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Loan Sales and Bank Liquidity Risk Management: Evidence from a U.S. Credit Register*

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Abstract

We examine the impact of banks' liquidity risk management on secondary loan sales. We track the dynamics of bank loan share ownership in the secondary market using data from the Shared National Credit Program, a credit register of syndicated bank loans administered by U.S. regulators. We analyze the 2007–2009 financial crisis as a market-wide liquidity shock and control for loan demand using a loan-year fixed effects approach. We find that banks with greater reliance on wholesale funding at the onset of the crisis were more likely to exit loan syndicates during the crisis. Our analysis identifies the importance of bank liquidity risk management as a motivation for loan sales, in addition to the credit risk transfer motive emphasized in prior literature.

JEL Classification: G01; G21; G23.

Keywords: Loan Sales; Wholesale Funding; Bank Risk Management; Financial Crisis.

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1 Introduction

Modern banks provide liquidity on demand to depositors and supply funds to borrowers through loans and lines of credit (Kashyap et al., 2002). Accordingly, bank liquidity risk management involves maintaining a store of liquid assets and access to various borrowing sources to guard against unexpected cash shortfalls. Recent financial innovations such as securitization (Loutskina, 2011; Loutskina and Strahan, 2009), as well as changes in banks' liability structure—notably, an increased dependence on short term wholesale funding (Adrian and Shin, 2010)—have had a profound impact on liquidity risk management at modern banks.[1] An important strand of academic research examines how such changes enhance banks' ability to provide liquidity and also looks at whether they make the financial system more fragile (Diamond and Rajan, 2011; Shleifer and Vishny, 2010, 2011).

This paper examines an increasingly important financial innovation: the secondary market for bank loans. Since the arrival of an active secondary market in the mid-1990s, bank loans have experienced a considerable increase in liquidity.[2] Data from the Loan Syndications and Trading Association (LSTA) indicate that the secondary market grew rapidly from 2000 until 2007, exceeding $100 billion of trading volume each year and peaking in excess of $350 billion in 2007.[3] This development raises the question of how bank liquidity risk management has changed in the presence of a deep and liquid secondary loan market.

[1] Although market-based wholesale funding can provide banks with greater flexibility, it may also increase vulnerability to market-wide liquidity shocks (e.g., Acharya et al., 2013a; Allen and Gale, 2000; Huang and Ratnovski, 2011). One key reason is that uninsured wholesale creditors incur greater credit risk and thus stronger incentives to promptly withdraw funds in stress scenarios (e.g., the asset-backed commercial paper crisis of August of 2007; see Acharya et al., 2013c; Covitz et al., 2013).

[2] The market for bank loans can be broken down into two categories: the "primary" or "syndicated" loan market and the "seasoned" or "secondary" loan sales market. In the primary market, fractions of a loan are shared with a number of banks and other institutional investors during the loan origination process. An established literature examines various aspects of the primary market (for a survey, see Roberts and Sufi, 2009b). On the other hand, transactions in the secondary market involve a bank selling an existing participation in a loan (or the loan in its entirety) to another investor after origination (for historical and institutional details, see Altman et al., 2010; Gorton and Pennacchi, 1995; Taylor and Sansone, 2007).

[3] LSTA data shows loan trading was resilient during 2007–2010. For example, loan trading volume in 2008 remained above $300 billion, while concurrent liquidity and trading in structured finance products froze.

Indeed, the ability of banks to easily sell loans may create an additional source of liquidity that allows banks to better manage both bank-specific and market-wide liquidity shocks.

We document how banks used loan sales to manage the market-wide liquidity shock that occurred during the financial crisis of 2007–2009. Anecdotal evidence suggests that banks were engaging in loan sales at the portfolio-level during this period due to funding troubles.[4] We conduct a micro-level analysis using essentially the universe of syndicated loan shares held by U.S. bank holding companies, which establishes, on the most granular scale, that banks with greater exposure to the liquidity shock—as measured by wholesale funding dependence at the onset of the crisis—were more likely to sell shares of syndicated loans in the secondary market during the crisis. Thus, we provide new evidence of how banks experiencing liquidity shortages use secondary market loan sales to achieve their liquidity risk management goals.

Our empirical tests are based on a confidential credit register of U.S. syndicated loan commitments (including term loans and drawn and undrawn lines of credit), the Shared National Credit Program, which is maintained 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 allows us to track the dynamics of loan share ownership in the years following origination. We use these data to identify sales of loan shares, which correspond to share ownership transfers occurring after origination, i.e., in the secondary market. To be precise, the central object of interest in our paper is the loan share sale, which is defined to occur whenever a U.S. bank holding company reduces its ownership stake in a syndicated loan in the current year relative to the previous year.

Figures 1 and 2 provide aggregated evidence on loan share sales behavior by U.S. bank holding companies from 1994 until 2010. Figure 1 shows considerable counter-cyclical variation in sales including peaks during 2002 and 2008–2010. Figure 2 shows that from the 2004

[4]For example, Citigroup's leverage loan portfolio sale of about $12.5 billion of assets in April 2008; see `www.bloomberg.com/apps/news?pid=newsarchive&sid=aFmnHyfCud_s&refer=home`.

trough to the 2009 peak, the fraction of all loan shares sold (in their entirety) doubled from just above 6% to around 13%. In this paper, we use this comprehensive data source to shed light on the bank-level determinants of these syndicated loan sales.

We link our data set on syndicated loan share ownership to bank-level balance sheet information to estimate the causal effect of liquidity risk management considerations, particularly wholesale funding dependence, on the loan sale decision during the financial crisis. We design our empirical strategy to address a classic identification problem: To credibly identify a bank liquidity risk management motivation for loan sales we must adequately control for changes in credit demand (e.g., unobservable changes in borrower default risk; see Khwaja and Mian, 2008). We address this identification problem using a loan-year fixed effects approach that exploits the multi-bank financing aspect of loan syndication, as well as complete information on loan share holdings and the panel structure of our data set. Our approach accounts for changes in borrower investment opportunities and risk at the *loan syndicate level* by comparing the loan sale decision across lenders as a function of wholesale funding dependence within a given loan syndicate-year pair.

Our results can be summarized as follows. We find banks more exposed to the market-wide liquidity shock had a higher probability of selling loan shares during the crisis. This relation is pervasive across all industry groupings and independent of loan performance, providing strong evidence in favor of a bank liquidity-driven effect. We examine the timing of this effect and find the positive relation between wholesale funding and loan sales peaks in 2008, at the time when wholesale funding markets were most stressed (e.g., see Acharya and Mora, 2013; Cornett et al., 2011). We examine the types of loans that were most likely to be sold and find that exposed banks were most likely to sell more liquid loans. For example, the estimated effect of wholesale funding dependence on loan sales for term loans is almost twice the effect for credit lines.[5] We investigate the role of banks' holdings of liquid assets (e.g.,

[5]Kashyap et al. (2002) show that deposit-taking commercial banks have a comparative advantage at

cash) on the relation and find higher liquid holdings mitigates the funding effect. We examine secondary loan share purchases and show that buyers were less reliant on wholesale funding during the crisis, especially during 2008. Finally, we analyze the impact of bank solvency on loan sales and two important results emerge. First, loan losses and insolvency risk (e.g., net charge offs and participation in the Troubled Asset Relief Program, respectively) have a significant impact on loan sales during the crisis (Adrian and Shin, 2010; Pennacchi, 1988). Second, there is an independent and strong effect of wholesale funding dependence on loan sales during the crisis, even after we control for several established measures of loan losses and insolvency risk. Overall, these results establish that banks exposed to the market-wide liquidity shock and liquidity shortages during the financial crisis used secondary loan sales to manage liquidity.

We also examine the bank-level determinants of loan sales in the relatively benign period from 2003 until 2006. We find robust evidence that bank capital constraints as well as the role of the bank in the lending syndicate are key determinants of the loan sale decision. Finally, and in sharp contrast to the crisis period, we find that banks with wholesale funding dependence are significantly *less likely* to sell loans, perhaps due to greater financial flexibility. This contrast indicates that banks' exposure to the drying up of liquidity in the recent financial crisis was an important determinant of the increase in loan sales.

Our paper relates to an established literature on the causes and consequences of bank loan sales. Previous research examines the motivations for loan sales from the perspective of the bank (e.g., as a function of the cost of capital, as in Demsetz, 1999; Parlour and Winton, 2013; Pennacchi, 1988), as well as contracting features that must emerge to overcome informational issues and ensure bank loans are marketable (Drucker and Puri, 2009; Gorton and Pennacchi, 1995). Gande and Saunders (2012) show, in recent years, borrowers' shareholders

managing the liquidity risk associated with credit lines. This advantage is reflected by commercial banks retaining the bulk of these commitments in the primary market, as compared to term loans which are held by a variety of financial institutions (Bord and Santos, 2012; Gatev and Strahan, 2009).

have benefited from increased liquidity in the secondary loan market due to a relaxation of borrowers' financial constraints. This contrasts earlier studies documenting a negative stock market reaction to loan sales, perhaps due to a negative signaling effect or termination of a valuable bank–borrower relationship (e.g., Berndt and Gupta, 2009; Dahiya et al., 2003). Our study advances this literature by providing new evidence of a bank liquidity risk management motivation for loan sales using a comprehensive sample of loan share sales from a regulatory data source that covers a long time horizon, including the post-2000 period of rapid expansion of the secondary market for corporate loans.

Second, our findings relate to recent work on bank liquidity risk management and wholesale funding dependence during the financial crisis. Acharya and Mora (2013) show that banks with greater exposure to the market-wide liquidity shock increased deposit rates and curtailed loan supply during the crisis (see also Dagher and Kazimov, 2014). Cornett et al. (2011) show that U.S. commercial banks with wholesale funding dependence cut lending and increased cash holdings during the crisis to conserve liquidity. Acharya et al. (2013a) and Bord and Santos (2014) show how banks with greater exposure to the asset-backed commercial paper crisis during the fall of 2007 adjusted their liability structure and credit line issuance in an attempt to increase their liquidity. Similarly, Acharya and Merrouche (2013) show during the same period that UK settlement banks with greater dependence on short term funding hoarded liquidity in the interbank market for precautionary purposes. Our paper provides additional insights into how wholesale-funded banks adjust their behavior when these sources of funding dry up. In particular, we show these banks were able to sell loans in the secondary market to handle liquidity shortages. Thus, we provide new empirical evidence of an alternative liquidity risk management tool at the disposal of commercial banks, a tool that was actively used during the recent financial crisis.[6]

[6]Other papers that focus on how banks sought out liquidity through interbank markets and lender of last resort facilities during the recent financial crisis include Acharya et al. (2014), Adrian et al. (2010), Afonso et al. (2011), Armantier et al. (2011), Campbell et al. (2011), Cassola et al. (2009), Drechsler et al. (2013),

Third, our paper relates to research on how financial institutions transmit balance sheet shocks to asset markets and the real economy (for a survey, see Shleifer and Vishny, 2011). Manconi et al. (2012) provide evidence of funding-driven fire sales of relatively liquid corporate bonds by mutual funds during the recent crisis (see also Ellul et al., 2011; Jotikasthira et al., 2012). Our results also indicate that during the crisis banks had a greater propensity to sell liquid loans, although we do not explicitly examine price pressure resulting from funding-driven bank loan share sales. Finally, empirical research on the effect of bank liquidity and capital shocks on primary loan issuance in the United States includes Peek and Rosengren (1997), Kashyap and Stein (2000), Ivashina and Scharfstein (2010), and Santos (2011). Our paper complements this research by showing how banks actively manage their *existing* loan portfolio in response to a liquidity shock, in addition to curtailing new lending to the market.

This rest of this paper is organized as follows. Section 2 summarizes the data and Section 3 the empirical framework. Section 4 presents the results. Section 5 concludes.

2 Data and Summary Statistics

We use two main data sets for our empirical analysis: bank-level data on U.S. bank holding companies and loan share-level data on syndicated loans granted by U.S. banks. We obtain quarterly bank holding company balance sheet data from the Federal Financial Institutions Examination Council (FFIEC) Consolidated Financial Statements for Holding Companies (Form FR Y9-C). Every bank holding company must file these reports with the Federal Reserve.[7] We collect loan share-level data from the Shared National Credit Program (SNC), an annual survey of syndicated loans carried out by the Board of Governors of

Duygan-Bump et al. (2013), Fleming et al. (2010), McAndrews and Wang (2008), and Wu (2011).

[7]The Y9-C is almost identical to the Call Reports banks have to file with their primary regulator (for details on Call Reports, see Cornett et al., 2011). Y9-C data are available for download at the website of the FFIEC; see `www.ffiec.gov/nicpubweb/nicweb/nichome.aspx`.

the Federal Reserve System, the Federal Deposit Insurance Corporation, the Office of the Comptroller of the Currency, and, until recently, the Office of Thrift Supervision.[8]

The SNC is a credit register of syndicated loans with coverage from 1977 to the present. The program obtains confidential information from administrative agent ("agent") banks on all loan commitments (including term loans and drawn and undrawn lines of credit) exceeding $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 to the same borrower for the same origination date where the total package of loans exceeds $20 million.[9] New and existing loans meeting this criteria are surveyed on December 31 each year.

For each qualifying loan, information is provided about the identity of the borrower, as well as several terms of the contract including the origination date, the maturity date, the type of loan (e.g., credit line or term loan), and the regulatory assessment of loan quality (pass or fail). Crucially, the SNC data provide complete information on loan syndicate membership each year following origination. That is, for each year, the program identifies the agent bank and non-agent ("participant") lenders, as well as their respective shares of the loan commitment. Each loan in the SNC is assigned a unique credit identifier. This identifier remains unchanged in years when the loan terms are amended or the loan is refinanced.

The SNC offers two distinct advantages over other commonly used data sets of syndicated loans, such as the Reuters' Loan Pricing Corporation DealScan data set. First, the researcher can track ownership of syndicated loan shares and see how they are distributed after origination. In contrast, DealScan provides a snapshot of loan ownership at origina-

[8]Some recent papers use this data. Notably, Mian and Santos (2011) is a notable example of a paper using this data. focus on liquidity risk management *from the perspective of the borrower* and examine loan refinancing behavior over the credit cycle.

