonbanks investing in these relatively illiquid loans.

The results in this paper provide insights that fit into two different strands of the banking literature. First, we provide a partial explanation for the prevalence of shadow banks in modern loan markets. On the positive side, technological advances, liquidity transformation, and superior knowledge could motivate nonbank entry into this market (Buchak et al. 2017; Moreira and Savov 2017; Ordoñez 2018), which may lead to greater efficiency and lower borrowing costs for households (Fuster et al. 2018) and corporations (Ivashina and Sun 2011; Nadauld and Weisbach 2012; Shivdasani and Wang 2011). Another view, as emphasized by Kashyap et al. (2010), is that regulatory burdens, in the form of rising capital requirements and greater scrutiny, for traditional banks may induce a migration of banking activities toward unregulated shadow banks that can escape these costs.

In line with this reasoning, our main contribution is to document the importance of capital regulation for the rise of shadow banks in the U.S. corporate loan market.[7] Acharya and Richardson (2009) argue that shadow banks avoid capital requirements—and thus possess a cost advantage in good times—but benefit from government bailouts when extreme losses arrive, possibly due to affiliations with traditional banks either directly or indirectly via guarantees (Acharya et al. 2013). We study "true sales" of corporate loan shares to shadow

[7]We focus explicitly on capital regulation and the bank capital channel, which is key for banking (Admati et al. 2013; Freixas and Rochet 2008). Other research examines how alternative features of bank regulation may precipitate nonbank entry into loan markets. Neuhann and Saidi (2016) argue that deregulating the scope of traditional bank activities contributed to the growth of nonbank market share in the U.S. syndicated loan market. Kim et al. (Forthcoming) find that supervisory guidance that tightens underwriting standards induces nonbank entry, and these nonbanks may have funded this U.S. syndicated lending by borrowing from traditional banks. Elliehausen and Hannon (Forthcoming) show that the Credit Card Accountability and Disclosure (CARD) Act—which restricted the risk management practices of credit card issuers—led individuals to substitute from bank credit cards to consumer finance company loans. Gete and Reher (2017) find that bank liquidity regulations introduced under Basel III stimulated nonbank entry in the Ginnie Mae segment of the U.S. residential mortgage market.

banks that are lightly-regulated, unaffiliated with the traditional banking sector, and do not have insured liabilities or (guaranteed) access to central bank liquidity. The closest, and complementary, paper to ours is Buchak et al. (2017), which examines the rise of shadow banks (notably, online "fintech" lenders) in the residential mortgage market. These authors find that the market share of shadow banks doubled between 2007 and 2015, and they attribute this expansion primarily to regulatory constraints among traditional banks after the crisis. We instead examine loans to corporations—rather than households—over three credit cycles spanning 23 years (1992 to 2015), which allows us to show how our effects respond to aggregate macroeconomic developments. For identification, we use a supervisory credit register of syndicated loans and examine changes in loan funding between banks and nonbanks participating in the same syndicate in the same year, thereby controlling for all borrower- and loan-specific characteristics (e.g., loan risk). In addition, we document the spillovers of shadow bank entry for selling and secondary market prices, with significant differences across shadow banks depending on the fragility of their liabilities (consistent with the theoretical models of Fahri and Tirole 2017; Hanson et al. 2015).

Second, we contribute to the nascent empirical literature on the consequences of securities trading by banks. Abbassi et al. (2016) provides security-level evidence on the secondary market trading activities of commercial banks based in Germany. They show that, after the fall of Lehman Brothers, well-capitalized banks reallocate capital toward profitable trading activities at the expense of lending opportunities that support the real economy. In addition, Irani and Meisenzahl (2017) analyze loan trading by U.S. commercial banks during the recent financial crisis, and find that liquidity-strained banks with heavy exposures to wholesale funding markets sold loans at depressed prices in the secondary market. Our focus is instead on the trading activities of both traditional banks and nonbanks. We connect entry by nonbanks to capital constraints at regulated commercial banks, and then show that nonbanks with fragile funding can have negative spillovers to market prices during a severe downturn.[8]

The next section presents our data, including summary statistics. Section 2 discusses the empirical strategy, whereas Section 3 presents and discusses the results. Section 4 concludes with some policy implications.

1 Data and Summary Statistics

1.1 Sample Selection and Variable Construction

Our primary data source is the Shared National Credit Program (SNC). The SNC is a credit register of syndicated loans maintained by the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation (FDIC), the Office of the Comptroller of the Currency, and, before 2011, the now-defunct Office of Thrift Supervision. Through surveys of administrative agent banks, the program collects confidential information on all loan commitments larger than $20 million and shared by three or more unaffiliated federally supervised institutions, or a portion of which is sold to two or more such institutions. This includes loan packages containing two or more facilities (e.g., a term loan and a line of credit) issued by a borrower on the same date where the sum exceeds $20 million. Loans meeting these criteria—both new and outstanding—are surveyed on December 31 each year. The SNC has comprehensive coverage of syndicated lending from 1977 to the present.[9] We restrict our analysis to the post-1992 period, since the data quality is much better and nonbank entry mostly picks up post-2002.

[8]Manconi et al. (2012) and Coval and Stafford (2007) provide evidence that mutual fund outflows can exert downward price pressure in bond and equity markets, respectively.

[9]Bord and Santos (2012) carefully compare average yearly dollar volume of U.S. issuances in the SNC and the Loan Pricing Corporation's Dealscan data set from 1988 to 2010 to examine potential sample selection due to the SNC inclusion criteria (Dealscan includes credits over $100,000 and has no restriction on lenders). The authors conclude the difference between the sources is small once loan amendments are accounted for: they find the size criterion can explain only about 0.6 percentage points of the difference between the two data sets. Similarly, Ivashina and Scharfstein (2010) report that about 95% of Dealscan loans meet both SNC criteria. Hence, we believe sample selection is unlikely to bias our estimates.

Loan-level information is given on the borrower's identity, the date of origination and maturity, loan type (i.e., credit line or term loan), and a pass/fail regulatory classification of loan quality. Most importantly, the data break out loan syndicate membership on an ongoing, annual basis. Thus, over the tenure of each loan, the data identify the names of the agent bank and participant lenders—these include banks and an array of nonbanks—and also their respective investments.[10] We identify each observation in the SNC data as a loan share-lender-year. In the cases where the same lender (e.g., different subsidiaries of the same holding company) owns multiple shares of the same loan, we aggregate across shares. The data map lenders into Replication Server System Database (RSSD) ID numbers and, for U.S. banks, the ultimate parent. All lenders assigned to the same ultimate parent are treated as a single entity. Notably, this includes any CLOs and other nonbanks that are affiliated with the holding company.

The SNC data tracks loan share ownership over time and allows us to measure loan sales in the secondary market. To this end, for each loan we compare syndicate membership from one year to the next, and code a loan share sale whenever a lender j reduces its exposure in year $t+1$ from year t. In these cases, we record a sale of loan i by lender j in year $t+1$. Naturally, the loan must not mature in $t+1$ or else it will appear that all lenders are selling. This loan sales measure includes both loan shares sold in their entirety and instances where a bank retains the loan share but reduces its exposure. Given that the data are aggregated to the holding company, these loan share sales are "true sales" as opposed to within-organization reallocations.[11]

In some tests, we examine observations for which there are no changes in the loan contract—that is, it is not refinanced or amended. For these observations, the credit identifier

[10] Each loan is assigned a credit identifier that does not change after the loan is amended or refinanced. The SNC therefore has advantages over data sets of syndicated loans, such as Dealscan, that focus only on the primary market, have incomplete data on loan ownership, and do not track refinanced or amended loans.

[11] While credit risk transfers to affiliated entities are interesting in their own right (e.g., Acharya et al. 2013), they are beyond the scope of this paper, and we therefore do not record them as sales.

will not change, but maturity dates, origination dates, or total loan amounts at origination will, and we can use this information to identify refinanced or amended loans. This "No Amend" sample allows us to address the identification concern that borrowers may remove underperforming banks from the syndicate, assuming it is easier to do so when the contract is up for renegotiation. The data also allow us to control for divestment activity around merger and acquisitions among banks. In particular, if a lender adjusts its loan exposure at the same time as its parent RSSD ID changes, then we code this as a merger instead of a sale.

In addition to the SNC, we use data from two other sources. First, we collect bank balance sheet data for U.S. bank holding companies from the Federal Financial Institutions Examination Council Consolidated Financial Statements for Holding Companies (Form FR Y9-C). Banks must file these reports with the Federal Reserve on a quarterly basis. These data are used to construct a number of bank control variables in our regressions, including measures of bank size, liquidity, and loan portfolio composition. We also use these data to construct several bank-level measures of regulatory capital, including the Tier 1 capital to risk-weighted assets ratio. Our analysis therefore focuses on U.S. bank holdings companies, and we use cross-sectional variation in their regulatory capital ratios to estimate the impact of bank capital on loan sales and nonbank entry.

Second, we collect secondary market bid and ask quotes for traded syndicated loans from the Loan Syndication and Trading Association (LSTA) Mark-to-Market Pricing data. The unit of observation in these data is a loan facility-quotation date pair. We hand-match loan facilities in the SNC data with the LSTA using information on issuer names and loan origination dates, and other loan characteristics where necessary. We use the LSTA data to construct proxies for secondary market loan prices. These loan price proxies allow us to estimate the association between nonbank participation in loan syndicates and price declines during the 2008 aggregate shock.

1.2 Summary Statistics

We start our sample description with graphical evidence based on aggregated data from the SNC. We focus on the term loan primary and secondary markets, since they are liquid and feature all financial institutions.[12]

Figure 1 plots the composition of nonbank funding of syndicated term loans from 2002 to 2014. The SNC classifies lenders into four categories: domestic banks, domestic nonbanks, foreign banks, and foreign nonbanks. We disaggregate the SNC classification of nonbanks, assigning nonbank lender names into the following categories: CLO, finance company, broker-dealer, pension fund, insurance company, mutual fund, and hedge fund or private equity.[13] Holdings are shown as a fraction of outstanding credit. The complement of the nonbank holdings are bank holdings. For example, in 1992, about 20% of credit was funded by nonbanks and 80% by (foreign and domestic) banks. Two important patterns emerge. First, there is an upward trend in nonbank funding, from about 20% in 1992 to 70% in 2014. Notably, nonbank participation accelerated between 2002 and 2006. Second, there is an increase in the diversity of creditors. CLOs—a form of corporate loan securitization—emerged in the late 1990s and by 2002 became the largest nonbank investor class.[14] Since 2008, hedge funds, private equity, and loan mutual funds have played an increasingly important role, and they had a similar market share to CLOs by 2014.

Figures 2 and 3 plot term loan share sales and purchases in the secondary market over the same time period for all financial institutions. Trades are represented in terms of both dollar

[12]Deposit-taking commercial banks have a comparative advantage at managing credit lines' liquidity risk (Kashyap et al. 2002), possibly due to government guarantees (Pennacchi 2006). Thus, banks retain most credit lines in the primary market (Gatev and Strahan 2006), and there is little depth in the secondary market for credit lines (Bord and Santos 2012).

[13]The National Information Center identifies finance companies and insurance companies. We identify CLOs, hedge funds, private equity, and mutual funds via Standard & Poor's Capital IQ and Moody's Structured Finance Database. Remaining lenders are manually classified using keyword and internet searches. The categories "other domestic entity" and "other foreign entity" (DEO and FEO, respectively) are catchalls for domestic and foreign nonbanks that we could not systematically classify.

[14]CLOs are primarily funded by highly-rated asset-backed securities, which is possible given that corporate loans typically have low expected losses (Benmelech and Dlugosz 2009).

values (top panel) and market shares (bottom panel). Nonbanks clearly played a prominent role in the dramatic increase in trading activity in the post-2007 period. However, these institutions actually began to dominate the secondary market much sooner, as early as 2002. Focusing first on sales, we find that while banks' loan funding shrank from 1992 to 2002, they held the largest market share of loan sales until 2003. Beyond this tipping point, nonbanks swamp the market. In terms of loan purchases, since 2002, CLOs and other asset management firms have steadily replaced banks and finance companies. Once the crisis arrives, all institutions increase trading activity, with nonbanks clearly dominant in terms of magnitudes. Comparing the financial crises of 1998 and 2008, we see dramatic differences in the extent of trading activity. This may, at least to some extent, be driven by the composition of investors in the loan market.[15]

Figures 4 and 5 repeat this description for the distressed term loans, which are those that are "criticized" by the regulator, as part of the SNC review that year—that is, rated "special mention," "substandard," "doubtful," or "loss." Banks do not actively purchase these loans in the secondary market, and investment management firms step in. In contrast, for sales, banks appear to offload nonperforming loans more often and in a countercyclical manner. These patterns are natural, given that these loans carry higher regulatory capital charges among banks, and the loan secondary market offers a mechanism for banks to adjust exposure.

The sample used in our empirical analysis consists of data from 1992 to 2015. As described in Section 1, the sample is restricted to loan shares funded by U.S. bank holding companies and includes 20,685 unique syndicated loans, 161,794 loan share-lender-year triples, held by 1,897 banks. Loan-level variables are measured at the time of the SNC review, and bank-level variables at the end of the calendar year. Definitions of these variables are found in

[15]Hanson et al. (2015) argue that traditional banks' stable funding makes them "patient" fixed income investors, better equipped to ride out temporary fluctuations in market prices than shadow banks.

Appendix A. Bank variables are winsorized at the 1st and 99th percentiles to mitigate the effect of outliers.

Panel A of Table 1 presents the summary statistics of the loan variables, averaged across loan share-years. In a given year, loan shares exposures are reduced 37% of the time. In 6.5% of the observations, shares are sold in their entirety, which means a participant bank exits the loan syndicate altogether. In terms of loan size, the average loan commitment is about $275 million. Of the shares, 18.1% have the bank in question acting as an agent. Collapsing the data to the loan-year level, we find that 23.1% of funding for a given syndicate comes from nonbanks. As described above, the nonbank share increases dramatically in the second half of the sample.

Panel B gives a sense of the differences across banks by bank capitalization. The table splits the sample according to whether the bank falls above or below median Tier 1 capital to risk-weighted assets each year, and averages the data across bank-years. Banks with below-median capital have average total assets of about $1 billion, with 60% and 10% of assets allocated to real estate and commercial lending, respectively. These banks have average Tier 1 capital ratios of 10.0%. The major differences between these groups are that banks with above-median capital are smaller in terms of book assets, have less wholesale funding dependence, and fund fewer commercial loans. These differences are both large in magnitude and significant at the 1% level, using standard difference of means tests.

2 Empirical Methodology

Our empirical approach is based on the idea that regulatory capital constraints lead banks to shed credit risk in the term loan secondary market. That is, banks with low capital have incentives to enhance regulatory capital ratios by lowering risk-weighted assets through term loan sales, much more so than banks with high capital ratios.

Estimating this empirical relationship poses an identification challenge: changes in borrower fundamentals that feed into loan-specific default risk could cause trading activity irrespective of lender-side factors, including capital constraints. For example, suppose low-capital banks grant loans to weak firms that perform poorly in recessions. And if tightening capital constraints signal an oncoming recession, then these banks may sell loan shares to diversify their loan portfolio.

We solve this selection problem by controlling for all borrower and loan characteristics through the inclusion of loan-year fixed effects. Khwaja and Mian (2008) pioneered this approach, and it has recently been adapted to the syndicated loan market (e.g., Irani and Meisenzahl 2017). Given that firms borrowing in the syndicated market in our sample always receive funding from more than one bank, we compare selling activity between banks within a given syndicate at a point in time. This approach removes confounding risk factors at the loan level—in addition to firm level—which is nontrivial given that firms typically have multiple loans outstanding, some of which might be unsecured or junior in debtors' capital structures.

Our baseline approach is to estimate the following linear probability model via ordinary least squares (OLS):

$$Loan\ Sale_{ijt} = \alpha_{it} + \alpha_j + \beta\ Tier\ 1\ Capital/RWA_{j,t-1} + \gamma X_{ij,t-1} + \epsilon_{ijt}, \tag{1}$$

where *Loan Sale*$_{ijt}$ is an indicator variable equal to one if any portion of the term loan share i held by bank j in year $t-1$ is sold in year t. *Tier 1 Capital/RWA*$_{j,t-1}$ is the Tier 1 capital to risk-weighted assets ratio of bank j in year $t-1$. The α_{it} and α_j variables are loan-year and bank fixed effects, respectively. The vector $X_{ij,t-1}$ contains control variables, described below, in conjunction with fixed effects, to ensure that β does not capture differences in bank or loan share characteristics that may correlate with loan sales behavior. We cluster standard errors at the loan level, which allows errors (ϵ_{ijt}) to correlate among banks and years within the same loan.

The coefficient β measures the effects of regulatory capital on term loan sales, controlling for any observable or unobservable differences between loans or within loans over time. If banks sell loans to reduce risk-weighted assets and bolster regulatory capital ratios, the coefficient β will be strictly negative. The null hypothesis is that regulatory capital is unimportant for loan sales (e.g., because banks can raise capital ratios through other means), which corresponds to β equal to zero.

For β to be unbiased, we require two identifying assumptions. Given that β is identified off within-loan variation, to identify a supply-side effect we first require that borrowers be equally willing to remove or keep each lender in the syndicate. This assumption is uncontroversial for two reasons. First, a design feature of the syndicated loan market is that borrowers cannot influence secondary market trading activity and associated ownership changes. Second, term loan shares are identical in the sense that all lenders receive the same contract terms. Moreover, in contrast to credit line shares, funds are disbursed at origination and banks will not have to perform other functions in the future (e.g., provide liquidity under a credit line commitment). Thus, since term loan shares are identical, it seems unlikely that borrowers will prefer one bank over another in the years following origination, say because the regulatory capital ratio of one bank deteriorates. While we do not believe that borrowers can or will separate from low-capital syndicate members ex-post for reasons driven by loan quality, we can find evidence consistent with this assumption. In particular, it is plausible that borrowers have less influence over syndicate structure when the contract is not up for renegotiation or being refinanced. Since we can identify such loan amendments in the data, if we can show that β is similar when we estimate our model on this subsample, then we can alleviate this concern.

The remaining challenge is less innocuous and arises from potential correlations among supply-side characteristics. This could complicate identification even if we exclude borrower selection effects. For example, suppose low-capital banks have weaker risk management or aggressive risk attitudes, or are larger and better diversified. Then our estimate of β could be biased, as *Tier 1 Capital/RWA*$_{j,t-1}$ could proxy for these other bank-level factors.

To address this potential issue, we take three steps. First, we always relate loan sales to banks' Tier 1 capital ratios conditional on other bank and loan characteristics. Bank control variables include size, funding structure, performance, and loan portfolio composition. These factors can differ significantly by bank regulatory capital (see Panel B of Table 1). In order to account for persistent characteristics, like bank ownership, we control for bank fixed effects. We also include controls at the loan share-lender-year level to capture banks' importance within the syndicate. If relationship banks cross-sell other products, then they might prefer to retain ownership irrespective of capital levels (Bharath et al. 2007). We therefore control for the fraction of the loan held by the lender and an agent bank indicator variable.

Second, we test how the link between banks' regulatory constraints and loan sales varies in the time series according to how difficult it is to raise capital (in terms of both retained earnings and access to external funding) and in the cross-section of loans by regulatory risk assessment. Since regulatory risk assessments map into capital charges, the latter test provides a clear and direct loan-level examination of the regulatory capital management channel of loan sales.

Third, we use plausibly exogenous shocks to bank capital arising from the post-crisis Basel III regulation to alleviate concerns regarding time-varying omitted bank-level variables. While the timing and content of the internationally agreed version of the reform was well understood, the precise implementation of the rule in the United States differed along several dimensions and surprised banks (Berrospide and Edge 2016). Notably, in 2012:Q2, U.S. banking agencies' proposed adjustments to both the types of capital counted toward Tier 1 capital and the risk-weights on numerous real estate exposures. The discrepancies found in the U.S. rule were largely unanticipated and created "winners" and "losers," whereby the losers faced unexpected shortfalls in regulatory capital following the announcement. This holds even among banks with similar risk profiles ex ante, for example, regulatory capital ratios under Basel I. While this setting is restricted to a narrow window, it provides variation in bank capital that is orthogonal to characteristics related to commercial lending activity—including risk within the syndicated loan portfolio—that might otherwise drive loan retention.

In addition to studying the effects of bank capital for loan sales, in Section 3.2 and beyond, we study the implications for nonbank entry and secondary market price spillovers. We will precisely cover the implementation of these tests in each respective results section.

3 Results

3.1 Bank Capital and Loan Sales

We begin our analysis by examining the statistical relationship between term loan sales activity and banks' Tier 1 capital ratio. The Tier 1 capital ratio, a crucial measure of banks' loss-bearing capacity, is calculated based on risk-weighted assets (RWA). Banks with low Tier 1 ratios are closer to regulatory constraints and may have incentives to lower RWA to enhance this ratio. To test this hypothesis in the context of syndicated loans, we estimate Equation (1). If capital constraints cause bank loan sales, then we expect the coefficient on Tier 1 capital (β) to risk-weighted assets to be negative.

Table 2 presents the first results. In Column [1], we estimate the model for the sample of term loan shares funded by U.S. banks. We estimate the model on the period from 2002 to 2015 during which time the loan secondary market was active. The model includes bank and loan-year fixed effects, as well as time-varying bank and loan controls. The point estimate for *Tier 1 Capital/RWA* is negative (–0.158) and statistically significant at the 1% confidence level. The direction of this estimate is consistent with our prior finding that banks with relatively low levels of regulatory capital have a higher probability of selling loan shares to reduce risk-weighted assets.

The remaining columns of the table provide more stringent tests of a bank capital channel. First, note that during times of market wide uncertainty, banks face limited access to external equity capital. Under such circumstances, undercapitalized banks will have heightened incentives to shed risk-weighted assets. To test this idea, we interact regulatory capital with a measure of the tightness of banks' funding conditions. We use the TED spread (TED_t), which we measure as the average difference between the three-month London Interbank Offered Rate (LIBOR) and the three-month Treasury rate. This average is calculated at the annual frequency and demeaned, for ease of comparison with Column [1]. The spread peaked in 2008, but also shows considerable time variation, with a higher TED indicating worse access to funds (Cornett et al. 2011). Consistent with this idea, Column [2] shows that the estimated effect of Tier 1 capital is larger in magnitude when the TED spread is elevated.