[9]Information on the purpose of the SNC is provided at `www.federalreserve.gov/bankinforeg/snc.htm` and detailed information on guidelines for inclusion of a credit are provided at `www.newyorkfed.org/banking/reportingforms/guidelines.pdf`.

tion, i.e., in the primary market. Second, refinanced or amended loans do not appear as new credits in the SNC data. With DealScan, in most cases such loans appear with a new credit identifier (see Freudenberg et al., 2013; Roberts, 2012; Roberts and Sufi, 2009a). This can lead to a double-counting problem that makes identifying a given borrower's stock of loans—especially for private firms—without further inspection of public filings.[10]

For each loan and year of the SNC, the data have one observation per loan share, so each observation can be identified as a loan share-lender-year triple. To ensure this identifier is unique, if a lender holds several shares of the same loan in a given year, then we aggregate all shares to arrive at a total loan share-lender-year triple. This occurs either because the same institution owns several shares of the same loan or different institutions belong to the same holding company. In the case of banks and their subsidiaries, the data identify the current holder of a loan share by the RSSD ID number and the ultimate parent (bank or financial holding company) of the lender, commonly referred to as the "top holder." This paper focuses exclusively on these U.S. bank holding companies and we conduct our regression analysis at the top-holder level. Lenders belonging to the same bank holding company are assigned to a common top holder and considered as a single "bank" (for a similar approach, see Acharya and Mora, 2013; Gatev and Strahan, 2006; Kashyap et al., 2002). This total loan share-lender-year triple is the unit of observation in our analysis.

We use the SNC data set to track the dynamics of loan share ownership and identify sales of loan shares occurring after origination, i.e., ownership transfers occurring in the secondary market. We identify sales of loan shares on a loan-by-loan basis by comparing the set syndicate members between two consecutive years. In particular, if a lender is a member

[10]Bord and Santos (2012) carefully compare average yearly dollar volume of U.S. issuances in the SNC and DealScan from 1988–2010 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. Indeed, 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 about 95% of DealScan loans meet both SNC criteria. Hence, we believe the impact of sample selection is minimal and unlikely to bias our estimates (see also Mian and Santos, 2011).

of a loan syndicate in year t but not in the same loan syndicate in year $t+1$, then we record a loan share sale for $t+1$.[11] We require that the loan has not matured in year $t+1$ to avoid the problem of all lenders being coded as selling their participations at maturity.

In some tests, we distinguish between loan-years in which there are no changes in the underlying contract and loan-years in which the loan is refinanced or some terms of the loan were amended. In such cases the credit identifier will not change, so we pinpoint refinanced or amended loans by observed changes in maturity dates, origination dates, or total loan amounts at origination. In our tests, we sometimes use a restricted "No Amend" sample including only loan share sales that occur in years with no contract term changes or refinancing activity. This classification is imperfect, however, as the SNC data set does not contain information about some material contract terms including loan pricing. We use this sample to directly address the concern that a *borrower* may remove a bank from its loan syndicate for credit demand reasons, under the assumption that it is more difficult to do so when the contract is not renegotiated or refinanced. We discuss the use of this sample in more detail in the identification strategy section.

The SNC data structure also allows us to control for merger and acquisition activity among banks and potential misclassification of loan sales. Sales are identified on the lender level, typically a commercial bank subsidiary, and assigned to a top holder, which is usually a bank holding company. If the lender RSSD ID does not change but the top holder RSSD ID does change, then we record this instance as a merger and not a sale. For example, if bank holding company A acquires bank holding company B—and A consolidates its loan portfolio

[11] For simplicity, our baseline tests do not include partial loan sales, where a bank reduces but retains a positive share of loan ownership from one year to the next. In the data we observe such transactions occurring infrequently, particularly among participant lenders. Nevertheless, such partial loan share sales may be important for the lead arranger who may be constrained from exiting the syndicate—perhaps due to reputation concerns—and may instead choose to reduce their exposure to a borrower. Along these lines, Bord and Santos (2012) provide evidence that, on average, lead arrangers *partially* reduce their ownership of term loans in the secondary market, particularly in the post-1994 period. In Section 4.2.5 we show that our point estimates increase in magnitude when we include these partial sales, consistent with this interpretation.

with B's—then we do not record B's disposal of loan shares as a sale in the year when the balance sheet consolidation takes place. Similarly, sometimes a loan share is transferred from one lender to another lender but both have the same top holder. Such within-banking organization reallocations of loan shares are not recorded as sales.[12]

We start our analysis of loan share sales by U.S. bank holding companies using aggregate evidence gathered from the SNC. Figure 1 plots loan share sales in terms of number sold and dollar value of these sales during the period from 1994 until 2010. The figure indicates that secondary market sales activity by U.S. bank holding companies trended upwards over time, increasing from approximately zero transactions in 1994 to nearly 30,000 shares sold with a dollar value of $200 billion in 2010.[13] There is a cyclical pattern in loan share sales with the total dollar value of sales exhibiting peaks in 2002 and from 2008 to 2010, while dipping from 2003 to 2007. Similarly, the total number of loan share sales increased from 1994 to 2002 and then slowed until 2007 before sharply accelerating in the recent recession.

Figure 2 plots the aggregate loan share sales trends, now scaled by beginning-of-year total shares (left axis) and total loan commitments (right axis) in the SNC data. We do this for two reasons. First, to measure the economic importance of loan sales by U.S. bank holding companies. Second, since we know that primary market issuance of syndicated loans is highly cyclical (see, for example, Ivashina and Scharfstein, 2010), to examine whether this economic importance fluctuates over the credit cycle. Figure 2 indicates that both the economic importance of loan sales by U.S. bank holding companies is both large in magnitude and cyclical. Focusing on sales as a fraction of total loan commitments, we see the dollar share of commitments sold by U.S. bank holding companies increases from, roughly, 3% in

[12]Within-bank loan transfers are interesting in their own right but are beyond the scope of this paper.

[13]This is less than the $350 billion in trading volume in 2007 reported by the LSTA for at least four reasons. First, our focus is on loan share sales. Second, we examine U.S. bank holding companies. Third, the annual frequency SNC data may omit ownership transfers with multiple legs occurring within a given year. Fourth, we require a loan to be in the SNC for two consecutive years, so we may omit trades of short maturity or maturing loans, as well has those trades occurring before the first respective SNC review.

1995 to 10% in 2010. Moreover, this magnitude varies over the cycle from a peak of 8% of loan commitments in 2002 down to 4% in 2007 and back up to about 10% in 2010. Thus, the loan share sale behavior of U.S. bank holding companies is both relevant and correlates with the credit cycle showing, in particular, a sharp increase in the 2008–2010 period.

Figure 3 plots the number of loan share sales in the full sample (left axis) and in years absent any contract change (right axis), i.e., the "No Amend" sample. The figure shows the number of sales in the sample free of amendments is approximately half the size of the full sample. The trend in this sample closely resembles the overall trend in the market, which indicates that working with the full sample of sales is a good benchmark. Finally, the fraction of total sales occurring without any contract amendment appears to sharply increase during the 2007–2009 period, as can be seen by the narrowing of the gap between the two time series. This suggests that a significant number of loan shares were sold by banks in 2007–2009 without any material change in borrower condition.

We estimate the impact of bank liquidity risk management on the loan sale decision during the crisis using cross-sectional variation in banks' dependence on wholesale funding. We capture this reliance on wholesale funding sources through the ratio of non-core funding (sum of large time deposits, foreign deposits, repurchase agreements sold, other borrowed money, subordinated debt, and federal funds purchased) to total assets. This is essentially the non-core liabilities-to-assets ratio reported by regulators (e.g., in the Uniform Bank Performance Report published by the Federal Deposit Insurance Corporation, Board of Governors of the Federal Reserve System, and Office of the Comptroller of the Currency) and used extensively in prior academic research (e.g., Acharya and Mora, 2013). This measure captures banks' dependence on wholesale deposits as well as nondeposit funding, such as reverse repurchase agreements, federal funds (interbank borrowing), and commercial paper.

Table I summarizes the sample used in our empirical analysis. We use data from 2002 to 2010. We define the "before crisis" period to be the years from 2003 to 2006 and the "during

crisis" period from 2007 to 2010. The before crisis period serves as a benchmark against which bank behavior during the financial crisis is compared. The sample is restricted to loan shares held by U.S. bank holding companies and includes 9,627 unique syndicated loans (67,647 loan share-lender-year triples, 322 banks) before the crisis and 9,599 loans (81,011 loan share-lender-year triples, 349 banks) during the crisis. Bank-level variables are from the FR Y-9C reports and are measured at the end of the calendar year at the top holder level. Bank variables requiring stock market information are calculated using data from CRSP. This additional data requirement reduces the number of loan share-lender-year observations by about one-third. Detailed definitions of these variables are found in Appendix A. These bank variables are winsorized at the 1st and 99th percentiles to mitigate the effect of outliers.

Summary statistics of the loan and bank level variables are shown in Panels A and B, respectively. Before the crisis, banks have average total assets of about $160 billion, hold 14.8% of assets in liquid instruments, and finance 35.7% of liabilities from wholesale sources. These banks have average book capital ratios of 8.5% and ratios of market equity value to total assets of 17.1%. The average nonperforming loan ratio is 1.1%. On average, loan shares are sold 6.6% of the time, each bank holds a 13.1% share of a given loan commitment, and 18.6% of the shares have a bank acting as an agent.

Several key patterns emerge when comparing these variables before and during the crisis. First, we see that the fraction of bank funding that comes from wholesale markets increases to 38.4%. Second, the average nonperforming loan ratio more than doubles during the crisis relative to the pre-crisis period. Third, the ratio of market capitalization to total assets declines significantly during the crisis, reflecting the crash in market valuations of U.S. banks during this period. Finally, consistent with the run up in loan sales shown in Figure 1, Table I indicates that the unconditional probability of a loan sale increases during the crisis by roughly 3 percentage points. Our goal is to examine whether these loan sales are motivated by bank risk management considerations.

3 Identification Strategy

We now describe how we use loan share-level data to estimate the impact of a market-wide liquidity shock on loan sales by U.S. banks due to liquidity risk management considerations.

This estimation poses a classic identification problem that requires separating changes in lending behavior due to supply side factors (e.g., bank liquidity risk management) from changes in borrower investment opportunities and risk (credit demand). The following example illustrates this problem. Suppose banks with marginal funding coming from wholesale markets lend to firms with cyclical performance, such as those in the consumer durables industries (e.g., automobiles). If the collapse in market-wide liquidity occurring at the onset of the crisis signals a coming recession, then wholesale banks may be more willing to sell loan shares associated with their existing borrower pool due to a lower expected performance and higher default risk. Consequently, if we document a greater incidence of loan share sales among wholesale-funded banks, then this may jointly reflect changes in default risk on the borrower side and bank liquidity risk management considerations. Indeed, any pattern of matching between firms and banks that correlates with credit demand during the crisis may contaminate estimation of the supply side impact of wholesale funding on loan share sales.

Our empirical approach addresses this identification problem directly. We exploit the fact that firms borrow from multiple banks in the syndicated loan market. Our approach accounts for changes in credit demand at the loan-year level by comparing the loan sale decision across lenders within a given loan syndication in a particular year. This level of analysis allows us to control for potentially confounding demand factors at the level of the loan, rather than across loan relationships within firms or across firms. We thus avoid the potential for our estimates to be biased by unobservable changes in credit demand across firms and even across different loan types within a firm. To illustrate our identification strategy, suppose a firm has a loan syndicate including banks A and B. Our estimation approach uses the loan

share sale decision from bank A relative to the loan share sale decision from bank B for the *same loan syndicate in the same year*. By using such within-loan-year variation, we control for time-varying loan-level credit demand shocks and thus identify the supply side impact of bank wholesale funding on loan share sales.

We implement this empirical strategy using ordinary least squares (OLS) to estimate:

$$\text{Loan Sale}_{ijt} = \alpha_{it} + \beta \text{ Wholesale Funding}_{j,2006\text{Q4}} + \gamma \text{ X}_{j,t-1} + \epsilon_{ijt}, \tag{1}$$

where Loan Sale_{ijt} is the loan sale indicator variable equal to one if a loan share i held by bank j in year $t-1$ is sold in year t.[14] The coefficient α_{it} captures loan-year fixed effects. $\text{Wholesale Funding}_{j,2006\text{Q4}}$, the wholesale funding exposure of bank j measured as of 2006:Q4, is our variable of interest. In the vector $\text{X}_{j,t-1}$, we control for other potential determinants of the bank loan sale decision.[15] The coefficient of interest is β, which captures the transmission of the liquidity shock occurring during the 2007-2009 financial crisis to bank loan sales after accounting for loan-specific changes in credit demand. The inclusion of loan-year fixed effects implies β is identified using within-loan syndicate variation in a given year.[16]

The first identifying assumption is that the expected rate of separation desired by firms is the same across all lenders in the respective syndicate during the crisis. This assumption is necessary for us to identify a bank-driven effect and it is plausible for two main reasons.

[14]This equation is estimated using a linear probability model to fit a binary dependent variable (BDV). In our setting, when N is large but T is fixed, a linear model yields estimates that are $\sqrt{N}$ consistent whereas nonlinear BDV (e.g., conditional probit) models generally produce inconsistent estimates Wooldridge (2002).

[15]In some tests, we also include bank fixed effects to control for time-invariant and potentially unobservable characteristics at the bank level. Since bank fixed effects are collinear with the wholesale funding variable in Equation (1), in these tests we consider the 2003–2010 period and interact wholesale funding with a crisis indicator variable. In addition, our baseline tests we cluster standard errors at the loan-level to allow for correlation of the error terms. This approach addresses the concern that the errors, conditional on the independent variables, are correlated across years and banks within the same loan. In specification tests, we instead consider year, loan-year, bank, and bank-year clustering. See Section 4.2.5 for these results.

[16]Using loan-year fixed effects nonparametrically absorbs any year- and loan-specific effects. See Chodorow-Reich (2014) and Lin and Paravisini (2011) for a similar firm-fixed effects approach using primary market origination data from the U.S. syndicated loan market. Also see Khwaja and Mian (2008), Jimenez et al. (2012), and Schnabl (2012) for the same approach using international credit register data.

First, the homogeneity of loan shares within a given syndicated credit: a loan share from lender A has identical contract terms as a loan share from lender B. Therefore, since shares are identical, it is unlikely firms will change preferences over banks for a given loan during the crisis. Second, a key institutional feature of our setting is that borrowers have little influence over the composition of their loan syndicate, especially ownership changes occurring in the secondary market.[17] While we do not expect borrowers to remove banks from loan syndicates for credit demand reasons, we separately investigate this issue under the assumption that demand-side factors are less likely to play a role when a contract is not being renegotiated or refinanced. We thus examine the impact of bank liquidity risk management on the incidence of loan sales in years where the contract is not amended (i.e., the "No Amend" sample defined previously) and in all other years.