Second, we analyze how bank capital interacts with loan-level credit ratings. To more effectively reduce total risk-weighted assets, banks might sell loans with higher risk-weights. The expected losses associated with distressed debt are higher, and therefore such loans have higher risk-weights and require more regulatory capital.[16] Thus, low-capital banks might have greater incentives to sell distressed loans as compared with banks that have more capital.

We test this hypothesis using supervisory credit ratings. As part of the annual SNC review, bank examiners classify loans as "pass" or "fail" depending on whether they are distressed or not. Loans are classified as fail if they are in default (about to be charged off or

[16] Under the standardized approach of the 1988 Basel I Accord, corporate loans that are externally rated from BBB+ to BB– and below BB– have 100% and 150% risk-weights, respectively. Note that even performing syndicated loans tend to have low ratings: about 50% of syndicated loans are externally rated as junk, i.e., BB+ and below (Sufi 2007).

nonaccrual) or if the examiner uncovers serious deficiencies, in which case the loan is labeled "doubtful," "substandard," or "special mention." We reestimate Equation (1) separately for loan-year observations that are classified as pass or fail. In Columns [3] and [4], we find negative and statistically significant estimates of β for the pass and fail subsamples. However, the relation between Tier 1 capital and loan sales is much larger in magnitude for distressed loans (and significant at the 1% level). Hence, credit ratings matter in a way that is consistent with banks with lower regulatory capital having stronger incentives to reduce risk-weighted assets.

3.1.1 Robustness checks

This baseline result survives several robustness tests reported in Table 3. In panel A, we first restrict the sample to loans outside of the finance, insurance, and real estate and construction (FIRE) industries. We exclude these industry sectors for two reasons. First, we wish to understand whether capital constraints lead purely to a reshuffling of interbank loans. Second, we know that real estate firms were under considerable stress during the 2007 to 2009 period. In either case, the results would not be uninteresting per se, but it might narrow the interpretation somewhat. Column [1] indicates that loans to these industries make up about 15% of the sample, which is nontrivial. It also shows that dropping these industries has a negligible effect on the coefficient of interest.

Column [2] restricts the sample to observations in which there were no changes to the underlying contract (we drop approximately 10,000 loan-years). As described in Section 2, borrower-side factors should play a less prominent role in loan sales for these observations. As indicated in the column, the estimate is largely unchanged in terms of both size and statistical significance for this "No Amend" sample. This gives us confidence that the loan sale decision reflects bank incentives, including regulatory capital constraints.

The next two columns conduct tests that falsify our main result. Column [3] estimates our baseline specification for credit lines, as identified by the SNC. As argued in Section 1.2, the credit line secondary market has limited depth, and it is therefore less likely that low-capital banks would undertake credit line sales to relax capital constraints. Consistent with this expectation, the column shows a statistically insignificant relation between bank capital and credit line sales. In Column [4], we incorporate data from the 1992 to 2001 period during which time there was very limited activity in the secondary market for syndicated loans. For this alternative timing, we find that the coefficient on Tier 1 capital is negative, but smaller than our baseline effect and statistically insignificant at conventional levels.

Column [5] repeats the baseline estimation, excluding both bank and loan-year fixed effects. The coefficient on Tier 1 capital in the column remains similar in terms of magnitude and statistical significance when these controls are excluded, thus supporting its exogeneity (e.g., Altonji et al. 2005). In Section 3.3, we isolate plausibly random variation in capital in a narrower setting to further mitigate concerns regarding selection on unobservables.

In panel B, we consider two alternative definitions of bank regulatory capital. First, following Plosser and Santos (Forthcoming), we estimate a bank's distance from its "target" Tier 1 capital ratio, as opposed to the level of regulatory capital considered thus far. The target is determined by bank characteristics and macro conditions. *Tier 1 Gap* is calculated as the residual from a regression of Tier 1 capital to risk-weighted assets on bank size, return-on-assets, leverage, and year fixed effects. We estimate this residual on an annual basis for each bank from 1992 to 2015. Second, we use the level of total capital (Tier 1 plus Tier 2) to risk-weighted assets, which is a related but broader measure of regulatory capital. For both of these alternative measures, the results are in line with our benchmark estimates in both magnitudes and statistical significance.[17] These additional findings underscore the importance of regulatory capital for loan trading activity, especially among the riskier loan types that carry high capital charges.[18]

[17]The one exception is the effect of the Tier 1 gap on the loan sales rate for pass versus fail loans.

[18]We do not find a statistically significant relation between the book equity-to-assets ratio and loan sales.

Overall, we find strong evidence of an increase in loan sales among banks with lower Tier 1 capital. Our findings suggest that banks facing regulatory constraints may cut risk-weighted assets and enhance capital ratios by selling loan shares in the secondary market.

3.2 Reallocation of Credit to Nonbanks

Our graphical evidence shows the systematic entry of nonbanks into the syndicated term loan market since the early 2000s, especially CLOs and investment funds (see Figure 1). Our regression evidence so far suggests that at least part of this entry reflects the decision by banks to circumvent the capital requirements associated with corporate loans. In this section, we further examine this conjecture with two sets of tests that focus on stocks rather than flows. First, we examine whether there is a net effect of bank selling activity on loan holdings. This will allow us to rule out the alternative hypothesis that low-capital banks simply trade more often on both the buy and sell sides. Second, we examine the relation between bank capitalization and nonbank share at the loan level. Naturally, if capital-constrained banks obtain funding from nonbank investors, these loans should have a greater nonbank share.

Table 4 analyzes the relation between bank capital and nonbank entry. We first estimate a modified version of Equation (1) that replaces the loan sale indicator as independent variable with a continuous measure of loan share retention. In particular, we use the dollar value of loan share i held by bank j scaled by lagged total assets ($Loan\ Share_{ijt}/Assets_{ij,t-1}$), which captures a bank's net exposure to a given loan with its portfolio. Column [1] estimates this model with loan and year fixed effects, as well as the full set of time-varying bank controls. The coefficient on *Tier 1 Capital/RWA* is positive (4.030) and statistically significant at the 1% level. In Column [2], we include bank fixed effects to control for time-invariant differences between banks and find similar effects in terms of sign and significance. Thus, consistent

This is likely to reflect the strong connection that we uncover between sales and the regulatory capital treatment of nonperforming loans.

with regulatory capital constraints and selling activity mattering for net loan exposure, banks with higher Tier 1 capital retain a greater exposure to a given loan on their balance sheet.

Given the evidence, it seems almost tautological that nonbanks will fill the gap when capital-constrained banks reduce exposure. However, it may be the case that credit is exclusively reallocated to other commercial banks.[19] This would limit the ability of bank capital constraints to explain nonbank entry into the syndicated loan market.

The remaining columns of the table therefore examine the relation between nonbank entry and bank capital. We collapse the data to the loan-year level and estimate our baseline regression model with bank- and loan-level controls. Nonbank entry ($Nonbank\ Share_{it}$) for loan i in year t is measured as the fraction of the loan held by nonbanks. The (lagged) Tier 1 capital ratio is now measured at the syndicate level by aggregating across banks within each loan-year, and similarly for the bank control variables.

In Column [3], we take the simple average of bank characteristics across syndicate member banks, and uncover a negative relation between Tier 1 capital and the nonbank share (significant at the 1% level). In terms of economic magnitudes, this point estimate indicates that a one-standard-deviation decrease in bank capital (2.1%) results in a 3.25 percentage point increase in nonbank share, which is 14.1% of the mean nonbank share (23.1%). Column [4] finds similar effects once we additionally control for loan characteristics. In Column [5], we instead aggregate by taking the median value of each bank characteristic among syndicate members, which mitigates the effects of outliers. Column [6] interacts Tier 1 capital with the TED spread and shows larger effects when banks' costs of funding are elevated. Finally, Columns [7] and [8] analyze the subsample of regulatory "fail" loans (5,380 loans) and find the effect of capital on nonbank share intensifies for these capital-intensive loans when the TED spread is high.

Overall, the point estimates indicate that—after netting out trading activity—syndicates

[19] In Section 3.4, we provide evidence that some loan shares are purchased by well-capitalized banks.

composed of less well-capitalized banks tend to feature higher nonbank holdings. Consistent with the selling behavior in Table 2, these effects amplify, first, when funding conditions tighten and, second, among loans that the regulator labels as nonperforming.

3.3 Plausibly exogenous variation from U.S. implementation of Basel III

Having established a robust negative association between bank capital and loan sales and nonbank entry, we next address a residual identification concern. While the loan-year specification takes care of loan-related factors, as discussed earlier, there remains a potential concern about omitted variables on the supply side. If these omitted variables jointly influence bank capital and loan sales activity, then the correlations reported so far could be spurious. While our examination of regulatory loan ratings and the inclusion of bank fixed effects helps—by alleviating concerns about persistent bank characteristics, such as risk attitudes—it cannot resolve the issue if these bank-level omitted variables are moving over time.

We address this endogeneity concern using a difference-in-differences approach based on plausibly exogenous variation in regulatory capital among U.S. banks that are active in the syndicated loan market. We focus on the shocks to bank capital due to the U.S. implementation of the Basel III regulation. The Basel Committee on Banking Supervision (BCBS) announced a new set of regulatory reforms in late 2010, including higher minimum capital standards for all banks.[20] However, the precise implementation of these rules in the United States proposed by its banking agencies in 2012:Q2 differed along at least two important dimensions.[21] First, the U.S. version of the rule proposed adjustments to the

[20]The BCBS announced its endorsement of Basel III on September 12, 2010 (`www.bis.org/press/p100912.htm`), and the contents of the reform were made public in December 2010 (`www.bis.org/publ/bcbs189_dec2010.pdf`).

[21]The Board of Governors of the Federal Reserve System made this announcement on June 7, 2012

list of items that counted toward Tier 1 capital. For example, it included in Tier 1 capital unrealized gains and losses in available-for-sale securities, but removed some preferred stock and trust preferred securities. The discrepancy in the treatment of mortgage servicing rights was a particularly big surprise.[22] Second, it adjusted how risk is accounted for among many exposures. Notably, the U.S. proposal included more refined risk measurement for residential mortgages, as well as greater risk-weights for high-volatility commercial real estate.

Generally speaking, the BCBS-endorsed Basel III capital reforms increased capital requirements for all banks relative to Basel I (i.e., for a given level of bank capital and risk weighted assets). Moreover, the proposed U.S. implementation increased capital requirements even further (Berrospide and Edge 2016). Our expectation is that, under the new regime, banks with larger regulatory capital shortfalls will need to recapitalize more and this will induce greater loan sales.

What is important for our purposes is that the surprising features of the U.S. rule created unexpected "winners" and "losers" in the cross-section of banks. Naturally, depending on their ex ante exposure to these U.S. adjustments, some banks will experience a larger shortfall in regulatory capital under Basel III after the announcement of the U.S. rule. Crucially, this will be the case even among banks with similar risk-taking profiles ex ante, for example, regulatory capital buffers under Basel I.

We can use this variation in regulatory capital shortfalls around the announcement of the U.S. rule to improve identification under two assumptions. The first, at least some of the specific features of the U.S. implementation constitute a shock in the sense that they were not anticipated by banks. This assumption is benign in the sense that if banks fully anticipate

(www.federalreserve.gov/newsevents/pressreleases/bcreg20120607a.htm).

[22] Under the proposal, among other punitive changes, the value of mortgage servicing rights could count for only up to 10% of a bank's common equity, as compared with 50% before. See "Basel requirements could shift mortgage servicing rights," *HousingWire.com*, October 18, 2012 (www.housingwire.com/articles/basel-requirements-could-shift-mortgage-servicing-rights and www.fdic.gov/regulations/laws/federal/2012-ad-95-96-97/2012-ad-95-96-97_c_334.pdf).

the negative implications of the U.S. rule for their capital positions, then they might decide to reduce risk-weighted assets by selling corporate loans prior to the announcement. This would lead us to underestimate the effects of the rule change. Second, we require that banks' capital shortfalls under the proposed rule do not systematically differ along dimensions that would otherwise induce loan sales. While we can never exclude this possibility, we know that the prominent discrepancies in the U.S. rule concerned real estate exposures. In addition, we examine several forward-looking measures of bank risk—especially risk in the syndicated loan portfolio—and show that the variation in bank capital induced by the announcement is uncorrelated.

To implement this test, we use data from the Expanded Shared National Credit Program, which, in 2009, began to collect information on syndicated loans meeting the standard SNC at the quarterly frequency. Aside from the higher frequency of the data, the data structure is otherwise the same as the annual SNC described thus far. Table 5 summarizes the data. All variables are measured as of 2012:Q2, except for the loan sales variable, which is measured as a flow from 2012:Q2 to 2012:Q3. Compared with the annual sample from 1992 to 2015, loans in 2012:Q2 are larger in size and more widely distributed (lower *Loan Share/Assets*).

The main dependent variable of interest is the *Basel III Tier 1 Shortfall*, which is the difference between a given bank's Tier 1 capital under Basel I and under the announced U.S. implementation of Basel III. This variable is calculated for each bank given their capital and risk weighted assets as of 2012:Q2.

Since the post-crisis Basel III reform raised capital requirements for all banks, the shortfall is always negative, but we can see there is considerable heterogeneity between banks in terms of the severity of the shock. When we split the sample at the median shortfall, two important patterns emerge. First, while there are big differences in the capital shortfalls between the groups, we see that there is considerable overlap in the distributions of *Tier 1 Capital/RWA*. We can therefore find banks with similar regulatory capital going into the announcement that were assigned quite different shortfalls in the wake of the announcement. Second, there do not appear to be clear systematic differences in bank characteristics between the two groups, including forward-looking measures of loan performance. Importantly, there is no statistically significant difference in *Average(Loan PD)*, which indicates that the average probabilities of default among the syndicated loans of both groups were similar.

Table 6 documents the influence of the 2012:Q2 capital reform for loan sales. To confirm the relevance of the shock, Column [1] shows the "first-stage" effect of the rule change on regulatory capital. This is a bank-level regression of the change in Tier 1 capital (under Basel III) at the one-year horizon from 2012:Q2 to 2013:Q2. Column [1] shows a negative relation between the capital shortfall and changes in the capital ratio going forward. That is, banks that were more undercapitalized had a (more negative shortfall) increased regulatory capital by a greater amount over the subsequent year. The effect of the shortfall for regulatory capital holds after we control for the level of capital under Basel I in 2012:Q2, highlighting the incremental effect of the new regime for bank decision-making.

Columns [2] to [8] show how banks engage in loan sales to meet the unexpected shortfall. Since this is a single cross-section, these regressions are at the loan share–bank level and include loan fixed effects. Thus, we identify the effect of the rule change off within-loan variation, analogously to Equation (1). The negative and statistically significant coefficient in Column [2] indicates that banks with a greater capital shortfall were more likely to sell loan shares. Columns [3] and [4] of the table replicate earlier robustness checks, and, notably, show that the rule change does not simply induce a reshuffling of claims among banks.

Column [5] repeats the test from Column [2], excluding loan fixed effects to examine the exogeneity of the capital shortfall variable. Importantly, the point estimates are very similar in terms of size and statistical significance, indicating that the variation in sales behavior across loans is close to the variation in sales within loans. This supports our argument that the trading activity is most likely in response to the shock to regulatory capital, as opposed to correlated demand-side factors (e.g., Altonji et al. 2005).

Column [6] implements a "placebo" rule change in 2011:Q2 and shows that the capital shortfall does not predict a greater incidence of loan sales from 2011:Q2 to 2011:Q3. This allows us to rule out the alternative that these sales were part of an ongoing trend of deleveraging among low-capital banks.

Columns [7] and [8] consider mortgage servicing rights as an alternative measure of banks' exposure to the shock. As described above, the treatment of mortgage servicing rights were surprisingly punitive under the U.S. Basel III implementation. Moreover, the size of the mortgage servicing business is plausibly exogenous with respect to risk in the syndicated loan portfolio, as of 2012:Q2. We implement this test using an indicator variable (*High MSR Exposure*) that is equal to one for banks with above-median mortgage servicing rights and zero otherwise. Confirming with the results for the Basel III capital shortfall, we find that banks with high exposure via mortgage servicing rights are more likely to sell off loans.[23]

Finally, Columns [9] and [10] show the implications for nonbank entry. In line with the previous section, we aggregate our data to the loan syndicate level in the quarters before and after the policy change. We then measure the change in the fraction of nonbanks in each syndicate (Δ*Nonbank Share*) in the period surrounding the policy change and regress this variable on the syndicate-level measures of banks' exposure to the shock. We adapt our measurement of bank-level exposure to the syndicate level along the lines of Section 3.2 by taking the maximal capital shortfall (Column [9]) and holdings of mortgage servicing rights (Column [10]) among banks in the syndicate. We include our set of bank controls (averaged among banks in the syndicate), as well as loan controls (loan maturity and loan quality).[24] The point estimates indicate that loan syndicates with a higher capital shortfall (greater

[23]In unreported tests, we confirm that each of the robustness checks shown in Columns [3] to [6] hold for the mortgage servicing rights variable. For example, the coefficient on *High MSR Exposure* is virtually identical when we exclude loan fixed effects from the regression, consistent with its exogeneity.

[24]The Expanded SNC provides loan-share level probabilities of default, so we take the average across banks. This allows for more accurate measurement of quality, compared with the regulatory assessment.

mortgage servicing rights) have a larger increase in nonbank holdings in the quarter after the U.S. capital rule was announced.

Overall, these patterns are consistent with our interpretation that low-capital banks decide to reduce risk-weighted assets to boost their regulatory capital ratios. We document how nonbanks fill the funding gaps created by these sales. In the next section, we document an important consequence of this nonbank entry for market quality.

3.4 Nonbank Funding and Loan Price Volatility

Having connected bank capital constraints to a shift in the composition of credit toward nonbanks, we next investigate a potential negative spillover of this reallocation: its impact on transaction prices during times of marketwide stress. Funding fragility may force financial institutions to sell assets to meet liquidity needs in a crisis, even when transactions must occur below fundamental values (Shleifer and Vishny 2011). Since nonbank financial institutions play an important role in funding syndicated loans, sales by stressed nonbanks, particularly those with fragile funding structures, may therefore have important implications for price volatility in the secondary market.

We collect secondary market price data from the Loan Syndication and Trading Association (LSTA) Mark-to-Market Pricing data. These data provide daily bid and ask quotes for a subset of syndicated term loans in the SNC. We calculate the daily loan price as the midpoint of the (average) bid and ask quote.[25] Our main dependent variable in this section is the 2007 to 2008 annual change in the secondary market loan price, which is the difference between the average daily price in 2008 and the corresponding value in 2007.

Figure 6 plots daily secondary market loan prices during the period from the beginning of 2007 until the end of 2009. We plot the average price across all loans in our sample, splitting

[25] When loans have quotes from multiple dealers, we average quotes across dealers. Since we use quote rather than transaction data, we interpret our estimates as changes in the willingness-to-pay for the subset of traded loans.

loans according to whether they have an above- or below-median fraction of nonbank funding in 2006. The plot shows that the average price drop from the peak in January 2007 to the trough in January 2009 is about –35 percentage points. The price rebounds thereafter. Most loans traded close to par before the summer of 2007, although loans with greater nonbank funding appear to trade at a slight discount. The plot also suggests that the steepness of this price drop—as much as an 8-percentage-point spread—is positively related to the nonbank funding of the syndicate.

Figure 7 further disaggregates this data according to the liability structure of the nonbanks funding each syndicate. Based on the nonbank classification defined in Section 1.2, we group nonbanks according to whether they have "stable" or "unstable" liabilities. Nonbanks with stable liabilities include insurance companies and pension funds. The liabilities of these institutions have long and predictable durations with limited redemption risk (Chodorow-Reich et al. 2016). Nonbanks with unstable liabilities include broker-dealers, hedge funds, and other investment funds.[26] In contrast, these institutions have liquid liabilities and often face sharp withdrawals during times of marketwide stress.[27] Strikingly, the plot suggests that the cross-sectional heterogeneity in loan prices is associated with the liability structure of the nonbank syndicate members. In particular, loans with an above-median share of unstable nonbank funding experience sharp declines in prices relative to syndicates with below-median unstable funding. No such price differential exists among loans with stable nonbank funding.

We use multivariate linear regression models to more rigorously investigate the relation between syndicate funding structure and the potential discounts at which term loans are

[26]Our classification is imperfect as we do not have data on the liability structure of these financial institutions. For example, some investment funds might have long lockup periods and therefore little redemption risk, whereas others might be exchange-traded. Likewise, we do not classify CLOs as either stable or unstable, since we do not know when they mature.

[27]For example, Goldstein et al. (2017) show that corporate bond fund outflows are very sensitive to poor performance, especially when the fund is invested in relatively illiquid assets and when aggregate uncertainty is high.

traded during the financial crisis. We estimate cross-sectional regressions of the form:

$$\Delta Loan\ Price_{i,t} = \alpha + \beta\ Nonbank\ Share_{i,t-1} + \gamma\ X_{i,t-1} + \epsilon_{i,t}, \tag{2}$$

where $\Delta Loan\ Price_{i,t}$ is the average annual change in the price of loan i from 2007 to 2008, and $Nonbank\ Share_{i,t-1}$ is the share of nonbank funding of the syndicate as of 2006. A negative coefficient on $Nonbank\ Share$ implies that loans with greater nonbank funding are associated with steeper price drops from 2007 to 2008.

We identify β from variation in outcomes across loans, as opposed to within loans. In $X_{i,t-1}$, we therefore must control for differences in loan quality, which may also determine loan price dynamics. As a reduced form for loan risk, we include the average loan price level in 2007. While the majority of loans trade at par, there is some variation around this value that likely captures loan quality. We also control for the (log) remaining maturity of the loan to proxy for effective seniority, and an indicator variable for whether the loan is downgraded by the regulator in either 2007 or 2008. The latter variable allows us to account for ex post changes in credit risk. Finally, we control for the balance sheet characteristics of the banks within each syndicate—size, wholesale funding, and so on—since balance sheet outcomes may influence trading activity. These variables are measured for each bank as of 2006:Q4, and aggregated to the syndicate level using an equally weighted average.

Table 7 describes the 116 loans in the SNC-LSTA matched sample and the financial institutions funding them. The loans were trading at 97.9 cents in the relatively benign period in 2007. The average loan price was 8.8 percentage points lower in 2008. In terms of the institutions funding the loans, about 45% of the loans are funded by nonbanks, and 9.5% and 1.8% are funded by unstable and stable nonbanks, respectively. Relative to the SNC population, the commercial banks funding the loans are larger and more reliant on wholesale funding. This reflects the fact that traded loans with prices publicly posted by the LSTA are larger and more widely distributed.