Our analysis is subject to a second identification problem of omitted variables. Since wholesale funding is an endogenous choice it may depend on the underlying risk-taking opportunities of the bank. For this reason, wholesale-funded banks may have sold loans during the crisis due to changes in these opportunities and not the liquidity dry-up. We address this identification problem in two steps. First, we measure wholesale funding dependence as of 2006:Q4 to capture banks' ex ante exposure to the liquidity shock (see also Iyer et al., 2014). Our wholesale funding measure is not time varying during the crisis, as such variation might be a reflection of changes in banks' investment opportunities or solvency concerns.[18] Second,

[17]Inspection of U.S. syndicated credit contracts in the DealScan data set, as well as conversations with practitioners, indicates that agreements may specify a minimum dollar amount of loan share sale, as well as a "black list" of lenders (e.g., certain investment funds) that are excluded from participating in the loan syndicate. Such black lists are typically provided by the borrower to the lead arranger before the deal is structured in the primary market. In addition, sometimes loan share sales in the secondary market may require approval of the administrative agent before any transaction takes place. While there has been little theoretical or empirical research into the motivation for such contractual provisions, we do not believe these restrictions exist to enable a borrower to remove a bank from their syndicate at will or to prevent a bank from selling their loan share for risk management purposes.

[18]There was no evidence that banks adjusted their funding position in 2006 due to concerns about an impending financial crisis. The crisis arguably began with a series of announcements of problems in the subprime mortgage market (see Acharya et al., 2013d). While media outlets and some market participants voiced concerns about banks' financial condition prior to the crisis, all standard indicators of bank risk

our regressions control directly for loan and bank variables that have been emphasized by the loan sales literature (e.g., Pennacchi, 1988), including whether a bank leads the syndicate and bank losses and capitalization. Thus, our second identifying assumption is wholesale funding dependence just before the crisis affects the likelihood of loan sales during the crisis only through liquidity management considerations, once we control for differences in banks' importance within the loan syndicate as well as bank characteristics.

The loan-level controls are defined at the loan share-lender-year level and include the fraction of loan held by the lender and whether the lender is an agent bank. The controls for bank characteristics are lagged balance sheet variables including various measures of bank solvency including loan losses and bank capitalization (the equity ratio), the natural logarithm of assets, and whether the bank has engaged in merger activity in the current and previous periods (Section 2 describes this variable). Controlling for losses and capitalization during the crisis is particularly important. Banks with access to wholesale funding are also likely to be money center banks that may have investment banking activities. These investment banking activities suffered relatively large losses during the crisis, so these banks suffered declines in the value of their capital. To restore their equity ratio these banks may choose to deleverage by simultaneously decreasing wholesale funding—the marginal source of funding—and selling off assets, including syndicated loans. Adrian and Shin (2010) provide evidence of such deleveraging behavior for standalone investment banks during the subprime crisis. While these authors do not find evidence of such behavior among U.S. commercial banks (see also Berrospide and Edge, 2010), they do not separately investigate the larger banks that are most likely to participate in the syndicated loan market. Hence, as we wish to separately identify the effect of wholesale funding shocks on loan sales, we control for losses due to nontraditional banking activities and changes in bank capital in our regressions.

implied a low likelihood of a financial crisis. For instance, all major U.S. and Eurozone banks had CDS spreads that were consistent with a low probability of bank failure and did not show any meaningful run up in 2006 (see Acharya et al., 2013c; Giglio, 2013).

Appendix B gives a sense of the differences across banks by wholesale funding dependence. The table splits the sample according to whether the bank falls above or below median wholesale funding in 2006:Q4. The major differences between these groups is banks with above-median wholesale funding dependence are larger in terms of book assets, are more likely to be the lead arranger, and also hold fewer liquid assets. These differences are both large in magnitude and significant at the 1% level, using standard difference of means tests. Other differences are either small in magnitude or insignificant, including all of the measures of bank loan losses and capitalization, which is an important finding as it indicates that these two bank groups did not differ much in terms of performance or risk taking. We control for differences in these observable characteristics throughout our regression analysis.

4 Results

This section starts by investigating the bank-level determinants of loan sales, including wholesale funding dependence, in the years before the financial crisis (Section 4.1). In Section 4.2, we repeat this analysis for the crisis period and conduct a number of cross-sectional tests to assess what is driving the estimated funding effect. In particular, we investigate the dynamics of the funding effect and how it varies by borrower and loan types and with a bank's liquid asset holdings. We also conduct several robustness tests. In Section 4.3, we examine the relation between wholesale funding dependence and secondary market loan purchases. We conclude by examining the role of losses and insolvency on bank loan sales (Section 4.4).

4.1 Liquidity Risk Management and Loan Sales during 2003–2006

We first use data from the period before the financial crisis to benchmark the impact of liquidity risk management considerations on loan sales. This analysis provides insights on

the bank-level determinants of loan sales, including the role of banks' liability structure and access to wholesale funding markets. In addition, it provides a benchmark against which bank loan sale behavior during the financial crisis can be compared.

The period from 2003 to 2006 was characterized by low macroeconomic volatility, credit expansion, and few corporate defaults. In such a benign macroeconomic environment, if wholesale funding markets (e.g., interbank lending) are well-functioning, then banks experiencing liquidity shortages should have no need to sell loans in order to raise cash. Indeed, banks able to tap wholesale funding markets may have greater flexibility in terms of access to funds as well as a lower cost of funds, potentially reducing the need to sell loans as compared to other banks. Accordingly, we expect the relation between wholesale funding dependence and loan sales to be nonpositive in the benign period before the financial crisis.

To investigate the supply side determinants of bank loan sales during this period, we modify the empirical approach outlined in the previous section by shifting the timing of the event window. Wholesale funding dependence is measured at the beginning of the period—i.e., 2002:Q4—and we estimate model (1) for the "before crisis" sample period.

Table II presents the results. Column [1] indicates the coefficient on the wholesale funding variable is negative and significant at the 5% level. The sign of this estimate implies that banks with greater use of wholesale funding have a lower probability of selling loan shares during this period. This finding suggests banks with access to well-functioning wholesale funding markets have greater financial flexibility and the ability to fund additional syndicated loans on the margin.

Columns [2]-[5] consider several variants of this benchmark estimation to check for robustness. Column [2] restricts the sample to loans with fewer than 250 syndicate members. These very large syndicates comprise a relatively small fraction of the sample (less than 50 loans); however, they may behave differently than traditional syndicates during normal times or times of stress. Column [2] indicates dropping the large syndicates from the sample

does not have any noticeable effect on any of the coefficient estimates.[19]

Column [3] restricts the sample to loan years in which the contract was not amended or refinanced and continues to provide evidence in line with our expectation. The point estimate remains nonpositive in sign, but it becomes statistically insignificant and attenuated towards zero when we remove amended contracts from the sample (about 2,500 loans).

Column [4] uses a longer time horizon and calculates average wholesale funding dependence across the four quarters in 2002, instead of the 2002:Q4 value. We find similar effects as the benchmark estimation using this alternative measurement.

Column [5] allows wholesale funding to become time-varying throughout the crisis period by including the lagged value in the baseline specification instead of using the data from 2002:Q4. This approach complements the exposure measure used in the benchmark estimation as it incorporates within-bank variation in wholesale funding dependence. Column [5] shows the coefficient of interest increases in magnitude and remains highly statistically significant after switching to this dynamic specification.

Columns [1]–[5] also control for bank characteristics. Several important and robust relations emerge. First, the book capital ratio has strong predictive power for loan sales. In each column, we find the coefficient on the capital ratio is negative and statistically significant at the 1% level. This indicates that well-capitalized banks are less likely to sell loan shares, all else equal, during normal times. This finding corroborates the theory that binding regulatory capital requirements may induce banks to push credit risk off their balance sheets through loan sales (Pennacchi, 1988). Second, larger banks are less likely to sell loan shares, on average, as indicated by the negative and highly significant coefficient on the bank size variable. This estimate is in line with expectation, as larger banks are better able to smooth liquidity shocks by accessing alternative sources of funding (see Acharya et al., 2013a). The

[19]The choice of 250 lenders is arbitrary and the same results are obtained when we consider other cutoffs for large syndicates (200,150, etc.). The median syndicate size is eight in our sample.

lagged bank merger variables indicate loan share sales occur more frequently after mergers among banks, consistent with portfolio rebalancing effects.

On the lenders' role in the syndicate, we find that when the lender is an agent bank or retains a large portion of the loan, they are less likely to sell their share. This is a robust finding that features throughout our regression analysis and is consistent with agent banks being less inclined to sell their fraction of the loan retained at origination. This is most likely due to relationship banking, signaling, or reputation concerns emphasized in the literature on the syndicated loan primary market (see, among others, Bharath et al., 2007; Ivashina, 2009; Lin and Paravisini, 2011; Sufi, 2007). Indeed, throughout our empirical tests we find that participant banks are more likely to sell their loan shares.

Taking these results together, we draw two main conclusions. First, when wholesale funding markets are well-functioning, banks with greater access to these funding sources have a lower propensity to sell loan shares. Indeed, we find robust evidence that banks accessing wholesale funding markets were less likely to sell loans in the 2003–2006 period, consistent with these banks having enhanced financial flexibility. Second, we find factors emphasized in the literature—such as regulatory capital constraints or the role of the bank in the lending syndicate—play a central role in the sale decision.

4.2 Liquidity Risk Management and Loan Sales during 2007–2010

Having shown wholesale funding may improve financial flexibility and fund syndicated loans on the margin, we now investigate banks' responses when wholesale funding markets came under pressure. With the cost of wholesale funding increasing and funding shortfalls becoming a first-order concern, during the financial crisis we expect banks to manage their balance sheet and liquidity position by selling assets. To test this hypothesis, we revert to specification (1) where wholesale funding dependence is measured using data from 2006:Q4. If liquidity risk management considerations caused bank loan sales then we expect the coef-

ficient on wholesale funding to be negative.

Table III provides the main results. The first column shows the results from the estimation of (1), including the full sample of loan shares held by U.S. bank holding companies during the period from 2007 to 2010. The coefficient on the wholesale funding variable is positive and significant at the 1% level. The direction of this estimate is consistent with our expectation that banks exposed to the market-wide liquidity shock had a greater probability of selling loan shares to meet liquidity risk management goals. Regarding economic magnitudes, the estimate implies that increasing wholesale funding by one standard deviation (this is, roughly a 0.14 increase in wholesale funding) leads to a 1.1% higher probability of a loan sale during the crisis, holding all else constant. The magnitude of this relation is large given that the frequency of loan sales was on average around 3 percentage points higher during the crisis as compared to before (as shown in Table I). This finding suggests secondary loan sales play an important role in bank liquidity risk management when wholesale funding markets become stressed.

Columns [2]-[5] repeat the same set of robustness tests from Section 4.1. Column [2] restricts the sample to loans with fewer than 250 syndicate members and shows very similar point estimates in terms of magnitudes or statistical significance.

Column [3] restricts the sample to loan years in which the contract was not amended or refinanced. The coefficient estimates remain unchanged in both magnitude and significance when we remove these loans from the sample (about 2,000 loans). This shows that wholesale-funded banks were equally likely to sell loans experiencing some change in borrower condition leading to the contract renegotiation, as compared to other loans during the crisis. In such non-amended loan-years, it is less likely that demand-side factors play a role in the loan sale decision. Thus, Column [3] provides further evidence that the loan sale decision reflects bank characteristics, including wholesale funding dependence.

Column [4] uses a longer time horizon and calculates the average of wholesale funding

dependence across the four quarters in 2006, instead of the 2006:Q4 value, and finds similar effects using this alternative timing.

Column [5] shows that the coefficient of interest increases slightly in magnitude and remains highly statistically significant once we allow wholesale funding to become time-varying throughout the crisis period.

Columns [1]-[5] continue to control for the same set of bank characteristics as in the previous section. Many of the relations emerging in normal times remain robust during the financial crisis, notably, the lenders' role in the syndicate. We continue to find robust evidence that when the lender is an agent bank or retains a large portion of the loan, it is less likely to sell its share.[20] We also find the loan loss variables (NPL ratio and net charge-offs) are important determinants of the loan sale decision during the crisis, whereas the book capital ratio appears to be less important. In Section 4.4 we revisit the issue of bank insolvency and credit risk management in more detail.

Overall, when we compare this finding with the relation estimated for the before crisis period (see Table II), we find strong evidence of an adjustment in the behavior of wholesale-funded banks during the crisis, in response to a market-wide liquidity shock. This rules out an alternative explanation that wholesale-funded banks have a greater propensity to sell loans through the credit cycle. We provide new evidence that during the crisis, in response to pressures in wholesale funding markets, banks more dependent on this funding source actively managed their balance sheet by liquidating loan shares. This finding suggests banks facing liquidity shortages and scrambling for cash may resort to secondary market loan sales, in addition to cutting primary market originations (Cornett et al., 2011), borrowing from

[20] We conduct two further tests to examine the impact of syndicate membership on the loan sale decision. First, we interact an indicator variable for agent bank status (equal to one if the bank is the lead arranger) with wholesale funding variable. We find the effect of being an agent bank entirely offsets the greater probability of a loan sale associated with wholesale funding during the crisis. Second, we re-estimate model (1) separately on the sample of participant banks and find a similar point estimate on wholesale funding as in Column 1 of Table III. This confirms that our estimates are not due to wholesale-funded banks sorting into the participant role within lending syndicates. These results are available upon request.

other sources (Acharya et al., 2013a), and raising deposit rates (Acharya and Mora, 2013).

4.2.1 The Role of Bank Liquid Asset Holdings

We next test a key auxiliary prediction that will further support our identification strategy and provide a more stringent test of a liquidity risk management channel. We examine whether the wholesale funding effect is less pronounced for banks with greater holdings of liquid assets. In models of financial intermediation, banks raise equity and carry liquid assets—cash reserves and debt securities—to manage the risk of cash shortfalls stemming from unexpected demand from borrowers or creditors (e.g., Diamond and Dybvig, 1983; Gorton and Pennacchi, 1990). In particular, banks with greater funding risk exposure from wholesale creditors should carry more liquid assets to mitigate the adverse effects of funding shocks.[21] Consequently, we expect banks with more liquid asset holdings to sell fewer loans during the crisis. This is likely because it is less costly for banks to use cash reserves or liquidate debt securities to meet liquidity needs.

Table IV presents the results of including liquid asset holdings as a control variable. We define liquid assets as the ratio of cash (including repurchase agreements and federal funds sold) and debt securities (excluding mortgage- and asset-backed securities) to total bank assets, along the lines of Acharya and Mora (2013). All columns include controls for loan-year fixed effects and the full set of loan and bank controls. Column [1] shows the baseline estimate on the full sample from Table III for ease of comparison. Column [2] appends the benchmark specification (1) to include the liquid assets ratio measured as of 2006:Q4. We find that the liquid assets ratio has a negative and statistically significant impact on loan sales during the crisis: Banks with more liquid asset portfolios are less likely to sell loans. This effect does not drive out the magnitude or statistical significance

[21] Appendix B indicates that banks with above-median wholesale funding dependence have lower average liquid asset holdings at the onset of the crisis compared to below-median banks (14.7% versus 18.7% of assets with the difference significant at the 1% level).

of the wholesale funding dependence coefficient. Indeed, the magnitude of the coefficient on wholesale funding increases from 0.076 in the benchmark estimation to 0.101 when we include liquid assets in the regression.