Table 8 presents results on the influence of nonbanks for loan trading and price volatility in the period from 2007 to 2008. Column [1] first estimates the relation between creditor identity and loan sales behavior. We estimate a version of our baseline loan-year fixed effects model (Equation (1)) that replaces bank characteristics with an indicator variable for whether a lender is a nonbank or a commercial bank. The point estimate is positive (0.018) and statistically significant at the 1% level. This indicates that nonbanks are about two percentage points more likely to sell the same loan, relative to commercial banks, in 2008.

The remaining columns of the table show the results of estimating Equation (2) at the loan level, which captures loan price effects. As indicated in Column [2], there is a negative and statistically significant estimated effect of the share of nonbanks funding the loan on the secondary market price change during the crisis. Column [3] includes loan and bank control variables, and the coefficient on nonbank share remains negative and statistically significant, although the coefficient reduces in size (from –0.084 to –0.049), indicating that these other factors play an important role. In terms of economic magnitudes, the conservative point estimate in Column [3] indicates that a one-standard-deviation increase in the nonbank share (0.344) is associated with a –1.69-percentage-point price change from 2007 to 2008. This indicates that the nonbank share accounts for 19.2% of the mean fall in loan prices (–8.8 percentage points).

Columns [4] to [9] repeat the estimation disaggregating the nonbank share into the unstable and stable nonbank share components. Two important results emerge that mirror the graphical evidence shown in Figure 7. First, the coefficient on *Unstable Nonbank Share* is negative and significant, whereas the coefficient on *Stable Nonbank Share* is statistically insignificant. Second, in terms of magnitudes, the most conservative point estimate for unstable nonbanks (–0.182, see Column [9]) is far larger than for all nonbanks (–0.049, see Column [3]). These patterns hold for the full sample of loans, as well as the subsample of

(79) loans containing both stable and unstable nonbanks. Thus, sales by nonbanks with fragile funding—broker-dealers, hedge funds, and other investment funds—are associated with large and negative price effects during 2008.

3.4.1 Who buys during the crunch?

To further understand why these price effects in 2008 came about, we examine the relation between the funding structure of financial institutions and loan purchasing activity. To this end, we collect all loan-share buy and sell transactions during 2007 and 2008. Loan buys are identified along the lines of loan sales: an institution j buys loan i in year t if it enters in t but is not present in year $t-1$. Based on these transactions, we analyze whether, first, banks with higher capital and, second, nonbanks with stable funding have greater propensities to purchase rather than sell loans in the secondary market.[28]

Panel A of Table 9 tests whether banks with greater regulatory capital were more likely to buy or sell loan shares through secondary transactions. We do these tests by comparing the average Tier 1 capital ratio of banks selling loan shares with the corresponding value for buying banks. We begin by examining the 2008 ("crisis") period of marketwide stress, with Tier 1 capital measured as of 2007:Q4, and find consistent evidence that banks buying loan shares had higher capital than banks selling loan shares. Columns [1] to [3] of the panel show, first, that the number of loan share sales during the crisis (1,069) exceeds the corresponding number of loan share sales in the year immediately prior to the crisis (701). Overall sales activity increased by banks during the crisis, and the gap between buys and sells closed relative to the period before the crisis. Second, the average Tier 1 capital ratio of buyers exceeded the sellers' average by one percentage point. This difference increases to 1.1 percentage points for amendment-free trades and is significant at the 1% confidence level for both samples. In contrast, immediately prior to the crisis we find some evidence that

[28] It is important to note that regression analyses based on buyer identity are infeasible, since we observe only the actual buyer and not a well-defined set of potential buyers; i.e., we do not have a clear counterfactual.

buyers have more equity capital than sellers, although the differences are less economically meaningful.

In panel B of Table 9, we examine statistics on the trading activity for stable and unstable nonbanks in the aggregate, both during the crisis and immediately prior. The evidence shown is consistent with the idea that stable nonbanks provide liquidity during the crisis. Notably, during the crisis, unstable nonbanks sold a larger fraction of their loan holdings (9.86%), as compared with stable nonbanks (6.50%). Furthermore, the selling rate of stable banks decreased relative to the pre-crisis period, whereas the opposite is true for the unstable nonbank group. When we look at buying activity in the crisis, a similar pattern emerges: stable nonbanks had a higher buying rate (13.18% of lagged holdings) compared with unstable nonbanks (9.20%). And, while both sets of nonbanks increased buying rates relative to the pre-crisis period, the effect was clearly more dramatic for the stable nonbanks (7.02 percentage points versus 1.27 percentage points for the unstable group).

Overall, the influence of nonbank ownership for loan trading activity and price declines is consistent with selling pressure being exerted on loans by nonbanks with fragile funding. On the buy side, these nonbanks do not increase loan share holdings, whereas nonbanks with stable funding and well-capitalized banks do. Taken together with our previous results, this finding highlights how capital constraints among regulated entities can contribute to greater volatility in asset prices during times of marketwide stress.

4 Conclusion and Policy Implications

We provide new evidence on the role of bank capital constraints for the emergence of nonbank financial institutions. We analyze the U.S. syndicated loan market using a novel U.S. credit register that tracks loan retention in terms of both stocks and flows, control for variation in loan quality using a loan-year fixed effects approach, and exploit plausibly exogenous bank capital changes. Our central result is that a tightening of bank capital regulation increases nonbank presence. In particular, weakly capitalized banks reduce loan exposure—notably, via loan sales—and less-regulated nonbanks take up the slack. These effects are stronger for loans with higher capital requirements (risk weights) and at times when bank capital is more costly. We also document spillovers of this reallocation of credit, in particular, loans funded by nonbanks with more fragile liabilities experience greater turnover and price volatility during the 2008 episode.

Our results can be interpreted more broadly in terms of the important policy debate on the consequences of bank capital regulation, including macroprudential regulation that aims to mitigate systemic risk (Freixas et al. 2015). Such regulation may improve the resilience of the commercial banking sector and credit markets. For example, nonbanks may have the flexibility to provide substitute credit when bank capital constraints bind, thus allowing borrowers to maintain access to credit. In line with this reasoning, there have been recent policy initiatives in Europe that aim to improve and even create secondary markets for banks to offload their riskier loans to other banks or nonbanks ECB (2017). In addition, nonbanks may be more diversified and less systemically-important, and hence the shifting of risks toward the nonbank sector could improve overall financial stability.

However, the credit reallocation might be counterproductive if the risks are simply transferred to unregulated entities that also pose risks to the financial system. As the theoretical literature argues, if shadow banks have less stable funding—say, due a lack of government guarantees—they may exacerbate secondary market price volatility during times of marketwide stress.[29] Such negative spillovers to market prices may have adverse consequences for other market participants (Brunnermeier and Pedersen 2008), thus potentially increasing

[29]Relatedly, Bruche et al. (2018) argue that information problems between banks and institutional investors—which may become worse during a downturn—may lead to instability in the primary markets. Furthermore, nonbanks may be less well informed than banks and less able to monitor the risks inherent in lending, and therefore less able to handle subsequent losses after a negative shock (Piskorski et al. 2010).

the vulnerability of the financial system to shocks. Consequently, shifting loans (potentially with higher credit risk) to nonbanks could increase overall risk in ways that could be harder to supervise, especially if these financial intermediaries are outside of the regulatory perimeter.

Our paper highlights at least part of the connection from bank capital regulation to nonbank market penetration, and then from nonbank holdings to secondary market prices during bad times. To further dissect the benefits and costs of nonbanks in modern credit markets, and how these entities interact with monetary policy and other forms of financial regulation, remains a fruitful area for future research.

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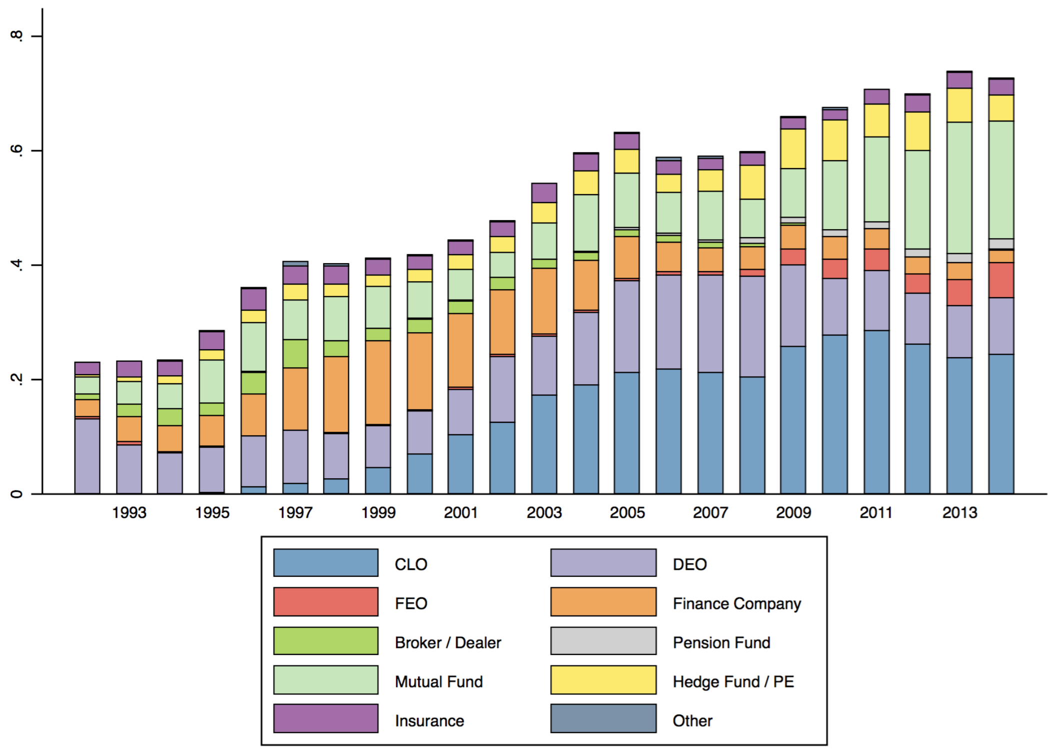


Figure 1

Nonbank share of U.S. syndicated term loans by entity type (annual, 1992–2014)
Composition of funding by lender type. DEO and FEO stand for other domestic and foreign entity, respectively. The categories in the figure refer to groups of financial firms and, to ensure confidentiality, data for no individual firm is disclosed. Source: SNC.

(a) Level

(b) Market share

Figure 2
Secondary market sells of term loan shares (annual, 1993–2014)
Total value in billions of dollars of syndicated term loans registered with the Shared National Credit Program that were sold in the secondary market during the period from 1992 until 2014. The figure shows sales in levels (top panel) and the lender composition (bottom panel). A loan share is a fraction of a syndicated loan commitment. A loan share sale occurs when a financial institution reduces its ownership stake in a loan share relative to the previous year. The categories in the figure refer to groups of financial firms and, to ensure confidentiality, data for no individual firm is disclosed. Source: SNC.

(a) Level

(b) Market share

Figure 3
Secondary market buys of term loan shares (annual, 1993–2014)
Total value in billions of dollars of syndicated term loans registered with the Shared National Credit Program that were bought in the secondary market during the period from 1992 until 2014. The figure shows buys in levels (top panel) and the lender composition (bottom panel). A loan share is a fraction of a syndicated loan commitment. A loan share buy occurs when a financial institution increases its ownership stake in a loan share relative to the previous year. The categories in the figure refer to groups of financial firms and, to ensure confidentiality, data for no individual firm is disclosed. Source: SNC.

(a) Level

(b) Market share

Figure 4
Secondary market sells of distressed term loan shares (annual, 1993–2014)
Total value in billions of dollars of distressed syndicated term loans registered with the Shared National Credit Program that were sold in the secondary market during the period from 1992 until 2014. The figure shows sales in levels (top panel) and the lender composition (bottom panel). A loan share is a fraction of a syndicated loan commitment. A loan share sale occurs when a financial institution reduces its ownership stake in a loan share relative to the previous year. The categories in the figure refer to groups of financial firms and, to ensure confidentiality, data for no individual firm is disclosed. Source: SNC.

(a) Level

(b) Market share

Figure 5

Secondary market buys of distressed term loan shares (annual, 1993–2014)

Total value in billions of dollars of distressed syndicated term loans registered with the Shared National Credit Program that were bought in the secondary market during the period from 1992 until 2014. The figure shows buys in levels (top panel) and the lender composition (bottom panel). A loan share is a fraction of a syndicated loan commitment. A loan share buy occurs when a financial institution increases its ownership stake in a loan share relative to the previous year. The categories in the figure refer to groups of financial firms and, to ensure confidentiality, data for no individual firm is disclosed. Source: SNC.

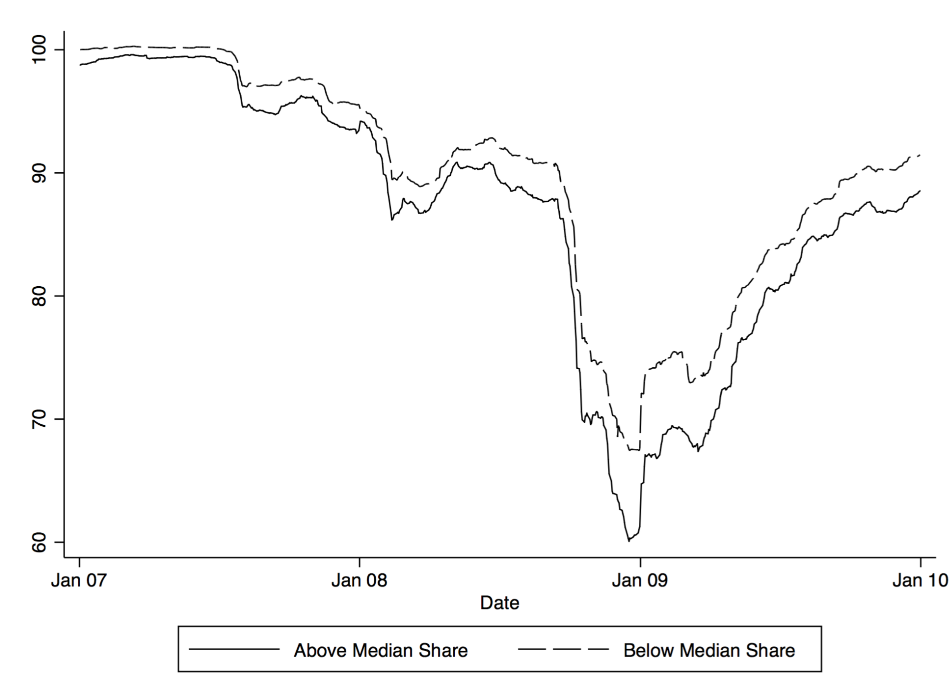
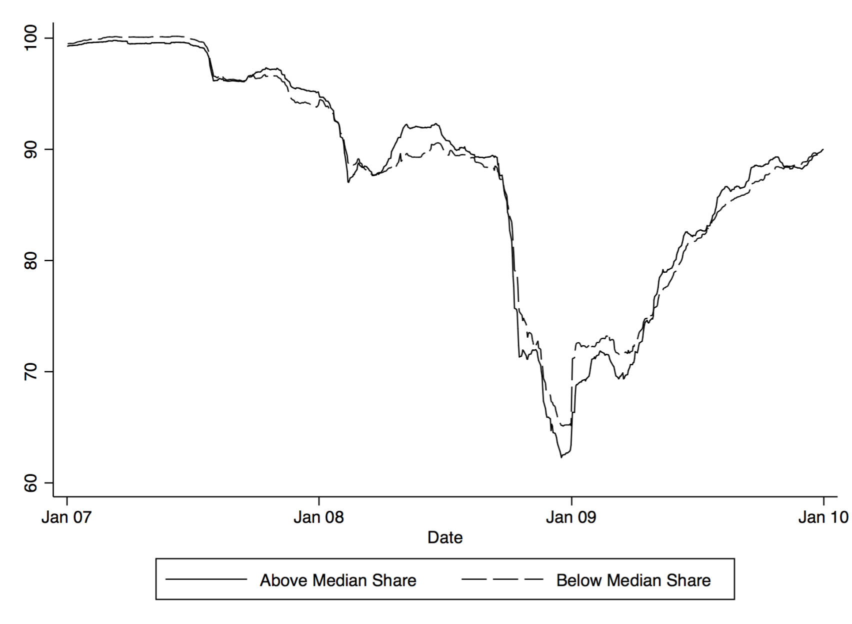
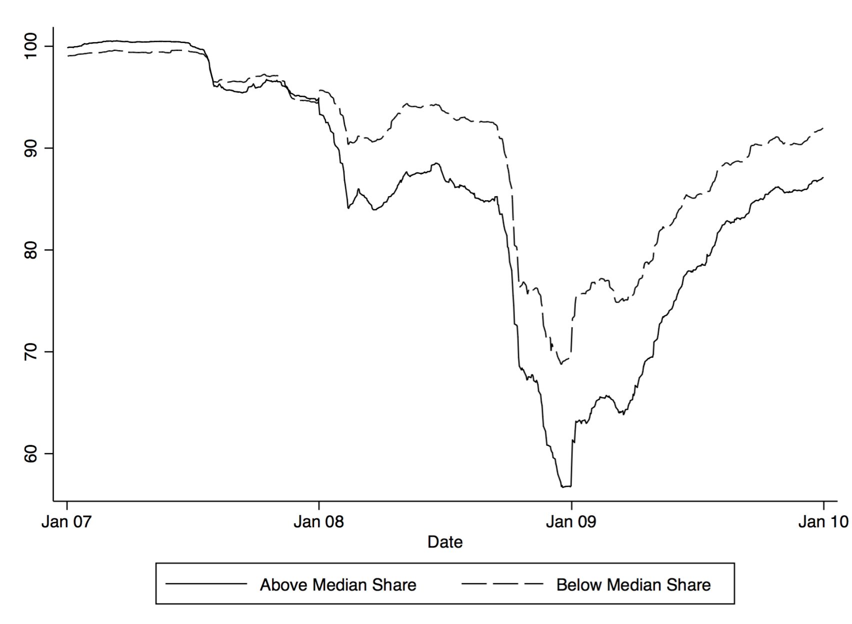


Figure 6
Nonbank share and loan prices (daily, 2007–2009)
Average price (bid-ask midpoint) among traded syndicated term loans with above (solid) and below (dashed) median nonbank share. Nonbank share is the ratio of nonbank investment to total loan commitment. Source: SNC, LSTA.



(a) Stable liabilities



(b) Unstable liabilities

Figure 7
Nonbank liability structure and loan prices (daily, 2007–2009)
Average price (bid-ask midpoint) among traded syndicated term loans with above (solid) and below (dashed) median nonbank share in each category. The figure classifies syndicates according to whether nonbank syndicate members have stable (top panel) or unstable (bottom panel) liability structures. Nonbanks with stable liabilities are pension funds and insurance companies. Nonbanks with unstable liabilities are hedge funds, private equity, broker/dealers, and mutual funds. Nonbank share is the ratio of nonbank investment to total loan commitment. Source: SNC, LSTA.

Table 1
Summary statistics for banks and loan sales tests

Panel A summarizes the loan-level data. The sample period is from 1992 to 2015. The sample is restricted to loans held by at least two U.S. bank holding companies with valid covariates at the beginning of the year. Loan-level variables are averaged (unweighted) across loan share-years. Bank-level variables are averaged across bank-years. Panel B provides bank-level summary statistics split by above- and below-median beginning-of-year *Tier 1 Capital/RWA*. All variables are defined in Appendix A.

	N	Mean	Std.	p25	Med.	p75	*N*	Mean	Std.	p25	Med.	p75
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Panel A: Loan-level variables												
Loan Sale	161,794	0.370	0.483	0	0	1						
Loan Share/Assets	161,794	0.676	1.865	0.027	0.104	0.383						
Loan Size	161,794	274.0	619.0	34.5	95.0	256.0						
Agent Bank	161,794	0.181	0.385	0	0	0						
Non-Bank Share	39,058	0.231	0.320	0	0	0.403						
Panel B: Bank-level variables												
	Below-median capital						Above-median capital					
Tier 1 Capital/RWA	2,017	0.100	0.014	0.092	0.101	0.112	2,018	0.175	0.060	0.135	0.153	0.191
Tier 1 Gap	2,017	–0.009	0.020	–0.022	–0.011	0.003	2,018	0.006	0.040	–0.018	0.000	0.023
Total Capital/RWA	2,017	0.115	0.012	0.107	0.115	0.124	2,018	0.187	0.061	0.147	0.166	0.203
Equity/Assets	2,017	0.085	0.021	0.072	0.082	0.094	2,018	0.115	0.036	0.091	0.106	0.130
Bank Size	2,017	13.80	1.883	12.49	13.63	14.90	2,018	12.69	1.766	11.44	12.43	13.75
Wholesale Funding	2,017	0.300	0.146	0.192	0.285	0.389	2,018	0.231	0.147	0.126	0.202	0.297
Real Estate Loan Share	2,017	0.607	0.194	0.496	0.637	0.753	2,018	0.631	0.217	0.513	0.685	0.795
C&I Loan Share	2,017	0.116	0.101	0.011	0.110	0.170	2,018	0.062	0.086	0	0.015	0.101
Non-Interest Income	2,017	0.154	0.099	0.088	0.136	0.195	2,018	0.153	0.123	0.075	0.121	0.192

Table 2
Bank regulatory capital and syndicated loan sales

This table shows the effects of bank regulatory capital for loan sales. The unit of observation in each regression is a loan share-bank-year triple. The dependent variable is an indicator variable equal to one if a lender reduces its ownership stake in a loan that it funded in the previous year. Column [1] includes the sample of loans from 2002 to 2015. Column [2] interacts capital with the TED spread (TED_t), defined as the yearly average of the daily difference between the three-month London Interbank Offered Rate (LIBOR) and the three-month U.S. Treasury rate. Note that TED_t is demeaned. Columns [3] and [4] classify a loan as "Pass" by the examining agency if it has not been criticized in any way and "Fail" otherwise (i.e., the loan is rated special mention, substandard, doubtful, or loss). All columns include controls for bank and loan-year fixed effects, and an indicator variable for whether the bank has undergone a merger in the past year. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denote 1%, 5%, and 10% statistical significance, respectively.