Next, we include the interaction of wholesale funding and liquid assets in the regression. Doing so allows us to test the joint effect of wholesale funding dependence and banks' liquid asset holdings on loan sales. If banks have sufficient liquid assets on hand then we would expect this to mitigate the positive impact of wholesale funding dependence on loan sales during the crisis. This would translate into a negative coefficient on this interaction term.

Column [3] presents the result of including this interaction term. The coefficient estimate on the interaction term is negative and statistically significant at the 5% level. Thus, for a given level of wholesale funding dependence, we find an increase in liquid assets reduces the propensity to sell loans during the crisis, consistent with a liquid asset portfolio mitigating the effects of the liquidity shock.

The results in this section provide supportive evidence of a liquidity risk management channel. The point estimates indicate liquidity management stemming from both the asset and liability sides of the balance sheet had important effects on bank loan sales during the crisis (Cornett et al., 2011). Importantly, the negative interaction effect of wholesale funding dependence and liquid assets shows cash-rich banks exposed to the liquidity shock were less likely to sell loans. This finding alleviates residual concerns about an omitted variable correlated with bank-level wholesale funding, since such a variable would now also have to correlate with the liquid assets interaction term in a very particular way. In the next set of tests, we examine the cross-section of loans to further rule out alternative explanations, as well as shed light on the borrower and loan types sold by banks experiencing liquidity shortages during the crisis.

4.2.2 Results by Industry Grouping and Credit Quality

We now examine loan sales by borrower industry and loan credit quality. We investigate whether the estimated effect of wholesale funding dependence on loan sales is concentrated in a particular industry or credit quality. We do this to learn which loan types were sold by wholesale-funded banks in the wake of the shock, as well as rule out alternative explanations of our findings. For instance, if wholesale-funded banks alone respond to changes in investment opportunities in a particular sector, say, real estate construction, then we may find a relation between loan sales and wholesale funding dependence in this industry group but not in others. Similarly, if these banks have a change in risk appetite or concurrently hit regulatory capital constraints during the crisis, we might expect to see a greater propensity to sell riskier loans as measured by credit quality.

Table V presents the results by the industry groupings provided by the SNC. Each column continues to include loan-year fixed effects and the same set of control variables. Column [1] shows the coefficient on wholesale funding dependence from the baseline estimation for ease of comparison. Columns [2]-[6] show the propensity to sell across the four largest industry groups and the other groups combined. We find the relation between wholesale funding and loan sales is positive and statistically significant at at least the 5% level across all industry groups. The coefficient is slightly smaller than the baseline effect in the agriculture and mining industry, about 50% larger in the financial services industry, and has the same magnitude as the baseline for manufacturing firms, the largest industry group. Hence, there is no evidence that the results in Table III can be explained only by one industry group. We instead find the funding effect is large and positive across all industries, which indicates wholesale-funded banks were not exiting one particular industry due to a change in investment opportunities or risk appetite during the crisis.

Next, we investigate the role of credit quality. We estimate our baseline specification separately on loan-year observations classified as "pass" and those classified as "fail" when

the Shared National Credit Program review is conducted. Loans are classified as fail if they are criticized or classified in any way by the examiner, which means they are either in default (and are soon to be charged off), nonaccrual, doubtful, substandard, or special mention. The latter three categories are assigned at the discretion of the examiner and are intended to reflect deficiencies in repayment prospects of the borrower or quality of pledged collateral. We do not have a prior as to whether banks with greater wholesale funding dependence will be more likely to sell high or low credit quality loans. On the one hand, there may be more demand from secondary market participants for less risky, high quality loans. On the other hand, distressed loan trading increased during the crisis (Gande and Saunders, 2012), so banks exposed to the funding shock may find it easier to sell poor credit quality loans albeit at a discount relative to par.

Columns [7] and [8] of Table V show the results by the pass or fail classification. We find a similar point estimate of 0.076 and 0.078 for the pass and fail subsamples, respectively, which is essentially the same as the baseline estimate. This indicates, on average, a similar propensity among banks with greater reliance on wholesale funding to sell performing versus nonperforming loans. One explanation for this is that nonperforming loans are no less liquid than performing loans, due to specialized funds providing liquidity during the financial crisis.

These results address concerns that wholesale funding dependence at the onset of the crisis is measuring changes in bank risk appetites or binding capital constraints during the crisis. Despite controlling explicitly for the bank capitalization and loan losses, if wholesale funding dependence was still capturing either changes in bank risk appetites or binding capital constraints during the crisis then we would expect to see a stronger positive effect for nonperforming loans. Instead, we observe sales for both loan credit quality types and find the same positive relation between sales and wholesale funding dependence. This suggests that it is unlikely that either of these alternative explanations can explain the results. The results in this section instead suggest that other factors (such as loan liquidity) may drive a

differential propensity for banks to sell loans across loan or borrower types.

4.2.3 The Impact of Bank Loan Liquidity on Loan Sales

Next, we explore the impact of loan liquidity—loan shares with more potential trading partners or greater secondary market depth—on loan sales during the crisis. It is unclear ex ante which loan types wholesale-funded banks would choose to sell when facing a liquidation problem during the crisis. On the one hand, banks facing uncertainty going forward may value keeping some liquidity cushion in their portfolios to insure against future liquidity needs and would thus choose to sell less liquid loan shares first (Brown et al., 2010; Scholes, 2000). On the other hand, banks may be hesitant to sell illiquid assets at fire sale prices, booking significant losses in the process, and would prefer to sell more liquid loans putting pressure on prices in liquid loan segments (Diamond and Rajan, 2011). This latter case is interesting, as it suggests that banks experiencing liquidity shortages affect liquid segments of the secondary loan market though fire sales.

We implement cross-sectional tests of the effect of loan liquidity using loan level liquidity measures motivated by recent research on bank loan trading (notably, Bushman and Wittenberg-Moerman, 2009). In particular, we consider four proxies: loan type, borrower size, loan securitization, and syndicate size.

We first estimate our baseline specification separately for credit lines and term loans. The SNC identifies each loan as belonging to one of these two categories and we partition our sample accordingly. Theoretical work suggests that deposit-taking commercial banks have a comparative advantage at managing the liquidity risk associated with credit lines (Acharya et al., 2013b; Kashyap et al., 2002; Pennacchi, 2006), which is reflected in their holdings of the majority of these commitments when they are syndicated in the primary market (Gatev and Strahan, 2006, 2009). Consequently, there is less depth in the secondary market for credit lines (i.e., fewer potential buyers), in contrast to the market for term loans

where banks and virtually every type of investment fund is an active participant (Bord and Santos, 2012). Thus, if wholesale-funded banks prefer to sell liquid assets after the liquidity shock then we will be more likely to see term loan sales as compared to credit line sales.

Columns [1] and [2] of Table VI show the results. The regressions continue to include loan-year fixed effects and the full set of bank and loan controls. The coefficient estimates are 0.058 and 0.097 for credit lines and term loans, respectively. Both point estimates are statistically significant at the 1% level. The results indicate that banks with greater exposure to the market-wide liquidity shock have a greater propensity to sell term loans relative to credit lines. This finding is consistent with banks with greater reliance on wholesale funding preferring to sell relatively liquid term loans to avoid fire sales on credit lines.

Next, we estimate the regressions separately by borrower size because studies find that small firms borrowing in the syndicated loan market are more informationally opaque (Sufi, 2007), and thus less likely to be actively traded in the secondary market (Bushman and Wittenberg-Moerman, 2009). Indeed, many of the smaller borrowers in the SNC data set are private firms and likely subject to an adverse selection problem if a bank tried to liquidate their loans at short notice. We define a firm as large if its loan size is above the upper quartile of $300 million and small if it is below the lower quartile of $50 million.

Columns [3] and [4] provide the results by borrower size. We find the coefficient on the wholesale funding variable is positive for small borrowers, however, it is not statistically significant. The coefficient on the wholesale funding variable is positive, larger in magnitude, and significant at the 1% for large borrowers.

Our final two tests consider whether a loan is securitized or not and syndicate size. Securitized loans must be of sufficient quality and transparency (e.g., they will have an external credit rating) and include contractual features that make them easier to trade, such as more financial covenants (Drucker and Puri, 2009). We classify a loan share as securitized if its syndicate contains a collateralized loan obligation in the current year—otherwise, a loan

is not classified as securitized. Loan shares from syndicates featuring more lenders may be easier to sell as one of the other lenders in the syndicate may be willing to take up the share. Alternatively, the share may have desirable properties that lead to more lenders holding it in the first place. We classify a syndicate as large if it contains greater than the median number of lenders (eight) and small otherwise.

Columns [5] and [6] report the result by securitized status. We find the coefficient on wholesale funding is positive and statistically significant at the 1% level in both subsamples, but the estimate for the securitized group is more than twice the size as compared with the nonsecuritized group.[22] Columns [7] and [8] find a similar pattern when comparing large and small loan syndicates. We find a positive and statistically significant relation between wholesale funding dependence and loan sales during the crisis and this effect is greater in magnitude for syndicates featuring a large number of lenders.

These results indicate banks facing liquidity needs resulting in a portfolio liquidation problem were more likely to sell liquid loan shares. This finding relates to previous studies, in particular, Manconi et al. (2012), which uncovers a contagion effect from institutional investors experiencing liquidity shortages during the financial crisis to the relatively liquid corporate bond market. Indeed, the results in this section suggest a direct transmission mechanism from bank funding constraints to liquid segments of the secondary loan market.

4.2.4 Dynamics of Liquidity Risk Management and Loan Sales

In the benchmark estimation, the crisis period was defined as the years from 2007 to 2010. The coefficient estimates in Table III capture a time-averaged estimate across this event window. We now examine the relation between wholesale funding and loan sales on a year-by-year basis by estimating the baseline model separately on each crisis year.

Table VII provides the results. Panel A excludes the liquid assets ratio from the regression

[22]The results are the same if we include only term loans in this test. The rationale for doing so is credit lines tend not to be purchased by collateralized loan obligations (Benmelech et al., 2012).

model. Panel B includes the liquid assets ratio. Column [1] shows the coefficient estimates from the baseline regression model in Table III, for ease of comparison. Columns [2]-[5], re-estimate this model separately for the years from 2007 to 2010, respectively. Each of these columns include loan-year fixed effects and the full set of loan and bank controls.

Examining the coefficients on wholesale funding dependence across these two panels, we find a hump-shaped pattern in the point estimates. Panel A indicates that from the end of 2007 to the end of 2008, the point estimate increases by more than a factor of three, from 0.048 to 0.181. From the end of 2008 to the end of 2009, this pattern sharply reverses and the point estimate decreases 0.181 to -0.016. The statistical significance of the point estimates increases from 10% in 2007 to 1% in 2008, and then the point estimate becomes insignificant. Panel B shows that controlling for the bank liquid asset ratio does not change this pattern: the effect of wholesale funding dependence on loan sales peaks in 2008 and drops off thereafter. Regarding the economic magnitude of this relation, in 2008 the estimate becomes as large as a one standard deviation increase in wholesale funding being associated with a 4.2% increase in the likelihood of a loan sale (up from 1.1% in the benchmark estimation).[23]

We interpret these findings in the context of the squeeze in wholesale funding markets during the financial crisis using the TED spread (the difference between the 3-month London Interbank Offered Rate (LIBOR) and the 3-month Treasury rate). A high level of the TED spread is understood to reflect greater risks with short-term lending to banks, indicating worse conditions in banks' access to wholesale funding (see, e.g., Cornett et al., 2011). In mid-2007—widely accepted as the onset of the financial crisis—the TED spread jumped up

[23]Regarding the relation between wholesale funding and loan sales in 2010, we find the coefficient on wholesale funding is still positive. The point estimate is not statistically significant once we control for the liquid assets ratio. Thus, for the years 2009 and 2010 we find the relation is statistically insignificant in three out of four cases. We believe that measurement error in using 2006:Q4 values of wholesale funding may play a role. For robustness, we repeat our main analysis defining the years 2007–2009 as the crisis period and we find the estimates are very similar in both magnitude and significance.

from around 0.5% to elevated levels between 1% and 2.5%. It remained at these levels until shortly after the Lehman bankruptcy, when the spread peaked at around 5.8%. From this peak, the spread declined until by the end of 2009 it had returned to 0.5%. Thus, we find time variation in the relation between wholesale funding dependence and bank loan sales that corresponds to shifts in liquidity during the crisis.

4.2.5 Additional Robustness Tests

In this section, we conduct several specification tests. One possible concern with our estimation is that it imposes a linear relationship between wholesale funding dependence and loan sales and the estimation of this relationship may be sensitive to outliers. Although we address concerns of outliers by winsorizing our bank-level variables, including wholesale funding dependence, we now consider an estimation approach that does not impose linearity.

To allow for a nonlinear relation between wholesale funding dependence and loan sales, we rank banks as having high, medium, and low exposure to the liquidity shock. Banks are assigned to exposure groups depending on the tercile wholesale funding distribution the bank falls into on 2006:Q4. We then estimate the following model:

$$\begin{aligned} \text{Loan Sale}_{ijt} = \alpha_{it} + \beta_1 \text{ Medium Exposure}_{j,2006Q4} + \beta_2 \text{ High Exposure}_{j,2006Q4} \\ + \gamma \text{ X}_{j,t-1} + \epsilon_{ijt}, \end{aligned} \tag{2}$$

where, as before, Loan Sale_{ijt} is the loan sale indicator variable equal to one if a loan share i held by bank j in year $t-1$ is sold in year t, α_{it} capture loan-year fixed effects, and $\text{X}_{j,t-1}$ includes controls for other potential determinants of the bank loan sale decision. The exposure indicator variables classify banks into groups, as described above. The coefficients of interest are β_1 and β_2, which capture the impact of the liquidity shock on bank loan sales controlling for loan-specific changes in credit demand. Here, β_1 measures the average

propensity of banks in the medium exposure group to sell loans relative the omitted group, which is comprised of the low exposure banks. And similarly for β_2.

Panel A of Table VIII presents the results. Column [1] estimates model (2) on the full sample of loan sales. We find medium and high exposure banks increase their likelihood of selling their loan share by 0.8% and 1.5%, respectively, relative to low exposure banks. These estimates are statistically significant at the 5% and 1% level, respectively. The results of this nonlinear specification mirror the baseline estimation: banks with a greater reliance on wholesale funding had a greater likelihood of selling loans during the financial crisis.

Columns [2] and [3] repeat the estimation for different samples. Using these alternative samples, we find the coefficient on the medium exposure indicator variable becomes smaller in magnitude and is no longer statistically significant. On the other hand, the high exposure indicator remains large in magnitude and highly significant. Column [4] repeats the analysis using the average value of wholesale funding dependence in 2006 to construct the exposure indicator variables and the same pattern emerges. This additional test shows a robust positive relation between wholesale funding dependence at the onset of the crisis and loan sales from 2007 until 2010, primarily among the high exposure banks.