Dependent variable: *Loan Sale*$_{ijt}$			Regulatory rating	
	Baseline	Dynamic	Pass	Fail
	[1]	[2]	[3]	[4]
Tier 1 Capital/RWA$_{t-1}$	–0.158***	–0.189***	–0.108*	–0.499**
	(0.057)	(0.050)	(0.060)	(0.196)
Tier 1 Capital/RWA$_{t-1}$ × *TED*$_t$		–0.292***		
		(0.070)		
Size$_{t-1}$	–0.004	0.005	–0.002	–0.012
	(0.004)	(0.003)	(0.004)	(0.012)
Wholesale Funding$_{t-1}$	0.110***	0.100***	0.111***	0.121**
	(0.017)	(0.014)	(0.018)	(0.057)
Real Estate Loan Share$_{t-1}$	0.020	0.043***	0.027	–0.036
	(0.019)	(0.017)	(0.020)	(0.062)
C&I Loan Share$_{t-1}$	–0.119***	–0.052**	–0.076**	–0.303***
	(0.030)	(0.026)	(0.031)	(0.004)
Non-Interest Income$_{t-1}$	0.009	–0.003***	–0.001***	–0.003***
	(0.018)	(0.000)	(0.000)	(0.001)
Loan Share/Assets$_{t-1}$	0.006***	0.005***	0.006***	0.008
	(0.001)	(0.001)	(0.002)	(0.005)
Agent Bank$_{t-1}$	–0.028***	–0.027***	–0.026***	–0.033***
	(0.003)	(0.003)	(0.003)	(0.009)
Bank controls × *TED*$_t$	N	Y	N	N
Bank fixed effects	Y	Y	Y	Y
Loan-year fixed effects	Y	Y	Y	Y
Observations	97,238	97,238	83,759	13,479
R^2	0.878	0.873	0.881	0.870

Table 3
Bank capital and loan sales: Further tests

This table shows robustness checks for the effects of bank regulatory capital for loan sales. The unit of observation in each regression is a loan share-bank-year triple. The dependent variable is an indicator variable equal to one if a lender reduces its ownership stake in a loan that it funded in the previous year. In panel A, Column [1] excludes loans made to finance, insurance, and real estate sectors. Column [2] restricts the sample to loan years in which no contract amendment or refinancing took place during the year. Column [3] includes credit line loan shares in the sample. Column [4] examines the extended time period, including from 1992 to 2001, where the loan secondary market was less active. Column [5] drops the bank and loan-year fixed effects. Panel B examines alternative measures of bank regulatory capital as independent variables and repeats the tests described in Table 2. All columns include bank controls shown in Table 2, controls for bank and loan-year fixed effects, and an indicator variable for whether the bank has undergone a merger in the past year. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denote 1%, 5%, and 10% statistical significance, respectively.

Panel A: Robustness checks

Dependent variable: *Loan* $Sale_{ijt}$

	Exclude FIRE	No Amend	Credit lines	Alternate timing	Exclude fixed effects
	[1]	[2]	[3]	[4]	[5]
Tier 1 Capital/RWA_{t-1}	–0.179***	–0.151**	0.051	–0.044	–0.198***
	(0.061)	(0.060)	(0.037)	(0.027)	(0.054)
Bank controls	Y	Y	Y	Y	Y
Bank fixed effects	Y	Y	Y	Y	N
Loan-year fixed effects	Y	Y	Y	Y	N
Observations	83,707	87,510	343,241	161,794	97,238
R^2	0.878	0.878	0.712	0.860	0.100

Panel B: Alternative measurement of regulatory capital

Dependent variable: *Loan* $Sale_{ijt}$

Regulatory capital measure:	*Tier 1* Gap_{t-1}				*Total Capital/*RWA_{t-1}			
			Regulatory rating				Regulatory rating	
	Baseline	Dynamic	Pass	Fail	Baseline	Dynamic	Pass	Fail
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$Capital_{t-1}$	–0.469***	–0.314***	–0.479***	–0.470*	–0.171***	–0.185***	–0.127***	–0.484***
	(0.077)	(0.079)	(0.082)	(0.256)	(0.047)	(0.047)	(0.049)	(0.148)
$Capital_{t-1} \times TED_t$		–0.698***				–0.300***		
		(0.118)				(0.073)		
Bank controls	Y	Y	Y	Y	Y	Y	Y	Y
Bank controls × TED_t	N	Y	N	N	N	Y	N	N
Bank fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Loan-year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	97,238	97,238	83,759	13,479	97,238	97,238	83,759	13,479
R^2	0.872	0.873	0.876	0.854	0.872	0.873	0.876	0.854

Table 4
Nonbank entry

This table shows the effects of bank regulatory capital for loan retention by banks and nonbanks. In Columns [1] and [2] the unit of observation in each regression is a loan share-bank-year triple. The dependent variable is the loan size in dollars scaled by bank assets at the end of the previous year. In Columns [3] to [8] the unit of observation in each regression is a loan-year. The dependent variable is the fraction of the loan held by nonbanks. Columns [6] and [8] interact bank capital with the TED spread (TED_t), which is defined as the yearly average of the daily difference between the three-month London Interbank Offered Rate (LIBOR) and the three-month U.S. Treasury rate. Note that TED_t is demeaned. Columns [7] and [8] consider loans that have been classified as "Fail" by the examining agency. These are loans rated special mention, substandard, doubtful, or loss. Where indicated, independent variables—bank controls shown in Table 2—are coded at the loan syndicate level by taking the simple average across syndicate member banks or the median value among syndicate members. The sample period is from 1992 to 2015. Where indicated, the columns include controls for bank, loan, and year fixed effects, and loan controls (a regulatory pass/fail dummy and the natural logarithm of loan maturity). All variables are defined in Appendix A. Where "N/A" is shown, this indicates that the controls in question cannot be included in the regression. Standard errors (in parentheses) are clustered at the loan and year levels in Columns [1] to [2] and [3] to [8], respectively. ***, **, * denote 1%, 5%, and 10% statistical significance, respectively.

Dependent variable:	$Loan\ Share_{ijt}/Assets_{j,t-1}$		$Nonbank\ Share_{it}$					
Syndicate aggregation:	None	None	Mean	Mean	Median	Mean	Mean	Mean
Regulatory rating:	All	All	All	All	All	All	Fail	Fail
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Tier 1 Capital/RWA$_{t-1}$	4.030***	2.153***	–1.547***	–1.582**	–1.334***	–1.460***	–1.406***	–1.025***
	(0.347)	(0.281)	(0.470)	(0.640)	(0.467)	(0.183)	(0.304)	(0.316)
Tier 1 Capital/RWA$_{t-1}$ × TED_t						–2.954***		–4.655***
						(0.601)		(0.980)
Bank controls	Y	Y	Y	Y	Y	Y	Y	Y
Loan controls	N/A	N/A	N	Y	Y	Y	Y	Y
Bank fixed effects	N	Y	N	N	N	N	N	N
Loan fixed effects	Y	Y	N	N	N	N	N	N
Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	161,794	161,794	39,058	29,121	29,107	29,121	5,380	5,380
R^2	0.635	0.860	0.102	0.203	0.196	0.210	0.266	0.270

Table 5
Summary stats for Basel III capital shortfall tests

Panel A summarizes the quarterly loan-level data. The sample includes data from 2012:Q2 and 2012:Q3. The sample is restricted to loans held by at least two U.S. bank holding companies with valid covariates as of 2012:Q2. Loan-level variables are averaged (unweighted) across loan share-years. Bank level variables are averaged across bank-years. Panel B provides bank-level summary statistics split by above- and below-median *Basel III Tier 1 Shortfall* as of 2012:Q2. All variables are defined in Appendix A.

	N	Mean	Std.	p25	Med.	p75	N	Mean	Std.	p25	Med.	p75	$\Delta_{\overline{X}}$	(t-stat.)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
Panel A: Loan-level variables														
Loan Sale	34,648	0.025	0.156	0	0	0								
Loan Share/Assets	34,648	0.125	0.148	0.028	0.075	0.160								
Loan Size	34,648	582.0	887.0	115.0	300.0	700.0								
Agent Bank	34,648	0.164	0.370	0	0	0								
Panel B: Bank-level variables														
	Below-median capital shortfall						Above-median capital shortfall							
Basel III Tier 1 Shortfall	125	–0.043	0.009	–0.050	–0.040	–0.036	126	–0.020	0.007	–0.025	–0.021	–0.016	–0.023	(–21.82***)
Tier 1 Capital/RWA	125	0.149	0.031	0.125	0.145	0.172	126	0.131	0.028	0.111	0.129	0.146	0.018	(4.850***)
Bank Size	125	15.49	1.445	14.31	15.17	16.16	126	15.40	1.723	14.22	14.61	15.90	0.090	(0.440)
Wholesale Funding	125	0.187	0.091	0.130	0.174	0.217	126	0.184	0.092	0.123	0.161	0.228	0.003	(0.190)
Real Estate Loan Share	125	0.685	0.192	0.617	0.743	0.845	126	0.674	0.181	0.600	0.706	0.825	0.011	(0.890)
C&I Loan Share	125	0.206	0.120	0.113	0.169	0.261	126	0.201	0.115	0.128	0.173	0.242	0.005	(0.450)
Non-Interest Income	125	0.264	0.169	0.160	0.235	0.318	126	0.246	0.150	0.153	0.220	0.290	0.018	(0.360)
Return-on-Assets	125	0.004	0.004	0.003	0.004	0.006	126	0.004	0.003	0.003	0.004	0.006	0.000	(0.030)
Loan Loss Provision	125	0.002	0.003	0.000	0.001	0.002	126	0.001	0.001	0.000	0.001	0.002	0.001	(1.700*)
Allowance for Loan Losses	125	0.000	0.000	0.000	0.000	0.000	126	0.000	0.000	0.000	0.000	0.000	0.000	(0.940)
Average(Loan PD)	125	0.045	0.110	0.003	0.010	0.031	126	0.070	0.195	0.002	0.008	0.035	0.030	(1.290)

Table 6
Basel III capital shortfall and bank loan sales

This table shows the effects of the 2012:Q2 proposed changes in bank capital regulation under Basel III for loan sales. The independent variable of interest, *Basel III Tier 1 Shortfall*, measures the bank-level difference between the current (under Basel I) and proposed level of regulatory capital under Basel III. In column [1] the unit of observation in each regression is a bank. The dependent variable is the change in the Tier 1 capital ratio under Basel III from 2012:Q2 to 2013:Q2. In the remaining columns, the unit of observation in each regression is a loan share-bank double. The dependent variable is an indicator variable equal to one if a lender reduces its ownership stake in a loan in 2012:Q3 that it funded in 2012:Q2. Column [3] excludes loans made to finance, insurance, and real estate sectors. Column [4] restricts the sample to loans for which no contract amendment or refinancing took place during 2012:Q2 or 2012:Q3. Column [5] drops loan fixed effects from the estimation. Column [6] falsely assigns the change in capital regulation to 2011:Q2. Columns [7] and [8] use the above-median value of mortgage servicing rights (*High MSR Exposure*) as an alternative measure of banks' capital shortfall. Columns [9] and [10] use the loan syndicate-level change in the nonbank share as the dependent variable and aggregate the independent variables to the syndicate level (i.e., maximum capital shortfall and MSR exposure dummy). Where indicated, columns control for loan fixed effects, and indicator variables for whether loans shares are held by nonbanks or foreign banks. All columns include the bank control variables shown in Table 2, as well as *Loan Sale Propensity*, given by the fraction of loan shares sold per quarter, time-averaged between 2009:Q4 and 2012:Q2. Where indicated, columns include loan controls (loan-level average default probability and log loan maturity). All variables are defined in Appendix A. Where "N/A" is shown, this indicates that the controls in question cannot be included in the regression. Standard errors (in parentheses) are clustered at the bank, loan, and year levels in Columns [1], [2] to [8], and [9] to [10], respectively. ***, **, * denote 1%, 5%, and 10% statistical significance, respectively.