We next include partial loan sales in the analysis. The loan sale variable we have examined so far only includes the complete sale of a loan share by a bank holding company. This choice was motivated by the fact that we observe partial sales of loan shares occurring infrequently. Nevertheless, a concern is that classifying such partial sales as nonsales may introduce measurement error into and bias our estimates, especially for lead banks for whom partial sales are more common (Bord and Santos, 2012). For instance, a bank more dependent on wholesale funding may choose to reduce its exposure to a given syndicated loan by selling only 50% of an existing share, rather than 100%. This would lead us to underestimate of β in baseline regression model (1).

We examine this issue by redefining our loan sale variable to be equal to one if any

reduction in the loan share is observed from year t to year $t+1$ and re-estimating the baseline model. Panel B of Table VIII shows the results. Each column includes the full set of controls for loan-year fixed effects, as well as bank and loan control variables. Columns [1]-[4] present a very similar picture to the main results in Table III. The magnitude of the coefficients appears to be slightly larger in each column, relative to the baseline results, suggesting that banks may use partial sales to handle liquidity shortages. This suggests our baseline estimates, which focus on loan shares sold in entirety, understate the true effect.

We also conduct a specification test that groups the before and during crisis periods together (i.e., 2003–2010) and runs a single estimation on a full sample of loans. Here, we measure wholesale funding dependence at the bank level using data from 2002:Q4. We include an interaction term to account for the differential impact of wholesale funding dependence in normal and stress scenarios. The specification is as follows:

$$\begin{aligned} \text{Loan Sale}_{ijt} = \alpha_{it} + \beta_1 \text{ Wholesale Funding}_{j,2002\text{Q4}} \\ + \beta_2 \text{ Crisis}_t \times \text{Wholesale Funding}_{j,2002\text{Q4}} + \gamma \text{ X}_{j,t-1} + \epsilon_{ijt}, \end{aligned} \tag{3}$$

where Crisis_t is an indicator variable equal to one if the year is between 2007 and 2010. The estimates of β_1 and β_2 and their difference are of interest. We continue to include bank and loan controls, as well as loan-year fixed effects. We also include bank fixed effects in this specification to control for unobserved time-invariant differences between banks.[24]

This bank fixed effects model allows us to rule out alternative explanations that relate to the organizational form of the bank holding company. For instance, one concern is large banks with broker-dealer arms may trade more actively in the secondary loan market, so they *mechanically* sell more loans during the crisis. Specification (3) is useful for ruling out this concern in two main ways. First, as in the benchmark specification, it includes control

[24]Bank fixed effects sweep out the main wholesale funding term due to co-linearity.

variables such as size that captures these organizational differences between banks. Second, allowing for differential selling behavior within-banks across the noncrisis and crisis periods lets us rule out mechanical trading behavior due to organizational form.

Panel C of Table VIII presents the results. Column [1] conducts a preliminary test that restricts the sample to the loan years from 2007 until 2010, which corresponds to the crisis period for our baseline tests. We find wholesale funding measured in 2002:Q4 has a positive and statistically significant impact on loan sales during the crisis. This follows quite naturally from the stickiness of the wholesale funding variable at the bank level.

Columns [2] and [3] consider the longer event window from 2003 until 2010 and includes a crisis interaction term. Column [2] shows the effect of wholesale funding dependence on loan sales is positive and statistically significant in the crisis period only. The coefficient on the main effect is negative—consistent with wholesale funding improving financial flexibility in the 2003–2006 period—although this effect is small in magnitude and not statistically significant. Column [3] adds controls for bank fixed effects and finds similar results.[25]

Next, we replace the crisis indicator variable with a continuous measure of the tightness of banks' funding liquidity conditions, the TED spread. We test the idea that wholesale-funded banks will be more likely to sell loans to conserve liquidity, as compared to banks with stable sources of funding, when the TED spread is elevated (see, e.g., Cornett et al., 2011). The TED spread peaks in 2008, but also shows meaningful variation from year-to-year. Columns [4] and [5] of Table VIII show the results remain similar when we use this continuous measure of wholesale funding conditions, whether we include bank fixed effects or not.

Finally, we re-estimate the baseline regression model (1) during the crisis measuring the bank controls using data from 2006:Q4 instead of lagged values. This test alleviates concerns

[25]Using the specification in Column [3], we also consider year, loan-year, bank, and bank-year clustering of standard errors. In each case, we find that the point estimates remain statistically significant at at least the 10% level (results unreported).

that our estimates are potentially biased by changes in control variables occurring due to wholesale funding pressures in the financial crisis. Panel D of Table VIII shows the results of this estimation. Columns [1]-[5] repeat the same tests as in the main analysis, but using this alternative measurement of the bank characteristics. We continue to find the coefficient on wholesale funding remains positive and statistically significant.

Using several alternative approaches, the results of this section confirm the strong link between bank liquidity risk management and loan sales. We continue to document systematic evidence that banks more exposed to liquidity shocks through larger wholesale funding dependence were more likely to sell loans when these funding markets came under pressure. These results complement the literature by providing new evidence on how funding-constrained banks actively manage their balance sheet during times of stress, particularly, their existing loan portfolio through secondary loan sales.

4.3 Liquidity Risk Management and Loan Purchases

So far, our analysis has examined how bank liquidity risk management impacts loan sales. We argue that banks with a greater dependence on wholesale funding at the onset of the crisis sold loan shares once this source of funding dried up. Until this point, we have put aside the question of loan buys. However, an alternative explanation of our findings is that wholesale-funded banks have a different business model and trade more frequently as a consequence.[26] In such a world, these banks are more likely to rebalance their portfolio during the crisis and are therefore likely to both buy and sell loans. To provide convincing evidence that wholesale-funded banks sold loans to meet liquidity needs, we collect and examine data on secondary market additions of loan shares to banks' loan portfolios and

[26]Notice that we have already addressed this concern in three ways. First, model (3) includes bank fixed-effects, which absorb any time-invariant bank characteristics related to organizational form. Second, we include a time-varying control for bank size, which is the characteristic most likely to proxy for business model. Third, we show the relation between funding structure and loan sale behavior flips sign from before the crisis to during the crisis, which would be unlikely for a bank trading more frequently.

investigate the relation between wholesale funding and loan buys.

We collect all loan share buy and sell transactions for the time period from 2003 until 2010. We define loan buys analogously to loan sales: Bank A buys a given loan in year t whenever this bank was absent from the corresponding syndicate in year $t-1$ and present in t. Using these transactions, we test whether banks with greater wholesale funding dependence are more or less likely to buy loans. A regression analysis of buyers is not feasible as we only observe the actual buyer and not all bidders (or potentially interested buyers). Hence, we explore differences between buyers and sellers by comparing the average wholesale funding dependence of banks buying loan shares with the average for banks selling loan shares. The purpose of this mean comparison is to show that buyers differed significantly from sellers in their dependence on wholesale funding. By doing so, we mitigate concerns that our baseline estimates are merely capturing portfolio rebalancing or mechanical trading behavior.

We use two different samples. The first incorporates the set of all loan transactions. The second uses the set of transactions where for a particular loan-year pair exactly one bank sells a share (i.e., exits the syndicate) and exactly one bank buys a share (i.e., enters the syndicate and holding a share of exactly the same size). This second sample resembles a loan fixed effects model, as, holding the loan constant, we compare the wholesale funding dependence of the syndicate entrant (buyer) with the bank exiting the syndicate (seller).

Table IX tests whether banks with greater wholesale funding dependence were more likely to buy or sell loan shares. We separately examine the before crisis (Panel A), during crisis (Panel B), and the 2008 height of the financial crisis (Panel C). We also separately consider trades of loans that are not amended in the year of the transaction.

Panel A examines the pre-crisis period from 2003 until 2006 and measures wholesale funding dependence as of 2002:Q4. There is suggestive evidence that banks buying loan shares had more wholesale funding in their capital structure. For instance, if we simply look at all transactions (4,363 sales and 5,556 buys) and compare the average wholesale funding

of loan sellers (34.9% of assets) versus loan buyers (37.2% of assets) we find a difference of roughly 2.3 percentage points, significant at the 1% level. When we restrict the sample to amendment-free trades only, we see the number of transactions reduces by a factor of four, but the same pattern emerges. When we consider the buys and sells coming from the same syndicate ("'Matched Bank-Bank Trades") this relation disappears but the number of transactions is small. Overall, this suggests that in the benign period before the crisis, wholesale-funded banks were actively adding loan shares to their portfolios via secondary transactions. This mirrors the findings in Section 4.1 where these banks were less likely to sell loan shares.

Panels B and C repeats the same tests for the crisis period. Here, we find consistent evidence that banks buying loan shares had less wholesale funding than banks selling loan shares, especially during 2008 peak of the crisis. Columns [1]-[3] of Panel B provide evidence in this regard. First, the number of loan share sales during the crisis (7,705) exceeds the corresponding number of loan share sales before the crisis (4,363, see Panel A) and number of loan share purchases during the crisis (4,337). Thus, overall sales activity increased by banks during the crisis and banks switched from being net buyers to net sellers. Second, the average wholesale funding dependence of sellers exceeded the buyers' average by 2.5 percentage points. This difference increases to 4.7 percentage points for amendment-free trades. For Matched Bank-Bank Trades, the difference has a similar magnitude although the statistical significance drops below conventional levels. When we examine the 2008 peak, the contrast becomes particularly stark. In this year, we find the wholesale funding difference between sellers and buyers increases to somewhere between 8-9 percentage points, depending on the sample used, and remains highly statistically significant when we consider amendment-free as well as matched bank-to-bank trades.

Taking these results together, we provide further evidence of the role of bank liquidity risk management in determining bank trading behavior in the secondary loan market. Indeed,

banks that were active buyers during the crisis tended to have lower wholesale funding and vice versa for the period before the crisis. Moreover, wholesale-funded banks switched from being net buyers before the crisis to net sellers of loan shares during the crisis. This finding is consistent with wholesale funding providing flexibility before the crisis, but leading to liquidity shortages during the crisis. In addition, these findings rule out the alternative explanation that the relation between loan sales and wholesale funding reflects portfolio rebalancing or is mechanical and due to differences in business models among banks.

4.4 Loan losses, Insolvency Risk, and Loan Sales

In this section, we examine the role of bank insolvency and credit risk management on loan sales during the crisis. The crisis was characterized by many bank failures, government interventions, and several of the largest banks booking substantial losses related to their mortgage businesses.[27] Banks incurring losses and reductions in equity capital may have chosen to sell loans to deleverage and restore a target equity ratio (Adrian and Shin, 2010) or satisfy binding regulatory capital constraints (Pennacchi, 1988). Alternatively, banks with larger losses may have engaged in loan evergreening, preferring to renew loans and avoid booking losses on their existing loan portfolio (Albertazzi and Marchetti, 2010; Caballero et al., 2008; Peek and Rosengren, 2005). We investigate this empirical question by testing if banks realizing larger losses in their loan portfolio and greater reductions in equity capital during the crisis were more or less likely to increase secondary loan sales.

Table X presents the results. Panel A shows the impact of measures of loan losses on loan sales, as well as banks' total participation in the Troubled Asset Relief Program (TARP) during the crisis. We include TARP participation as a measure of bank insolvency,[28] and

[27] See Santos (2011) and references therein for a detailed discussion of losses incurred by U.S. banks during the subprime crisis and the impact of these losses on bank lending in the syndicated loan primary market.

[28] Banks' participation in the TARP is available on the website of the United States Treasury Department `www.treasury.gov/initiatives/financial-stability/TARP-Programs/Pages/default.aspx`. Bayazitova and Shivdasani (2012) show that solvency considerations and bankruptcy costs were key determinants

use two standard measures of loan losses. First, we consider the nonperforming loans ratio, which measures the fraction of loans that have been classified as in default or close to being in default (e.g., 90 days past due). Second, we consider the net charge-off ratio, which captures the fraction of assets that have been written off the balance sheet (net of recoveries). Some studies argue that net charge-offs is a more accurate indicator of losses, as it is more difficult to manipulate, however, banks can be slow to write down loans which makes timing a potential issue (Beatty and Liao, 2013). We include these loan loss variables measured in 2006:Q4 and also lagged values in a dynamic specification to measure the impact of losses during the crisis. Each specification follows naturally from our baseline specification (1) and includes the full sample of loan-lender-year observations and, as before, includes loan-year fixed effects and the full set of loan and bank controls.

Columns [1] and [2] regress the loan sale variable on the non performing loan ratio and the net charge offs ratio measure in 2006:Q4, respectively. Column [3] includes both ratios in the same regression model. In each case the loan loss variable is statistically insignificant. Column [4] adds TARP participation to the model. The coefficient on TARP is positive and significant at the 1% level, indicating, for a given loan syndicate, banks with greater take up of TARP funds were more likely to exit syndicates during the crisis. The magnitude of this effect is large: A one standard deviation increase in TARP participation (roughly, 0.01) is associated with a 2.2% increase in the probability of a loan sale, all else equal.

Columns [5]-[8] repeat this exercise, but this time consider lagged values of nonperforming loans and net charge offs (for a similar specification, see Santos, 2011). In each of these specifications, we see a positive and statistically significant relation between loan losses and loan sales. The discrepancy between these two sets of specifications is likely due to a lack of variation in loan losses between banks at the onset of the crisis. Put simply, most banks in

of banks' participation in the program. Among others, Duchin and Sosyura (2014) examine the impact of TARP borrowing on bank loan supply and risk taking (see also Wu, 2014).

the sample have close to zero values for both loan loss measures as of 2006:Q4.

Next, we examine how credit risk management and loan losses are associated with loan sales before the crisis. Panel B of Table X presents the results. Column [1] examines the nonperforming loan ratio for the period from 2003 until 2006. Columns [2] and [3] examines nonperforming loans and net charge offs for the period 2004 until 2006.[29] Each specification includes the full sample of loan share-lender-year observations and full set of fixed effects and controls. Of particular interest is the bank capital ratio, which is included in all specifications.

We find the loan loss variables, particularly, net charge offs, are strongly associated with loan sell offs during the period before the crisis (see also Table II). Columns [1]-[3] indicate the capital ratio has strong predictive power for loan sales. In each column, we find that the coefficient on the capital ratio is negative and statistically significant at the 1% level. This implies well-capitalized banks are less likely to sell loan shares, all else equal, before the crisis. This corroborates the theory that binding regulatory capital requirements induce banks to push credit risk off their balance sheets through loan sales.