Dependent variable:	Δ*Basel III Tier 1/RWA*$_j$	*Loan Sale*$_{ij}$							Δ*Nonbank Share*$_i$	
			Exclude FIRE	No amend	Exclude fixed effects	2011:Q2 placebo	Alternative measurement			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Basel III Tier 1 Shortfall	–0.152***	–0.382***	–0.409***	–0.463***	–0.491***	0.211		–0.279**	–0.095**	
	(0.041)	(0.135)	(0.147)	(0.150)	(0.133)	(0.165)		(0.138)	(0.044)	
High MSR Exposure							0.014***	0.012***		0.006***
							(0.003)	(0.003)		(0.002)
Tier 1 Capital/RWA	–0.164***	–0.295***	–0.307***	–0.349***	–0.248***	–0.188*	–0.003	–0.143*	0.048	0.155
	(0.021)	(0.068)	(0.073)	(0.079)	(0.066)	(0.081)	(0.051)	(0.077)	(0.185)	(0.176)
Bank controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loan controls	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Y	Y
Loan fixed effects	N/A	Y	Y	Y	N	Y	Y	Y	N/A	N/A
Observations	838	218,252	188,932	143,345	218,252	212,855	218,252	218,252	2,121	2,121
R^2	0.167	0.136	0.134	0.122	0.046	0.152	0.136	0.136	0.994	0.994

Table 7
Summary statistics for loan price impact tests

The unit of observation in each panel is a loan. Syndicate member characteristics are measured as of 2006:Q4 and equally weighted average across all banks in the syndicate. *Loan Price Change* is measured from the beginning of 2007 until the end of 2008. All variables are defined in Appendix A.

	N	Mean	Std.	p25	Med.	p75
	[1]	[2]	[3]	[4]	[5]	[6]
Panel A: Loan characteristics						
Loan Price Change	116	–0.088	0.072	–0.118	–0.070	–0.041
Loan Price Level	116	0.979	0.024	0.973	0.986	0.992
Log(Remaining Maturity)	116	3.664	1.157	3	4	4.5
Non-Pass	116	0.198	0.400	0	0	0
Panel B: Syndicate member characteristics						
Nonbank Share	116	0.453	0.344	0.119	0.398	0.837
Unstable Nonbank Share	116	0.095	0.112	0	0.057	0.147
Stable Nonbank Share	116	0.018	0.032	0	0	0.024
Tier 1 Capital/RWA	116	0.105	0.051	0.079	0.083	0.102
Bank Size	116	18.83	1.169	18.18	18.89	19.39
Wholesale Funding	116	0.421	0.041	0.396	0.415	0.445
Real Estate Loan Share	116	0.260	0.078	0.221	0.248	0.283
C&I Loan Share	116	0.476	0.110	0.408	0.500	0.542
Non-Interest Income	116	0.154	0.031	0.136	0.153	0.174

Table 8
Nonbank loan share and price drop in 2007–2008

This table examines the effects of regulatory capital for the change in the secondary market loan price. In Column [1] the unit of observation in the regression is a loan share-bank-year triple. The dependent variable is an indicator variable equal to one if a lender—classified as either bank or nonbank—reduced its ownership stake in a loan that it funded in the previous year. In Columns [2] to [9] the unit of observation in each regression is a loan. The dependent variable is the 2007 to 2008 change in the price level. The price level is measured as the average bid-ask midpoint. Nonbanks with unstable liabilities include broker-dealers, hedge funds, and other investment funds, and nonbanks with stable liabilities include insurance companies and pension funds. Columns [5], [7], and [9] require stable and unstable nonbanks to be present in the syndicate for sample inclusion. Bank-level variables are averaged across all bank syndicated members (equally-weighted) as of 2006:Q4. Loan-level variables are measured as of 2006:Q4, except for *Non-Pass*, which is measured over 2007 and 2008. Where indicated, columns include the bank controls shown in Table 2 (equal-weighted average across syndicate members), as well as loan-year fixed effects. All variables are defined in Appendix A. Where "N/A" is shown, this indicates that the controls in question cannot be included in the regression. Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, * denote 1%, 5%, and 10% statistical significance, respectively.

Dependent variable:	$Loan\ Sale_{ij}$	$\Delta Loan\ Price_i$							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
$Nonbank_{t-1}$	0.018***								
	(0.003)								
$Nonbank\ Share_{t-1}$		–0.084***	–0.049**						
		(0.023)	(0.019)						
$Unstable\ Nonbank\ Share_{t-1}$				–0.236***	–0.182**			–0.230***	–0.182**
				(0.061)	(0.090)			(0.064)	(0.091)
$Stable\ Nonbank\ Share_{t-1}$						–0.237	0.006	–0.114	0.020
						(0.243)	(0.302)	(0.251)	(0.288)
$Non\text{-}Pass_{t-1}$			0.012	0.003	–0.011	0.001	–0.012	0.005	–0.011
			(0.019)	(0.017)	(0.020)	(0.018)	(0.019)	(0.016)	(0.018)
$Log(Remaining\ Maturity)_{t-1}$			0.006	0.010*	0.015**	0.004	0.011*	0.009*	0.015**
			(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)
$Loan\ Price_{t-1}$			1.468***	1.344***	1.466***	1.414***	1.600***	1.350***	1.466***
			(0.329)	(0.334)	(0.382)	(0.352)	(0.365)	(0.326)	(0.387)
Bank controls (synd. avg.)	N/A	Y	Y	Y	Y	Y	Y	Y	Y
Loan-year fixed effects	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Observations	204,533	116	116	116	79	116	79	116	79
R^2	0.641	0.238	0.458	0.511	0.569	0.443	0.532	0.512	0.569

Table 9
Further evidence on term loan trading activity

The table describes the identity buyers and sellers of term loan shares during the crisis (2008) and immediately prior to the crisis (2007). Panel A considers measures of bank Tier 1 capital for all buy and sell transactions by banks. A transaction is classified as a loan share sale (buy) whenever a bank that was (was not) in the syndicate in the previous year is not (is now) present this year. "No amendments" excludes transactions in years where the loan contract is amended. Each cell shows the average characteristic of the banks engaged in a loan share transaction as either sellers or buyers. A simple average is taken across loan transactions. The number of loan transactions (N) is indicated. The difference in the mean characteristic for each transaction type is indicated. The t-value from an independent two-sample test with equal variances are shown below in parentheses. ***, **, and * denote 1%, 5%, and 10% statistical significance, respectively. Panel B describes secondary market trading activity by nonbanks in the aggregate. As before, stable nonbanks include insurance companies and pension funds, and unstable nonbanks include broker-dealers, hedge funds, and other investment funds. Each cell shows the aggregate characteristic of the nonbank group engaged in a loan share transaction as either sellers or buyers.

Panel A: Role of bank capital

Sample:	All trades			No amendments		
	Sellers	Buyers	Diff. [t-value]	Sellers	Buyers	Diff. [t-value]
	[1]	[2]	[3]	[4]	[5]	[6]
Crisis						
Tier 1 Capital/RWA$_{t-1}$	0.087	0.097	–0.010***	0.087	0.098	–0.011***
			[-9.23]			[-12.26]
N	1,069	1,179		541	361	
Pre-crisis						
Tier 1 Capital/RWA$_{t-1}$	0.090	0.091	–0.001	0.091	0.091	0.000
			[–0.96]			[0.06]
N	701	1,186		300	308	

Panel B: Stable and unstable nonbank trading activity

Timing:	Crisis			Pre-crisis		
	Stable	Unstable	Diff.	Stable	Unstable	Diff.
	[1]	[2]	[3]	[4]	[5]	[6]
Loans sold$_t$/holdings$_{t-1}$ (%)	6.50	9.86	–3.36	6.73	6.87	–0.14
Loans bought$_t$/holdings$_{t-1}$ (%)	13.18	9.20	3.98	6.16	7.93	–1.77
Number of sells	316	1,355		191	583	
Number of buys	641	1,265		175	673	

Appendix A: Variable definitions

This appendix presents the definitions for the variables used throughout the paper.

Variable	Definition	Source
Panel A: Loan characteristics		
Loan Sale	Indicator variable equal to one if bank reduces its stake in a loan syndicate that it participated in last year that continues to exist in the current year	SNC
Loan Share/Assets	Fraction of total loan commitment held by syndicate member	SNC, Y-9C
Loan Size	Dollar value of loan commitment	SNC
Agent Bank	Indicator variable equal to one if lender identified as administrative agent	SNC
Nonbank	Indicator variable equal to one if lender is nonbank	SNC
Nonbank Share	Share of loan held by nonbanks	SNC
Unstable Nonbank Share	Share of loan held by broker-dealers, hedge funds, and other investment funds	SNC
Stable Nonbank Share	Share of loan commitment held by insurance and pension funds	SNC
Loan Price	Bid-ask quote midpoint	LSTA
Log(Remaining Maturity)	Natural logarithm of the number of years until loan matures	SNC
Non-Pass	Indicator variable equal to one if loan is distressed	SNC
Panel B: Bank characteristics		
Tier 1 Capital/RWA	Ratio of Tier 1 capital to risk-weighted assets	Y-9C
Tier 1 Gap	Difference between actual and predicted Tier 1 capital ratio, where the predicted value comes from a regression of *Tier 1 Capital/RWA* on bank size, return-on-assets, Tier 1 leverage, and year fixed effects	Y-9C
Total Capital/RWA	Ratio of Tier 1 and Tier 2 capital to risk-weighted assets	Y-9C
Total Capital/RWA	Ratio of bank equity to total assets	Y-9C
Basel III Tier 1 Shortfall	Difference between current Tier 1 capital under Basel I and proposed Tier 1 capital requirement under Basel III (as of 2012:Q2)	Y-9C
Wholesale Funding	Sum of large time deposits, foreign deposits, repo sold, other borrowed money, subordinated debt, and federal funds purchased divided by total assets	Y-9C
Real Estate Loan Share	Real estate loans divided by total loans	Y-9C
Bank Size	Natural logarithm of total assets	Y-9C
C&I Loan Share	C&I loans divided by total loans	Y-9C
Non-Interest Income/Net Income	Non-interest income divided by net income	Y-9C
Loan Sale Propensity	Average fraction of loan shares sold per quarter (2009:Q4–2012:Q2)	SNC
Return-on-Assets	Net income divided by total assets	Y-9C
Loan Loss Provision	Loan loss provision this quarter over assets	Y-9C
Foreclosures	1-4 family residential real estate loans in foreclosure over assets	Y-9C
Allowance for Loan Losses	Sum of past provisions minus sum of past recoveries over assets	Y-9C
Average(Loan PD)	Average loan-level probability of default	SNC