Panel C of Table X examines whether the effect of wholesale funding dependence on loan sales during the crisis survives once we control for measures of insolvency. These tests are designed as an additional robustness check, as our benchmark estimation already controls for bank capital, nonperforming loans, and net charge-offs (see Table III). These tests also examine whether there are any interaction effects between bank illiquidity and insolvency (see, e.g., Rochet and Vives, 2004).

Column [1] indicates that when we additionally control for TARP the sign and statistical significance of wholesale funding effect remains unchanged. Column [2] includes the interaction of TARP and wholesale funding and shows the interaction effect is insignificant. Columns [3] and [4] include a market-based measure of bank solvency: the ratio of market capitalization to assets. This measure complements the book capital ratio and incorporates

[29]Data items required to calculate net charge-offs only become available in 2003.

market expectations. Including this control variables reduces the sample size, as we must examine banks with publicly traded equity. Two results emerge from these last two columns. First, and most importantly, the wholesale funding effect remains unchanged in terms of size and significance once when we control for this measure and its interaction. Second, the ratio of market capitalization to assets is negative and significant at the 1% level. This latter result complements the negative relation between book capital and loan sales.

Overall, and taken together with the results from Table III, these results indicate the effect of wholesale funding dependence on loan sales are not driven out by bank credit risk and solvency considerations. In addition, we find some evidence that bank losses and insolvency led to loan sales during the crisis, consistent with banks deleveraging to meet a target or required equity capital ratio (Adrian and Shin, 2010; Pennacchi, 1988).

5 Conclusion

We provide new evidence on the bank-level determinants of secondary market loan share sales. We exploit a credit register of U.S. syndicated loans to track the dynamics of loan syndicates after origination. This allows us to identify loan sales, as well as control for shifts in credit demand using a loan-year fixed effects approach. We show how banks' exposure to liquidity risk (i.e., wholesale funding dependence) affected their decision to sell loan shares during the financial crisis. Our paper shows wholesale-funded banks were able to partially smooth out funding shocks using the secondary loan market. This finding complements prior research emphasizing credit risk transfer and capital constraints as motivations for loan sales.

In recent times, financial institutions have increasingly turned to wholesale funding sources. Although access to wholesale funding may improve financial flexibility, it can also make institutions more susceptible to credit market disruptions. The existing literature indicates that the drying up of liquidity in the recent crisis caused banks to hoard liquidity.

In addition, adverse funding conditions may have been transmitted to other asset markets through portfolio rebalancing effects, and, ultimately, the real economy through curtailed lending. More research is required to further our understanding of the use of wholesale funding by financial institutions and its implications for financial stability.

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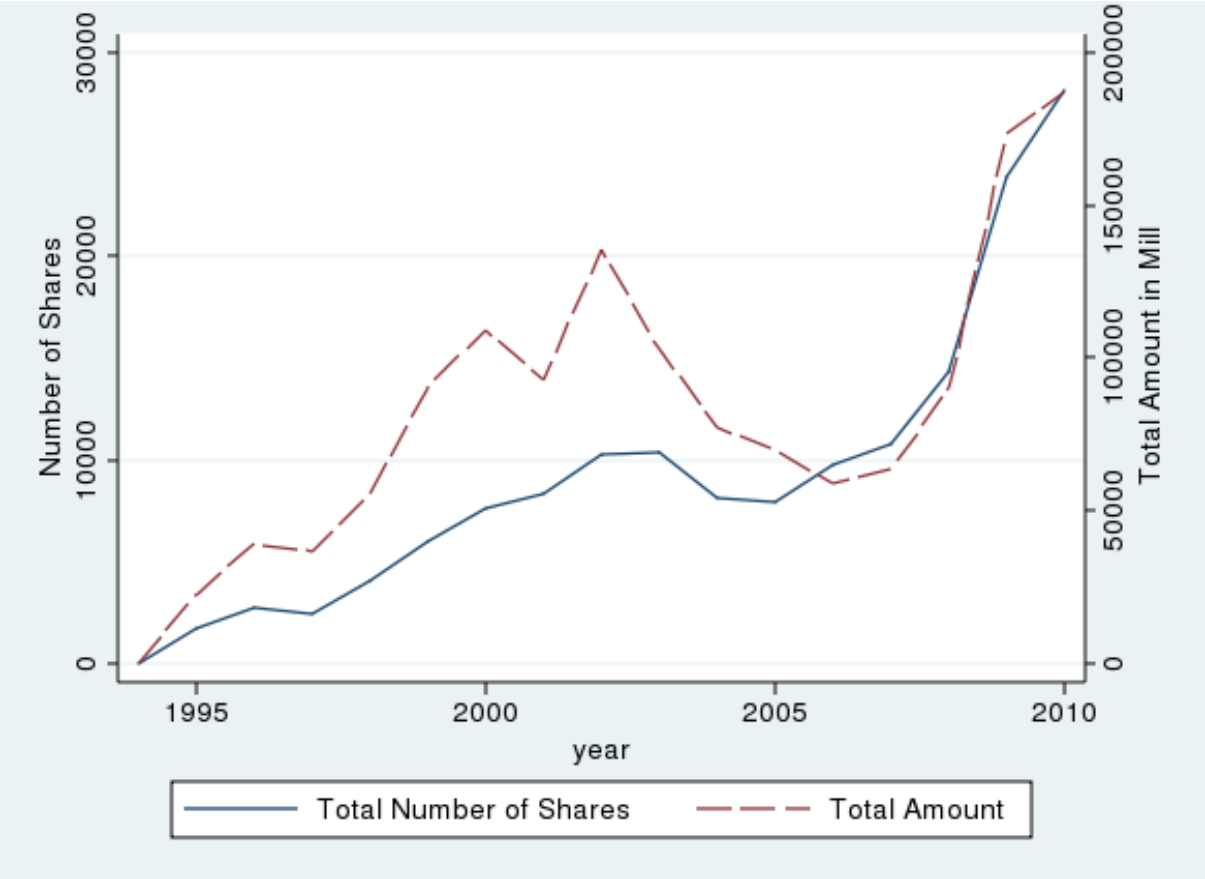

Figure 1: Loan Shares Sold (in millions $, 1994–2010). Total number (left axis) and value in millions of dollars (right axis) of shares of U.S. syndicated loan commitments (including term loans and drawn and undrawn lines of credit) registered with the Shared National Credit Program that were sold in the secondary market by U.S. bank holding companies during the period from 1994 until 2010. A loan share is a fraction of a syndicated loan commitment. A loan share sale occurs when a U.S. bank holding company ceases to own a loan share relative to the previous year.

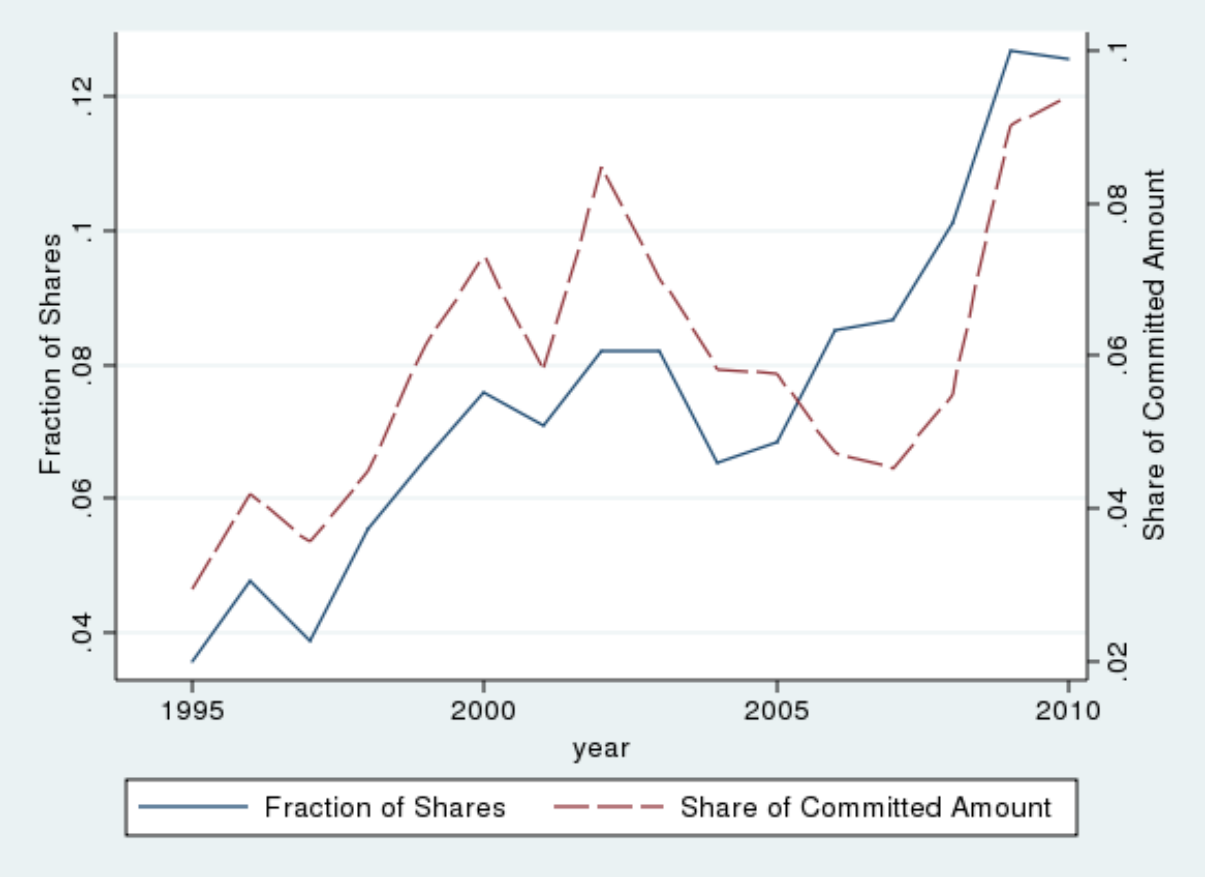

Figure 2: Loan Shares Sold (% of total loan commitments, 1995–2010). Fraction of the (lagged) total number of shares (left axis) and fraction of the (lagged) total dollar value (right axis) of shares of U.S. syndicated loan commitments (including term loans and drawn and undrawn lines of credit) registered with the Shared National Credit Program that were sold in the secondary market by U.S. bank holding companies during the period from 1995 until 2010. A loan share is a fraction of a syndicated loan commitment. A loan share sale occurs when a U.S. bank holding company ceases to own a loan share relative to the previous year.

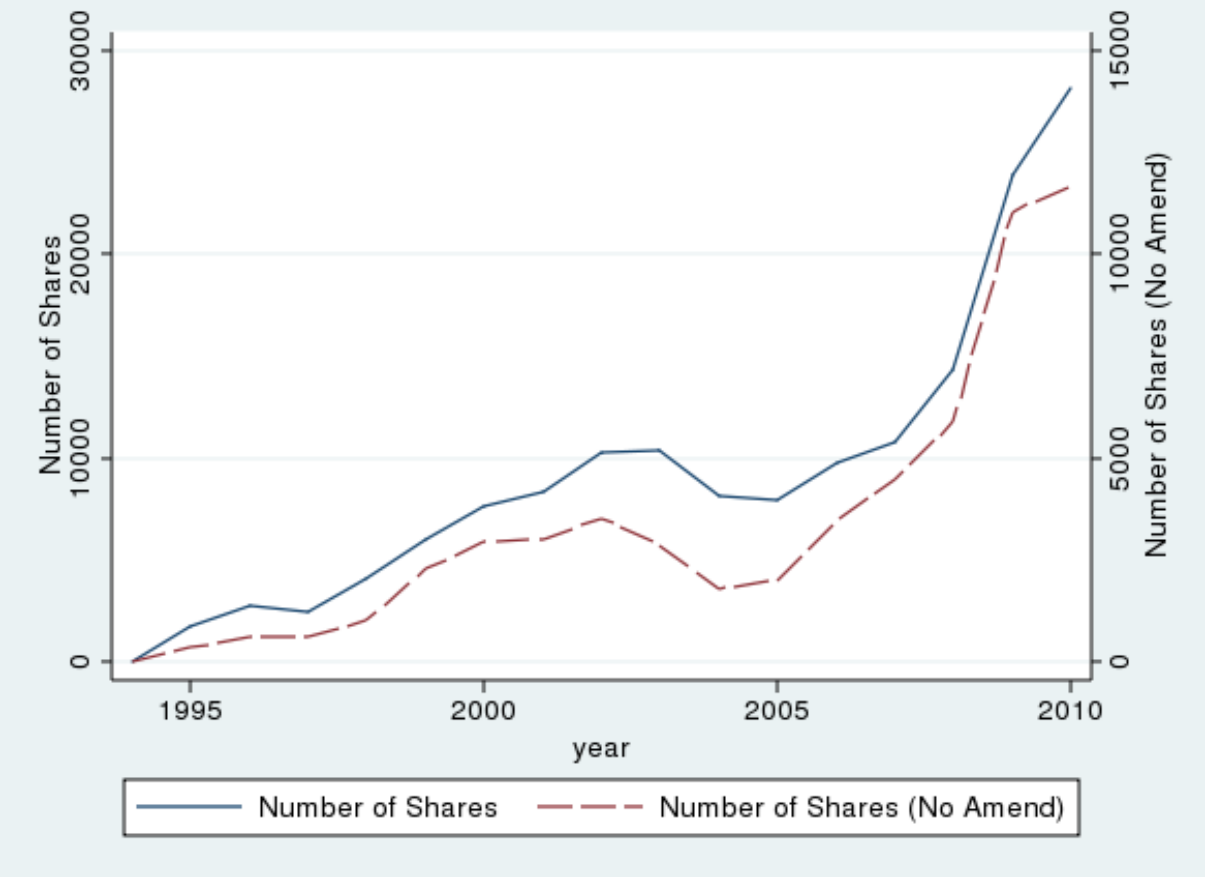

Figure 3: Loan Shares Sold ("No Amend" Sample, 1994–2010). Total number of sales (left axis) and "No Amend" sales (right axis) of shares of U.S. syndicated loan commitments (including term loans and drawn and undrawn lines of credit) registered with the Shared National Credit Program that were sold in the secondary market by U.S. bank holding companies during the period from 1994 until 2010. A loan sale is in the "No Amend" sample provided it occurs in a year with no coincident change in a term (e.g., maturity) of the underlying contract. A loan share is a fraction of a syndicated loan commitment. A loan share sale occurs when a U.S. bank holding company ceases to own a loan share relative to the previous year.

Table I
Shared National Credit Program Summary Statistics

This table provides summary statistics for the Shared National Credit Program data. Columns [1]–[6] summarize the data for the 2003-2006 "Before Crisis" period and columns [7]–[12] for the 2007-2010 "During Crisis" period. 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. There are 9,627 (9,599) loans funded by 322 (349) banks in the 2003-2006 (2007-2010) period. Panel A provides summary statistics for the loan level variables. Panel B summarizes bank level variables, where each variable is weighted by the sampling frequency of each bank. Bank variables denoted with the "200XQ4" subscript are measured as of the fourth quarter of 2002 (2006) in the before (during) crisis periods, with the exception of Net Charge Offs which is measured as of 2003:Q4 in the before crisis period. All variables are defined in Appendix A.

Variable	Before Crisis (2003–2006)						During Crisis (2007–2010)					
	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	67,647	0.066	0.249	0	0	0	81,011	0.095	0.294	0	0	0
Agent Dummy	67,647	0.186	0.390	0	0	0	81,011	0.169	0.375	0	0	0
Loan Fraction Held	67,647	0.131	0.108	0.005	0.100	0.182	81,011	0.114	0.108	0.034	0.083	0.160
Panel B: Bank Level Variables												
Wholesale Funding$_{200XQ4}$	66,267	0.357	0.120	0.283	0.331	0.439	76,621	0.384	0.138	0.279	0.374	0.453
Liquid Assets$_{200XQ4}$	66,267	0.148	0.096	0.081	0.128	0.201	76,621	0.136	0.104	0.067	0.087	0.209
NPL Ratio$_{200XQ4}$	66,320	0.015	0.007	0.009	0.014	0.019	79,766	0.008	0.005	0.005	0.007	0.010
Net Charge Offs$_{200XQ4}$	47,758	0.000	0.000	0.000	0.000	0.000	79,766	0.000	0.000	0.000	0.000	0.000
NPL Ratio	67,647	0.011	0.006	0.006	0.01	0.014	81,011	0.027	0.022	0.010	0.019	0.037
Net Charge Offs	48,601	0.000	0.001	0.000	0.000	0.000	81,011	0.000	0.001	0.000	0.000	0.000
Real Estate Loan Share	67,647	0.496	0.144	0.395	0.500	0.589	81,011	0.520	0.147	0.434	0.554	0.600
Capital Ratio	67,647	0.085	0.014	0.078	0.089	0.094	81,011	0.094	0.021	0.081	0.092	0.104
Bank Size	67,647	18.90	1.674	18.17	19.60	20.42	81,011	19.42	1.909	18.42	19.41	21.17
Large Bank	67,647	0.816	0.387	1	1	1	81,011	0.858	0.349	1	1	1
Merger Dummy	67,647	0.010	0.099	0	0	0	81,011	0.018	0.134	0	0	0
TARP/Assets	-	-	-	-	-	-	81,011	0.003	0.009	0	0	0
MVE/Assets	41,393	0.171	0.048	0.145	0.152	0.198	57,177	0.107	0.060	0.058	0.094	0.154

Table II
Loan Sales and Bank Liquidity Risk Management during 2003–2006

The regressions in this table examine the impact of wholesale funding dependence and liquidity risk management on bank loan sales before the crisis period. 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 exits a loan syndicate that it was present in during the previous year. Wholesale Funding is measured as of 2002:Q4. All columns include controls for loan-year fixed effects. Column [1] includes the full sample. Column [2] restricts the sample to loan syndicates with fewer than 250 participants. Column [3] restricts the sample to loan years where no contract amendment or refinancing took place during the year. Column [4] measures Wholesale Funding using the time-averaged data for 2002. Column [5] uses time-varying (lagged) Wholesale Funding. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Loan Sale$_t$					
	All	<250 Lenders	No Amend	2002 Avg.	Dynamic Spec.
	[1]	[2]	[3]	[4]	[5]
Wholesale Funding$_{2002Q4}$	-0.037**	-0.037**	-0.011	-0.036**	-0.059***
	(0.015)	(0.015)	(0.014)	(0.017)	(0.016)
NPL Ratio$_{t-1}$	0.127	0.238	0.008	0.638**	0.118
	(0.274)	(0.273)	(0.253)	(0.264)	(0.272)
Real Estate Loan Share$_{t-1}$	-0.023*	-0.016	-0.026**	-0.014	-0.021**
	(0.012)	(0.012)	(0.011)	(0.013)	(0.011)
Capital Ratio$_{t-1}$	-1.071***	-1.096***	-0.630***	-1.126***	-1.183***
	(0.127)	(0.126)	(0.126)	(0.136)	(0.120)
Bank Size$_{t-1}$	-0.012***	-0.012***	-0.007***	-0.014***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Large Bank$_{t-1}$	-0.001	-0.001	0.002	0.005	-0.002
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
Bank Merger$_t$	-0.016*	-0.012	0.000	-0.016*	-0.019**
	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)
Bank Merger$_{t-1}$	0.204***	0.207***	0.012	0.208***	0.185***
	(0.020)	(0.020)	(0.016)	(0.020)	(0.017)
Agent Bank$_{t-1}$	-0.022***	-0.022***	-0.001	-0.022***	-0.022***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Loan Fraction Held$_{t-1}$	-0.172***	-0.168***	-0.062***	-0.169***	-0.168***
	(0.023)	(0.023)	(0.019)	(0.023)	(0.022)
Loan-Year fixed effects	Y	Y	Y	Y	Y
N	66,267	65,822	38,621	66,267	67,647
# Loans	9,612	9,575	7,194	9,612	9,627
R^2	0.36	0.36	0.36	0.36	0.36

Table III
Loan Sales and Bank Liquidity Risk Management during 2007–2010

The regressions in this table examine the impact of wholesale funding dependence at the onset of the crisis on bank loan sales during the crisis period. 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 exits a loan syndicate that it was present in during the previous year. Wholesale Funding is measured as of 2006:Q4. All columns include controls for loan-year fixed effects. Column [1] includes the full sample. Column [2] restricts the sample to loan syndicates with fewer than 250 participants. Column [3] restricts the sample to loan years where no contract amendment or refinancing took place during the year. Column [4] measures Wholesale Funding using the time-averaged data for 2006. Column [5] uses time-varying (lagged) Wholesale Funding. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Loan Sale$_t$	All	<250 Lenders	No Amend	2006 Avg.	Dynamic Spec.
	[1]	[2]	[3]	[4]	[5]
Wholesale Funding$_{2006Q4}$	0.076***	0.077***	0.066***	0.057***	0.103***
	(0.014)	(0.014)	(0.015)	(0.014)	(0.014)
Net Charge Offs$_{t-1}$	23.64***	23.74***	5.135*	36.94***	25.18***
	(3.121)	(3.147)	(2.817)	(6.035)	(2.941)
NPL Ratio$_{t-1}$	0.317**	0.205	0.362**	0.807***	0.305**
	(0.145)	(0.145)	(0.143)	(0.188)	(0.128)
Real Estate Loan Share$_{t-1}$	-0.031**	-0.032**	-0.057***	-0.027**	-0.015
	(0.014)	(0.013)	(0.015)	(0.014)	(0.012)
Capital Ratio$_{t-1}$	0.172*	0.086	0.115	0.063	0.224***
	(0.091)	(0.089)	(0.097)	(0.089)	(0.075)
Bank Size$_{t-1}$	0.004**	0.003**	0.001	0.002	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Large Bank$_{t-1}$	-0.065***	-0.064***	-0.042***	-0.056***	-0.064***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Bank Merger$_t$	-0.021**	-0.005	-0.012	-0.023***	-0.024***
	(0.009)	(0.008)	(0.009)	(0.009)	(0.008)
Bank Merger$_{t-1}$	0.145***	0.153***	0.047***	0.158***	0.134***
	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)
Agent Bank$_{t-1}$	-0.017***	-0.015***	-0.006**	-0.018***	-0.017***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Loan Fraction Held$_{t-1}$	-0.181***	-0.173***	-0.078***	-0.180***	-0.172***
	(0.020)	(0.020)	(0.017)	(0.020)	(0.019)
Loan-Year fixed effects	Y	Y	Y	Y	Y
N	76,621	73,045	46,210	76,625	81,011
# Loans	9,564	9,301	7,409	9,564	9,599
R^2	0.42	0.41	0.43	0.42	0.41

Table IV
Bank Liquid Assets and Loan Sales during 2007–2010

The regressions in this table examine the impact of wholesale funding dependence at the onset of the crisis on bank loan sales during the crisis period controlling for bank liquid assets. 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 exits a loan syndicate that it was present in during the previous year. Wholesale Funding is measured as of 2006:Q4. Liquid Assets is the ratio of cash and short-term investments to total bank assets measured as of 2006:Q4. All columns include controls for loan-year fixed effects, bank controls, and loan controls. Bank controls comprise net charges offs, NPL ratio, real estate loan share, capital ratio, bank size, a large bank indicator, and bank merger controls. Loan controls comprise an agent bank indicator and loan fraction held. Column [1] shows the benchmark estimation on the full sample. Column [2] includes Liquid Assets as a control variable. Column [3] additionally includes the interaction of Wholesale Funding with Liquid Assets. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Loan Sale$_t$			
	[1]	[2]	[3]
Wholesale Funding$_{2006Q4}$	0.076***	0.101***	0.158***
	(0.014)	(0.019)	(0.029)
Liquid Assets$_{2006Q4}$		-0.053***	0.042
		(0.020)	(0.052)
Wholesale Funding$_{2006Q4}$ × Liquid Assets$_{2006Q4}$			-0.217**
			(0.095)
Bank controls	Y	Y	Y
Loan controls	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y
N	76,621	76,621	76,621
# Loans	9,564	9,564	9,564
R^2	0.42	0.42	0.42

Table V
Industry Group, Loan Credit Quality, and Loan Sales during 2007–2010

The regressions in this table examine the impact of wholesale funding dependence at the onset of the crisis on bank loan sales during the crisis period by borrower industry group and loan credit quality. Industry groupings are provided by the Shared National Credit Program. A loan is classified 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). 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 exits a loan syndicate that it was present in during the previous year. All columns include bank and loan controls as well as controls for loan-year fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance

Dependent Variable: Loan Sale$_t$								
		Industry Group					Credit Quality	
	All	Agriculture & Mining	Manufacturing	Wholesale & Retail	Financial Services	Other	Pass	Fail
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Wholesale Funding$_{2006Q4}$	0.076***	0.066**	0.076***	0.115***	0.121***	0.067**	0.076***	0.078**
	(0.014)	(0.029)	(0.025)	(0.041)	(0.042)	(0.026)	(0.014)	(0.037)
Bank controls	Y	Y	Y	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
N	76,621	18,895	18,768	7,982	6,590	24,386	59,288	14,679
# Loans	9,564	2,595	2,250	953	897	2,970	7,621	2,417
R^2	0.42	0.41	0.40	0.41	0.42	0.42	0.38	0.45

Table VI
Impact of Loan Liquidity on Sales during 2007–2010

The regressions in this table examine the impact of wholesale funding dependence at the onset of the crisis on bank loan sales during the crisis period by loan liquidity. We define loans as credit lines or term loans according to how they are categorized in the Shared National Credit Program data. We define a borrowers as small (large) if they take out a loan in the bottom (top) 25th percentile of the loan size distribution. We define a loan as securitized if we identify a syndicate participant as a collateralized loan obligation and not securitized otherwise. We define a loan as having a large syndicate if the number of syndicate members is above the median and small otherwise. 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 exits a loan syndicate that it was present in during the previous year. Wholesale Funding is measured as of 2006:Q4. All columns include controls for loan-year fixed effects, bank merger controls, and loan controls. Bank merger controls comprise contemporaneous and lagged bank merger variable. Loan controls comprise an agent bank indicator and loan fraction held. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Dependent Variable: Loan Sale$_t$								
	Loan Type		Borrower Size		Securitized		Syndicate Size	
	Credit Line	Term Loan	Small	Large	No	Yes	Small	Large
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Wholesale Funding$_{2006Q4}$	0.058***	0.097***	0.053	0.076***	0.045***	0.105**	0.056***	0.078***
	(0.015)	(0.027)	(0.041)	(0.019)	(0.013)	(0.042)	(0.022)	(0.016)
Bank controls	Y	Y	Y	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
N	48,227	28,394	12,009	30,285	63,145	13,476	29,311	47,310
# Loans	5,795	4,564	2,635	2,522	7,986	1,578	5,320	4,462
R^2	0.36	0.43	0.50	0.36	0.36	0.36	0.49	0.39

Table VII
Dynamics of Bank Liquidity Risk Management during 2007–2010

The regressions in this table examine the impact of wholesale funding dependence at the onset of the crisis on bank loan sales during the crisis period on a year by year basis. Panel A examines this relationship excluding Liquid Assets. Panel B repeats this analysis including Liquid Assets. 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 exits a loan syndicate that it was present in during the previous year. Wholesale Funding is measured as of 2006:Q4. Liquid Assets is the ratio of cash and short-term investments to total bank assets. All columns include controls for loan-year fixed effects, bank controls, and loan controls (defined in Table IV). Columns [1]-[5] use different event windows. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance.

Panel A: Excluding Liquid Assets

Dependent Variable: Loan Sale$_t$

	2007–2010	2007	2008	2009	2010
	[1]	[2]	[3]	[4]	[5]
Wholesale Funding$_{2006Q4}$	0.076***	0.048*	0.181***	-0.016	0.097***
	(0.014)	(0.019)	(0.020)	(0.021)	(0.019)
Bank controls	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y	Y
N	76,621	19,856	16,895	23,051	16,819
# Loans	9,564	4,893	4,558	5,634	3,790
R^2	0.42	0.38	0.42	0.42	0.45

Panel B: Including Liquid Assets

Dependent Variable: Loan Sale$_t$

	2007–2010	2007	2008	2009	2010
	[1]	[2]	[3]	[4]	[5]
Wholesale Funding$_{2006Q4}$	0.101***	0.081**	0.299***	0.047	0.056
	(0.019)	(0.038)	(0.039)	(0.035)	(0.040)
Liquid Assets$_{2006Q4}$	-0.053***	-0.068*	-0.099**	-0.126***	0.0951**
	(0.020)	(0.036)	(0.045)	(0.042)	(0.045)
Bank controls	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y	Y
N	76,621	19,856	16,895	23,051	16,819
# Loans	9,564	4,893	4,558	5,634	3,790
R^2	0.42	0.38	0.42	0.42	0.45

Table VIII
Additional Specification Tests

The regressions in this table conduct a number of specification tests to examine the impact of wholesale funding dependence on bank loan sales. Panel A ranks banks' wholesale funding dependence as of the onset of the financial crisis, instead of using the ratio of wholesale funds to total bank assets as an independent variable. A high, medium, or low exposure bank falls into the upper, middle, or lower tercile of the wholesale funding dependence distribution as of 2006:Q4. The low exposure banks are the omitted group in the regression. Panel B redefines the loan sale variable to include partial loan sales, which are identified as any reduction in loan share size. Panel C additionally controls for bank fixed effects and also uses the TED Spread as a continuous measure of stress in wholesale funding markets. The TED Spread 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. Wholesale funding dependence is measured as of 2002:Q4. Panel D measures all bank characteristics as of 2006:Q4. 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 exits a loan syndicate that it was present in during the previous year. All columns include bank and loan controls as well as controls for loan-year fixed effects. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance

Panel A: Ranked Wholesale Funding Dependence

Dependent Variable: Loan Sale$_t$

	All	<250 Lenders	No Amend	2006 Avg.
	[1]	[2]	[3]	[4]
Medium Exposure$_{2006Q4}$	0.008**	0.003	0.005	0.003
	(0.003)	(0.003)	(0.003)	(0.003)
High Exposure$_{2006Q4}$	0.015***	0.014***	0.013**	0.013**
	(0.005)	(0.005)	(0.005)	(0.005)
Bank controls	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y
N	76,621	73,045	46,210	76,621
# Loans	9,564	9,301	7,409	9,564
R^2	0.42	0.41	0.43	0.42

Panel B: Inclusion of Partial Loan Sales

Dependent Variable: Loan Share Decrease$_t$

	All	<250 Lenders	No Amend	2006 Avg.
	[1]	[2]	[3]	[4]
Wholesale Funding$_{2006Q4}$	0.089***	0.096***	0.091***	0.063***
	(0.015)	(0.015)	(0.016)	(0.015)
Bank controls	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y
N	76,621	73,045	46,210	76,625
# Loans	9,564	9,301	7,409	9,564
R^2	0.43	0.43	0.46	0.42

Panel C: Bank Fixed Effects and TED Spread

Dependent Variable: Loan Sale$_t$

	2007-2010	2003-2010			
	[1]	[2]	[3]	[4]	[5]
Wholesale Funding$_{2002Q4}$	0.110***	-0.001		-0.020	
	(0.016)	(0.012)		(0.015)	
Wholesale Funding$_{2002Q4}$ × Crisis$_t$		0.097***	0.104***		
		(0.016)	(0.016)		
Wholesale Funding$_{2002Q4}$ × TED$_t$				0.099***	0.100***
				(0.018)	(0.019)
Bank controls	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y
Bank fixed effects	N	N	Y	N	Y
Loan-Year fixed effects	Y	Y	Y	Y	Y
N	71,829	138,096	138,096	138,096	138,096
# Loans	9,564	16,318	16,318	16,318	16,318
R^2	0.43	0.40	0.44	0.40	0.44

Panel D: All Bank Characteristics Measured 2006:Q4

Dependent Variable: Loan Sale$_t$

	All	<250 Lenders	No Amend	2006 Avg.
	[1]	[2]	[3]	[4]
Wholesale Funding$_{2006Q4}$	0.065***	0.058***	0.068***	0.039***
	(0.015)	(0.015)	(0.016)	(0.014)
Net Charge Offs$_{2006Q4}$	-15.900	4.005	-2.215	-32.290
	(12.910)	(12.500)	(11.690)	(19.860)
NPL Ratio$_{2006Q4}$	0.310	0.516*	-0.395	0.161
	(0.291)	(0.289)	(0.297)	(0.423)
Real Estate Loan Share$_{2006Q4}$	-0.004	-0.010	-0.038***	-0.016
	(0.013)	(0.013)	(0.014)	(0.014)
Capital Ratio$_{2006Q4}$	0.210*	0.058	0.152	0.079
	(0.115)	(0.111)	(0.122)	(0.104)
Bank Size$_{2006Q4}$	0.003**	0.003*	0.001	0.005***
	(0.001)	(0.001)	(0.001)	(0.002)
Large Bank$_{2006Q4}$	-0.045***	-0.046***	-0.034***	-0.050***
	(0.006)	(0.006)	(0.006)	(0.006)
Bank Merger$_t$	-0.019**	-0.005	-0.011	-0.0184**
	(0.009)	(0.008)	(0.009)	(0.009)
Bank Merger$_{t-1}$	0.178***	0.188***	0.054***	0.178***
	(0.012)	(0.012)	(0.012)	(0.012)
Agent Bank$_{t-1}$	-0.017***	-0.015***	-0.006**	-0.017***
	(0.003)	(0.003)	(0.002)	(0.003)
Loan Fraction Held$_{t-1}$	-0.189***	-0.183***	-0.082***	-0.188***
	(0.020)	(0.020)	(0.017)	(0.020)
Loan-Year fixed effects	Y	Y	Y	Y
N	76,621	73,045	46,210	76,621
# Loans	9,564	9,301	7,409	9,564
R^2	0.42	0.41	0.43	0.44

Table IX
Wholesale Funding Dependence and Loan Share Trades

The table reports the average wholesale funding dependence of buyers and sellers of loan shares during the period from 2003 until 2010. Panel A examines loan transactions in the period from 2003 until 2006. Panels B examines the period from 2007 until 2010. Panel C examines the year 2008 only. Unmatched bank trades include all buy and sell transactions by banks. Matched bank-bank trades restricts the set of transactions to those where, in a given year and syndicate, one bank exits the syndicate and exactly one other bank enters and holds a loan share of the same size. A transaction is classified as a loan share sale whenever a bank that was in the syndicate last year is not present this year and similarly for a loan share buy. "No Amendments" further restricts the sample to exclude transactions in years where the loan contract is amended. Each cell shows the average wholesale funding dependence of the banks engaged in a loan share transaction either as sellers or buyers. A simple average is taken across loan transactions. The number of loan transactions (N) is indicated. The difference in the mean wholesale funding dependence for each transaction type is indicated. The t-value from an independent two-sample test with equal variances are shown below in parentheses. ***, **, * Denotes 1%, 5%, and 10% statistical significance.

Panel A: 2003–2006 Before Crisis Period

	Unmatched Bank Trades			Matched Bank-Bank Trades		
	Sellers	Buyers	Diff. [t-value]	Sellers	Buyers	Diff. [t-value]
	[1]	[2]	[3]	[4]	[5]	[6]
Sample: All Trades						
Wholesale Funding$_{2002Q4}$	0.349	0.372	-0.023*** [-9.04]	0.354	0.340	0.014 [1.35]
N	4,363	5,556		255	255	
Sample: No Amendments						
Wholesale Funding$_{2002Q4}$	0.359	0.399	-0.041*** [-7.33]	0.348	0.340	0.009 [0.63]
N	1,056	1,150		143	143	

Panel B: 2007–2010 Crisis Period

	Unmatched Bank Trades			Matched Bank-Bank Trades		
	Sellers	Buyers	Diff. [t-value]	Sellers	Buyers	Diff. [t-value]
	[1]	[2]	[3]	[4]	[5]	[6]
Sample: All Trades						
Wholesale Funding$_{2006Q4}$	0.395	0.369	0.025*** [8.77]	0.343	0.321	0.022 [1.44]
N	7,075	4,337		145	145	
Sample: No Amendments						
Wholesale Funding$_{2006Q4}$	0.424	0.378	0.047*** [8.50]	0.348	0.327	0.021 [1.02]
N	2,234	1,219		86	86	

Panel C: 2008 Only

	Unmatched Bank Trades			Matched Bank-Bank Trades		
	Sellers	Buyers	Diff. [t-value]	Sellers	Buyers	Diff. [t-value]
	[1]	[2]	[3]	[4]	[5]	[6]
Sample: All Trades						
Wholesale Funding$_{2006Q4}$	0.432	0.352	0.079*** [15.36]	0.359	0.277	0.082*** [3.36]
N	1,664	1,272		48	48	
Sample: No Amendments						
Wholesale Funding$_{2006Q4}$	0.452	0.360	0.092*** [10.18]	0.374	0.296	0.078** [2.29]
N	703	391		28	28	

Table X
Impact of Loan losses and Insolvency on Loan Sales

The regressions in this table examine the impact of wholesale funding dependence and loan losses on bank loan sales during the crisis period. Panel A examines the impact of non performing loans, loan charge offs, and participation in the Troubled Asset Relief Program (TARP) on loan sales. Panel B examines the relationship between loan losses and loan sales before the crisis. Panel C examines the relationship between liquidity management, insolvency risk, and 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 exits a loan syndicate that it was present in during the previous year. Wholesale Funding is measured as of 2006:Q4 in Panels A and C, and 2002:Q4 in Panel B. All columns include controls for loan-year fixed effects, bank controls, and loan controls (defined in Table IV). All columns use the full sample available. All variables are defined in Appendix A. Standard errors (in parentheses) are clustered at the loan level. ***, **, * denotes 1%, 5%, and 10% statistical significance

Panel A: Loan Losses and Bank Loan Sales during 2007–2010

Dependent Variable: Loan Sale$_t$

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
NPL Ratio$_{2006Q4}$	-0.074		-0.0749	-0.280				
	(0.290)		(0.290)	(0.291)				
Net Charge Offs$_{2006Q4}$		5.639	5.659	9.814				
		(10.55)	(10.54)	(10.56)				
NPL Ratio$_{t-1}$					0.257***		0.293**	0.228*
					(0.129)		(0.128)	(0.129)
Net Charge Offs$_{t-1}$						20.62***	20.87***	15.08***
						(2.860)	(2.857)	(2.972)
TARP/Assets$_{t-1}$				2.207***				1.800***
				(0.242)				(0.250)
Bank controls	Y	Y	Y	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
N	79,766	79,766	79,766	79,766	81,011	81,011	81,011	81,011
# Loans	9,585	9,585	9,585	9,585	9,599	9,599	9,599	9,599
R^2	0.41	0.41	0.41	0.42	0.41	0.41	0.41	0.41

Panel B: Losses and Loan Sales during 2003–2006

Dependent Variable: Loan Sale$_t$

	2003–2006	2004–2006	
	[1]	[2]	[3]
NPL Ratio$_{2002Q4}$	1.401***		
	(0.246)		
NPL Ratio$_{2003Q4}$			-0.747**
			(0.309)
Net Charge Offs$_{2003Q4}$		154.5***	156.2***
		(54.88)	(54.63)
Capital Ratio$_{t-1}$	-0.877***	-1.557***	-1.587***
	(0.120)	(0.154)	(0.155)
Bank controls	Y	Y	Y
Loan controls	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y
N	66,320	47,758	47,758
# Loans	9,612	7,286	7,286
R^2	0.36	0.35	0.35

Panel C: Controlling for Insolvency during 2007–2010

Dependent Variable: Loan Sale$_t$

	[1]	[2]	[3]	[4]
Wholesale Funding$_{2006Q4}$	0.073***	0.074***	0.062***	0.080**
	(0.013)	(0.014)	(0.019)	(0.035)
TARP/Assets$_{t-1}$	1.776***	1.839***		
	(0.257)	(0.436)		
TARP/Assets$_{t-1}$ × Wholesale Funding$_{2006Q4}$		-0.237		
		(1.349)		
MVE/Assets$_{t-1}$			-0.335***	-0.280***
			(0.053)	(0.098)
MVE/Assets$_{t-1}$ × Wholesale Funding$_{2006Q4}$				-0.139
				(0.221)
Bank controls	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y
Loan-Year fixed effects	Y	Y	Y	Y
N	76,621	76,621	53,565	53,565
# Loans	9,564	9,564	8,999	8,999
R^2	0.42	0.42	0.48	0.48

Appendix A: Variable Definitions

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

Panel A: Loan Level Variables

Variable	Definition	Source
Loan Sale	Indicator variable equal to one if bank exits syndicate that it participated in last year that continues to exist in the current year	SNC
Loan Share Decrease	Indicator variable equal to one if bank decreases share of syndicate that it participated in last year that continues to exist in the current year	SNC
Agent Dummy	Indicator variable equal to one if SNC identifies lender as administrative agent	SNC
Loan Fraction Held	Fraction of total loan commitment held by syndicate member	SNC

Panel B: Bank Level Variables

Variable	Definition	Source
Wholesale Funding	Sum of large time deposits, foreign deposits, repo sold, other borrowed money, subordinated debt, and fed funds purchased divided by total assets	Y-9C
Liquid Assets	Sum of cash, fed funds sold, repo bought, and securities (excluding mortgage- and asset-backed securities) divided by total assets	Y-9C
NPL Ratio	Non performing loans divided by total loans	Y-9C
Net Charge Offs	Charge offs net of recoveries divided by total assets	Y-9C
Real Estate Loan Share	Real estate loans divided by total loans	Y-9C
Capital Ratio	Book capital divided by total assets	Y-9C
Bank Size	Natural logarithm of total assets	Y-9C
Large Bank	Indicator variable equal to one if total assets greater than $50bn	Y-9C
Merger Dummy	Indicator variable equal to one if lender top holder ID changes in current year	SNC
TARP/Assets	Funds extended under Troubled Asset Relief Program divided by total assets	Treasury
MVE/Assets	Market value of equity scaled by total assets	CRSP, Y-9C

Appendix B: Summary Statistics for 2007–2010 split by Wholesale Funding Dependence

This table provides summary statistics for the Shared National Credit Program data for the 2007-2010 event window split by wholesale funding dependence measured as of 2006:Q4. Columns [1]–[6] summarize the data for observations with wholesale funding dependence below the sample median and columns [7]–[12] for above-median wholesale funding dependence. 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. Panel A provides summary statistics for the loan level variables and the unit of observation is a loan share-year. Panel B summarizes bank level variables measured as of 2006:Q4 and the unit of observation is a bank. All variables are defined in Appendix A.

Variable	Below Median Dependence						Above Median Dependence					
	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	39,985	0.093	0.291	0	0	0	36,636	0.092	0.288	0	0	0
Agent Dummy	39,985	0.113	0.317	0	0	0	36,636	0.244	0.430	0	0	0
Loan Fraction Held	39,985	0.116	0.119	0.032	0.080	0.163	36,636	0.115	0.114	0.029	0.085	0.163
Panel B: Bank Level Variables (2006:Q4)												
Wholesale Funding	174	0.188	0.050	0.150	0.198	0.230	175	0.365	0.106	0.292	0.329	0.400
Liquid Assets	174	0.187	0.097	0.121	0.166	0.240	175	0.147	0.097	0.078	0.118	0.179
NPL Ratio	174	0.007	0.007	0.002	0.005	0.008	175	0.007	0.007	0.003	0.005	0.009
Net Charge Offs	174	0.000	0.000	0.000	0.000	0.000	175	0.000	0.000	0.000	0.000	0.000
Real Estate Loan Share	174	0.682	0.147	0.614	0.709	0.787	175	0.714	0.143	0.653	0.759	0.820
Capital Ratio	174	0.093	0.027	0.075	0.090	0.106	175	0.085	0.023	0.071	0.081	0.095
Bank Size	174	14.50	1.067	13.60	14.27	15.00	175	15.15	1.733	13.86	14.58	16.07
Large Bank	174	0.017	0.131	0	0	0	175	0.097	0.297	0	0	0
MVE/Assets	75	0.162	0.263	-0.007	0.111	0.294	49	0.167	0.240	0.004	0.140	0.262